Analysis And Simulation of Mobile Ad-Hoc Network Mobility Patternfor Central & Decentral Communication

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Abstract: A Mobile Ad hoc Network (MANET) is a collection of wireless mobile nodes forming a self-configuring network without using any existing infrastructure. Since MANETs are not currently deployed on a large scale,research in this area is mostly simulation based, in this paper we are using ANSim simulator.The main objective of this paper is to study and analyze Random Waypoint Mobility Model, Gauss Markov Mobility Model and their effect on Central and Decentral communication. Our study shows that, in Random Waypoint and Gauss Markov mobility model, if number of nodes in a specific area is less than 35, then the probability that two nodes are connected is high in Central Communication. But if we compare Random Waypoint and Gauss Markov Mobility model we find that probability is much higher in Random Waypoint model,therefore it is best suited for a small network, where number of nodes are less.

Keywords: MANET, Random Waypoint, Gauss Markov Mobility Model, Central Communication, Decentral Communication.

I INTRODUCTION

According to Charles Perkins an Ad-Hoc network is an infrastructureless, wireless computer network whose end systems are mobile in many cases and in which only certain subsets of end systems can reach each other directly at a time. Mobile Ad Hoc Network (MANET) [1][2][3] is one that comes together as needed, not necessarily with any support from the existing internet infrastructure or any other kind of fixed station. In MANET topology may dynamically change in an unpredictable manner since nodes are free to move. As for as mode of operation, ad hoc networks are basically peer-to-peer multi-hop mobile wireless networks where information packets are transmitted in a store and forward manner from a source to an arbitrary destination, via intermediate nodes. We assume that it is not possible to have all nodes within range of each other. In case all nodes are closed–by within radio range, there are no routing issues to be addressed. Important issue is that different nodes often have different mobility patterns. Some nodes are highly mobile, while others are primarily stationary. It is difficult to predict a node’s movement and pattern of movement. In ad hoc networks, nodes mobility is an important issue due to ad hoc characteristics such as dynamic network topology, shared medium, limited bandwidth, multihop nature and security etc. Thus, there is a requirement of effective mobility management scheme i.e. seamless mobility in ad hoc networks. Seamless mobility provides easy access and effective communication among nodes present in the network. The MANET research field has attracted a lot of attention from academia and industry in recent years. In the near future, MANET could potentially be used in various applications such as mobile classrooms, battlefield communication and disaster relief applications and many more.

II *AD HOC NETWOR MOBILITY MODEL*

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.Communication between two nodes does not produce effective results ifboth nodes are not in same transmission range. This problem can be resolve by using intermediate nodes with routing. Thus routing is very important in mobile adhoc networks where mobility models must be evaluated with respect to end to end delay and efficient data transmission. Mobility models are intended to focus on individual movement patterns due to point to point communication in cellular networks [4] [5] [6] [7] whereas adhoc networks are designed for group communication.

2.1 The Random Waypoint Model

The Random Waypoint Model was first proposed by Johnson and Maltz[5]. Soon, it became a 'benchmark' mobility model to evaluate the MANET routing protocols, because of its simplicity and wide availability. To generate the node trace of the Random Waypoint model the setdest tool from the CMU Monarch group may be used. This tool is included in the widely used network simulator ns-2 [8]. This model [9][10][11][12][13] is widely used by the researchers. It generates non homogenous spatial distribution of nodes. In simulated area, mobile node selects a random position and velocity v with range from maxspeed and minspeed. It contains both feature of entity and statistical models. Mobile node starts to travel new chosen destination at selected speed. In the random waypoint model, V_{max} and Tpause are the two key parameters that determine the mobility behavior of nodes. If the V_{max} is small and the pause time Tpause is long, the topology of Ad Hoc network becomes relatively stable. On the other hand, if the node moves fast (i.e. V_{max} is large) and the pause time (Tpause) is small, the topology is expected to be highly dynamic. Varying these two parameters, especially the V_{max} parameter, the Random Waypoint model can generate various mobility scenario with different levels of nodal speed. Therefore, it seems necessary to quantify the nodal speed.Topology of adhoc network is stable in low velocity and long pause time where as topology is high dynamic if velocity is high and pause time is short. So, by varying these parameters, we can generate various mobility scenarios with different levels of node speed.

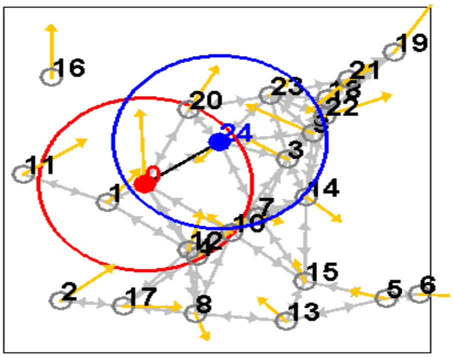


Fig 2.1 Random Waypoint Model

2.2 Gauss Markov Mobility Model

The Gauss-Markov Mobility Model was first introduced by Liang and Hass and widely utilized. In this model, the velocity of mobile nodes is assumed to be correlated over time and modeled as a Gauss-Markov stochastic process. Gauss-Markov mobility model creates random movement changes that are dependent on node's current speed and direction. At fixed intervals the simulator generates a new speed and direction based on their current values and standard deviations. In addition the model keeps nodes away from the edges by changing their direction away from them should they get too close. This model [14][8] was designed to maintain different levels of randomness by using one varying parameter alpha in mobility pattern. This pattern is based on statistical mobility pattern .and overcome the problem of sudden changes in random waypoint mobility model. At each fixed intervals of time n a movement occurs by modifying the speed and direction of node. Value of alpha is lies between 0 and 1. If it is zero then Brownian motion is obtained otherwise linear motion is obtained. By varying the value of alpha [0, 1], intermediate levels of randomness could be obtained. Value of next location is calculated based on current location.

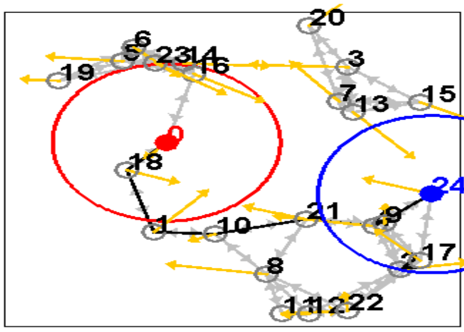


Fig 2.2 Gauss Markov Mobility Model

III MODEL FOR THE SIMULATION (ANSim)

MANETs are not currently deployed on a large scale, research in this area is mostly simulation based, Inthis paper we are using ANSimsimulator. ANSim simulates Ad-Hoc networks and examines connectivity and is especially suited for statistical simulation with long simulation times and large networks. ANSim checks if the location of the nodes Ni and Nj allows to send data from Ni to Nj. Whether such transmissions will suffer from collisions or transmission errors

is not taken into account. Also transmission delays caused by busy transmission media in the real world are ignored. New links and paths between nodes can be used to one hundred percent and without any delay. ANSim supports the simulation of static Ad-Hoc networks and Ad-Hoc networks with mobile nodes by two different operational modes. In mobile mode snapshots are generated periodically where nodes move according to the mobility model. The results of these snapshots are accumulated as a random sample over time. The choice of the mobility model plays an important role and simulation results vary very much with changing mobility model.

The following assumption we are taking while doing the simulation with ANSim:

1. Model in the geometry of two dimensions R2

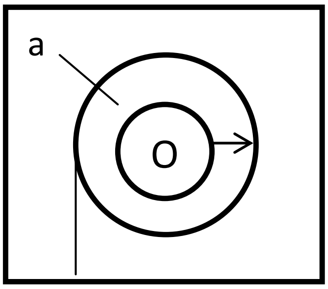
   1.1 Area *A*
   1.2 NNodes uniformly distributed within *A*
   1.3 Node positions are independent of each other
   PB<>f(PA)
   1.4 Transmission radius *r*

2. Free-space loss : Distance *d* between 2 Nodes smaller than *r*

2.1 => transmission possible

2.2 *d>r* =>no Transmission

'A' X Size



Y Size

Fig 3.1 Model for Analysis and Simulation

3.1 COMMUNICATION:

There are two possibilities of the communication:

a) Central communication: Central communication means that the source is always placed in the center of the field. In the below figure red color circle showing the source node, where as blue color is showing the destination node. In central communication source node always be in the centre of the area.

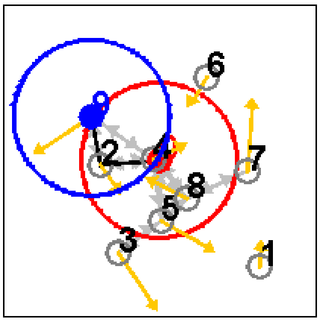


Fig 3.2 Central Communication

b) Decentral Communication: During decentral communication the source node behaves like all the other nodes. It moves anywhere in the area.

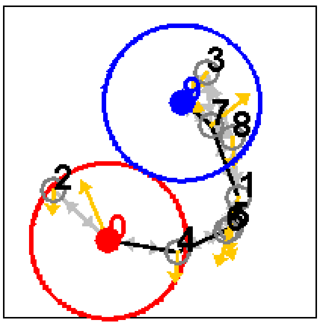


Fig 3.3 Decentral Communication

IV EXPERIMENT AND RESULTS

Doing the Simulation, we fix some parameters in the ANSImsimulator. Under these parameter we did all our experiments:-

a)X Size = 1000 (Size of the simulation field Xsize)

b)Y Size = 1000 (Size of the simulation field Ysize)

c) Radius = 250m (Transmission range of the nodes)

d) Shape = Rectangle (Shape of the simulation field)

e) Mode= Mobile (Behavior of the nodes. The nodes may be mobile or static)

f) Model = Random Waypoint Mobility Model and Gauss Markav Mobility Model.(The mobility model of the nodes)

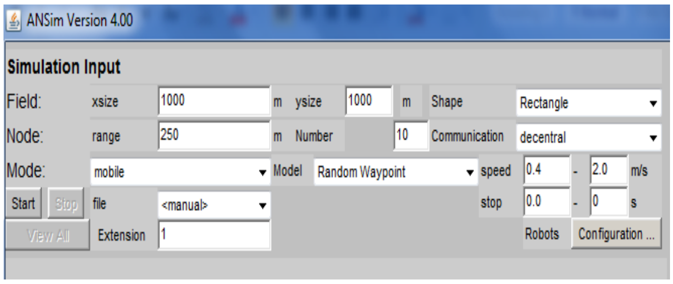


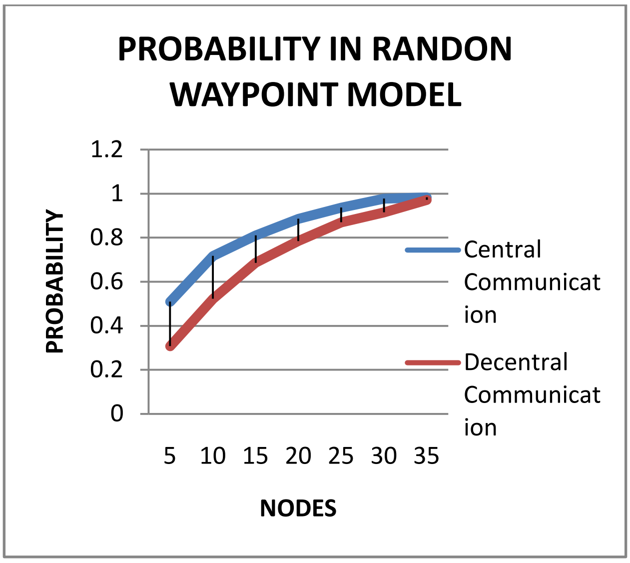
Fig 4.1 ANSim Parameters

Experiment 1:

We have taken Random Waypoint Mobility Model and test the Probability under different numbers of node the results are represented in the below table:-

Number of Nodes	Probability (Central Communication)	Probability (Decentral Communication)
5	0.509546	0.307655
10	0.717666	0.522706
15	0.811038	0.686384
20	0.885709	0.785236
25	0.937543	0.870002
30	0.978273	0.915496
35	0.983807	0.971864

Table 4.1ANSim results for Random Waypoint Mobility Model



Result 1:

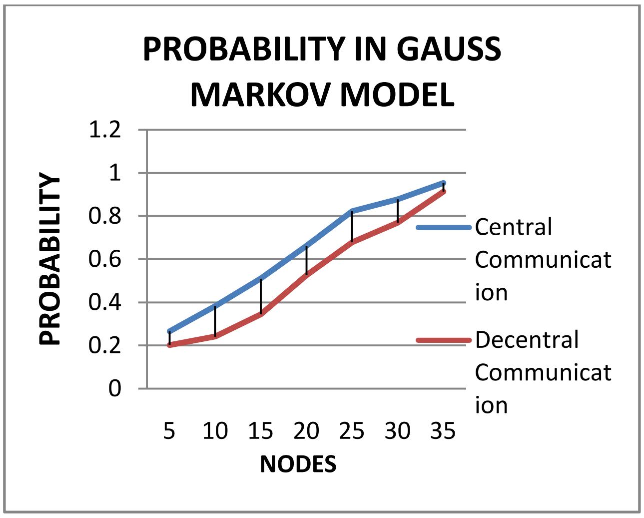
The above table is represented in Line Chart which clearly shows that in Random waypoint mobility model, upto 35 nodes in a specific area central communication is best suited, but after 35 nodes the central and decentral communication probability is almost same. Therefore for a small network where number of nodes are less central communication is best.

Experiment 2:

IN a similar way we have taken Gauss Markov Mobility Model and test the Probability under different numbers of node the results are represented in the below table:-

Number of Nodes	Probability (Central Communication)	Probability (Decentral Communication)
5	0.265620	0.202390
10	0.383740	0.241725
15	0.510410	0.344295
20	0.662490	0.525401
25	0.823216	0.678526
30	0.877490	0.768833
35	0.953754	0.913161

4.2 ANSim results for Gauss Markov Mobility Model



Result 2:

The above table is represented in Line Chart which clearly shows that in Gauss Markov mobility model, upto 35 the central communication is best,where as if we increase the number of nodes more than 35 the probability is almost same for central and Decentral communication.

V CONCLUSION

The main objective of this paper is to study and analyze Random Waypoint Mobility Model and Gauss Markov Mobility Modelalongwith their effect on Central and Decentral communication. We have verified the results on ANSim and our study shows that

In Randon Waypoint and Gauss Markov mobility model,if number of nodes in a specific area is less than 35, the probability that two nodes are connected is high in Central Communication. But if we compare Random Waypoint and Gauss Markov Mobility model we find that probability is high in Random Waypoint model. Therefore for a smaller network central communication is good whereas for a larger network where numbers of nodes are more then 35 there is not much difference in central and Decentral communication.

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