# Performance Analysis of Dispersion Mobility Model in Mobile AdHoc Networks

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**Summary**

In this paper, we present a new mobility model for multi-hop Adhoc networks. We show that group motion occurs frequently in ad hoc networks, and introduce a novel group mobility model – Dispersion Mobility Model (DMM) - to represent the relationship among mobile hosts. DMM can be readily applied to many existing applications. Moreover, by proper choice of parameters, DMM can be used to model several mobility models which were previously proposed. One of the main themes of this paper is to investigate the impact of the DMM mobility model on the performance of a specific application. We have applied our DMM model to different network transmission scenarios, clustering, time, speed, steady state and routing, and have evaluated network performance under different mobility patterns and for different implementations. We have validated our model with real traces. Numerical and simulation results are presented to validate the analysis. Through extensive simulations on DMM, we demonstrate up to 70% improvement in packet delivery rate.

***Key words:***
*Dispersion Mobility Model(DMM), MANET, Randomness, Routing, Clustering.*

## 1. Introduction

Mobile Ad hoc networks are maintaining a dynamic interconnection topology between mobile users. Ad hoc networks are expected to play an increasingly important role in real time settings. The short range transmissions of nodes are often results in a multi-hop communication and distributive scenario to retransmit packet before it reaches its destination. The mobility of nodes in Manet often results in a highly dynamic topology leads to the task of routing in an ad hoc network more difficult. Managing of large number of mobile units, topological changes, delay, bandwidth, multimedia transmission, and speed access are some of the important points to be considered. The nodes in an ad hoc network move according to various patterns. In mobile ad hoc networks, communications are often among teams which tend to coordinate their movements. Messages are forwarded through multiple hops due to the restriction of radio transmission range in every mobile. Routing is an essential mechanism to support multiple hop radio transmissions. However, node mobility and limited communication resources make routing in MANETs very difficult. Mobility causes frequent topology changes and may break existing paths. A routing protocol should quickly adapt to the topology changes and efficiently search for new paths. On the other hand, the limited power and bandwidth resources in MANETs make quick adaptation very challenging.

Thus, we are developing a flexible mobility framework which allows us to model different applications and network scenarios to identify the impact of mobility on different scenarios such as clustering motion and individual decisions of nodes. The proposed mobility framework is called Dispersion Mobility Model(DMM). In the model, mobile hosts are organized as group of clusters. We study the impact of DMM on Multihop routing, Stability of clusters and avoiding ripple effects.

## 2. Related work

The Diffusion Mobility Mode have many entities in nature move in extremely unpredictable ways. In this mobility model, an MN moves from its current location to a new location by randomly choosing a direction and speed in which to travel. The new speed and direction are both chosen from pre-defined ranges. Each movement in the DMM occurs in either a time interval at‘t’ or a distance traveled‘d’. If a MN which moves according to this model reaches a cluster border with an angle determined by the direction. The MN then continues along this new path. DMM moves on a one or two-dimensional surface returns to the origin with complete certainty. This characteristic ensures that the DMM represents a mobility model that tests the movements of entities around their reference points.

Several existing approaches utilize dynamic routing schemes to design efficient routing protocols for MANETs.

In [1] Associativity based cluster formation and management protocol for ad hoc networks. This protocol takes into account the spatio-temporal stability and the optimal location of the CH (ClusterHead) in a

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cluster and briefly discuss about the different issues that may arise in management of a cluster and summed up the necessary action to be taken by the cluster head.

In [2], Uncertainty is one core dimension of trust, which reflects a node's confidence in the sufficiency of past experiences. It deeply impacts nodes' anticipation and decision. This system uses mobility as an asset to reduce uncertainty in far-flung nodes, and reduce the overall uncertainty in the network. It explains a certainty oriented reputation system that emphasizes the relationship among uncertainty, observation and recommendation.

In [3], Geng Chen et al, did not experiment with k values that are greater than 3. These values involve significant amount of data broadcasts in creation and maintenance process, and may be justified only for higher values of n. However, when n is expressed in thousands, an organization with several levels in hierarchy may be more appropriate. Some of described k-cluster algorithms may be further generalized by introducing two parameters. Thus, one can consider (m, t)-clustering variants of these algorithms, as follows. Each undecided visited node checks all its undecided m-hop neighbors and chooses one with the greatest number of t-hop neighbors. The details for other algorithms may be similarly given. The cases of (1, 2) -clustering and (2, 1)-clustering algorithms may deserve some attention.

Static nature obtained in the Random Walk Mobility Model when the MN is allowed to move 10 steps (not one) before changing direction; as shown, the MN does not roam far from its initial position. In summary, if the goal of the performance investigation is to evaluate a semi-static network, then the parameter to change an MN's direction should be given a small value. Otherwise, a larger value should be used.

If the Random Waypoint Mobility Model is used in a performance evaluation, appropriate parameters need to be evaluated. For example, the Random Waypoint Mobility Model is used to evaluate a multicast protocol for ad hoc networks in [4]. In this performance investigation, the speed of the mobile nodes was varied between 0-1 m/s, the pause time of the mobile nodes was varied between 60-300 seconds, and each simulation executed for 300 seconds. With such slow speeds, and large pause times, the network topology hardly changes. In other words, the results presented in [4] are only valid for an ad hoc network scenario with MNs that barely move.

A slight modification to the Random Direction Mobility Model is the Modified Random Direction Mobility Model [5]. In this modified version, MNs continue to choose random directions but they are no longer forced to travel to the simulation boundary before stopping to change direction. Instead, an MN chooses a random direction and selects a destination anywhere along that direction of travel. The MN then pauses at this destination before choosing a new random direction. This modification to the Random Direction Mobility Model produces movement patterns that could be simulated by the Random Walk Mobility Model with pause times.

The RPGM model was originally defined in [6] and then used in [7]. If appropriate group paths are chosen, along with proper initial locations for various groups, many different mobility applications may be represented with the RPGM model. In [6], three applications for the RPGM model are defined. First, the In-place Mobility Model partitions a given geographical area such that each subset of the original area is assigned to a specific group; the specified group then operates only within that geographic subset. Second, the Overlap Mobility Model simulates several different groups, each of which has a different purpose, working in the same geographic region; each group within this model may have different characteristics than other groups within the same geographical boundary. For example, in disaster recovery of a geographical area, one might encounter a rescue personnel team, a medical team, and a psychologist team, each of which have unique traveling patterns, speeds, and behaviors.

The directionless DMM is of special interest. In the Random DMM, an MN may change direction after traveling a specified distance instead of a specified time. The DMM is a memoryless mobility pattern because it retains no knowledge concerning its past locations and speed values. The current speed and direction of an MN is independent of its past speed and direction. This characteristic can generate unrealistic movements.

## 3. Entity Vs DMM

The Random Waypoint Mobility Model includes pause times between changes in direction and/or speed [9]. An MN begins by staying in one location for a certain period of time (i.e., a pause time). Once this time expires, the MN chooses a random destination in the simulation area and a speed that is uniformly distributed between [$S_{min}$, $S_{max}$].

In our investigations we use the DMM; the MNs are initially distributed randomly around the reference point area. This initial random distribution of MNs is not representative of the manner in which nodes distribute themselves when moving. The average MN neighbor percentage is the total number of MNs that are a given MN's neighbor. There is high variability during the start of transmission. To avoid this initialization problems, location information of each MNs are distributed to all cluster heads. Discarding the initial transmission has an added benefit over the first solution proposed. Specifically, this simple solution ensures that each transmission has a random initial configuration. The fast MNs and long pause times actually produces a more stable network than a scenario with slower MNs and shorter pause times [10].

For a performance evaluation, the appropriate parameters need to be evaluated for DMM. For example, the DMM is used to evaluate a Multihop protocol for ad hoc networks in. The DMM was created to overcome clustering of nodes in the average number of neighbors produced by the Random Waypoint Mobility Model. In the case of the Random Waypoint Mobility Model, clustering occurs near the center of the simulation area. In the Random Waypoint Mobility Model, the probability of an MN choosing a new destination that is located in the center of the simulation area, or a destination which requires travel through the middle of the simulation area, is high[10]. Thus, the MNs converge, diffuse, and converge again. In this model, MNs choose a random direction in which CH (ClusterHead) to travel similar to the Random Walk Mobility Model. In addition, Cluster formation will be more likely with the Random Direction Mobility Model compared to other mobility models.

In Modified Random Direction Mobility Model. In this modified version, MNs continue to choose random directions but they are no longer forced to travel to the simulation boundary before stopping to change direction. Instead, an MN chooses a random direction and selects a destination anywhere along that direction of travel. The MN then pauses at this destination before choosing a new random direction. This modification to the Random Direction Mobility Model produces movement patterns that could be simulated by the Random Walk Mobility Model with pause times. Compared to the above model our aim is reduce the pause time at the time of cluster instability and we are going to propose one new model for cluster formation called DMM.

## 4. Group Mobility Models

In an ad hoc network, it is necessary to model the behavior of MNs as they move together. In DMM, a motion function is used to create MN movements and its useful for searching the neighbors. This model represents a set of MNs that move around a given reference line. In Column Mobility Model the individual MNs to follow one another. In Column Mobility Model, where the MNs move perpendicular to the direction of movement.

In the DMM, nodes are roaming randomly around a given CH. When the CH changes, all MNs in the cluster travel to the new area defined by the reference point and then begin roaming around the new reference point. If the elected online CH is not able to give the continuous stability, the other node being kept in standby. The standby unit is assumed to the immune from failure. The life time of either unit is a random variable $\xi$ with pdf $a(\cdot)$. As soon as the online unit fails, the standby unit is switched online and the failed unit is sent to the repair facility which reinstates the unit to its original state, a process which takes a random time $\eta$ governed by the pdf $b(\cdot)$. If the repair is completed before the failure of the online unit, then its is kept in standby, for use when the unit in current use fails. It is possible that the repairs are completed in such a way that the system has a failure-free performance.

In other words, every time $\xi$, the random variable representing the life time of the online unit, is greater than $\eta$, the repair time. We choose the time origin $t=0$ to synchronize with the first failure and denote by $X_1$, the time to the failure of the online unit. If we assume $\eta < X_1$, then to epoch $X_1$ is a renewal epoch in the sense that it synchronizes with the commencement of the life cycle an online unit as well as the commencement of repair of the failed unit. If again the life $X_2$ of the unit is greater than the repair time $\eta$,the epoch $X_1 + X_2$ is a renewal epoch. Thus the random variables $\{X_n; n \geq 1\}$ from an *iid* family with the pdf of $X_i$ being give by $\xi(\cdot)$ where $g(x) = a(x)B(x)$ where $B(x)$ is the distribution function of the random variable $\eta$.

$$B(x) = \int_0^x b(u)\,du \quad (1)$$

It is easy to see in general $G(\infty) < 1$.For Instance if we consider special case when $B(x) = (1 - e^{-\mu x})$ then we have

$$G(\infty) = 1 - a^*(\mu) \quad (2)$$

so that it is possible to choose $a(\cdot)$ in such a way that $a^*(\mu)$ >0. However it is clear that there is non-zero probability of the termination of the process of such renewals in the sense that the repair time at some stage exceeds the life time of the online unit leading to the system breakdown. For instance the probability that the nth renewal epoch is the last one to occurs and is not greater than the time point '*x*' is give by,

$$\int_0^x g^{(n)(u)} du \int_u^\infty a(y-u)\overline{B}(y-u) \qquad (3)$$

which can be identified to be $Gn(x)\{1-G(\infty)\}$ .

Returning to the general case we note that $S_n$ , the time to the nth renewal defined by,(1)

$$S_n=X_1+X_2+\ldots+Xn \qquad (4)$$

*where{* $S_n$; $n>=1$}

($X_1$, $X_2$,…-Sequence of random variables is a defective random variable with distribution $G_n(\cdot)$ . We can again *N(t)* by $N(t)=\sup\{n : Sn \le t\}$ and all the results relating to N(t) proved earlier will hold good in the present case; the function H(t) defined by *H(t)=E[N(t)]* represents the expected number of renewals in [*0*,*t*]. However we have in this case an *interesting* result: the expected number of renewal epochs is finite:

$$\lim_{t\to\infty} H(t) = \frac{1}{1-G(\infty)} \qquad (5)$$

Moreover the probability that the nth renewal epoch Sn is the last and is not greater than x is given by $[1-G(\infty)]G_n(x)$.

At the time of forming clusters the parameters for the mobility model define how far an MN may roam from the Cluster Head. Compared to the Column Mobility Model, the MNs in the DMM share a global information through other Cluster Heads. The RPGM Model represents the random motion of a group of MNs as well as the random motion of each individual MN within EACH group[8]. Group movements are based upon the path traveled by a logical center for the group. The logical center for the group is used to calculate group motion via a group motion vector. One difference, however, is that 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.

In DMM if appropriate group and individual paths are chosen, along with proper initial locations for various groups, many different mobility applications may be represented with the DMM model. First DMM partitions a given geographical area such that each subset of the original area is assigned to a specific group; the specified group then operates only within that geographic subset. Second, the DMM simulates several different groups, each of which has a different operations, working in the same geographic region; each group within this model may have different characteristics than other groups within the same geographical boundary.

Lastly, the Clustering DMM divides a given area into smaller subsets and allows the groups to move in a similar pattern throughout each subset. To create this movement pattern, we added the following restriction to the DMM model: all heads in a group must be in contact[9].

## 5. Analyzing the Mobility Model

The results presented illustrate the importance of choosing DMM mobility model for the performance evaluation of a given ad hoc network protocol. We use ns-2 and Glomosim to compare the performance of the Random Walk Mobility Model, and the Reference Point Group Mobility (RPGM) model via a simulation with 25 MNs and 100 MNs in Glomosim. Two sets of results are presented for the DMM model; one set of results obtained from the transmission within the cluster communication only, and the other set of results consists of cluster-cluster communication. Each MN in the simulations has a 200m transmission range. For example, in the Random Walk Mobility Model, the MN changes directions after moving a distance of 100m, which produces movement patterns similar to the Random Waypoint Mobility Model when pause time is zero[10].

DSR, a route to a destination is requested only when there is data to send to that destination, and a route to that destination is unknown or expired. We choose DSR since it performs well in many of the performance evaluations of unicast routing protocols. The simulations are executed for 3000 seconds; however, our results are gathered from 500 seconds of simulated time and data is only sent from 700-1500 seconds of simulation time. All the performance results presented are an average of 20 different simulation trials in both ns2 and Glomosim. Initially all the MNs are distributed randomly throughout the simulation area. In our comparison of the mobility models, we consider the following performance metrics obtained from the DSR and AODV protocol: packet delivery ratio, delay, average hop count, cluster stability, randomness of the nodes, speed of transmission and overhead.

Specifically, the DMM Model has the highest data packet delivery ratio than Random waypoint mobility model, the lowest delay, and the lowest average hop count compared to the Random Walk Mobility Model and Random Direction Mobility Model. These results exist since MNs using the Random Waypoint Mobility Model are often traveling through the Cluster Header of the simulation area. The Random Direction Mobility Model has the highest average hop count, the highest end-to-end delay, and the lowest data packet delivery ratio since the Random Direction Mobility Model has each MN move to the border of the simulation area before changing direction. The performance of DSR when using the Random Walk Mobility Model falls between these two extremes.

The DMM with only intercluster communication has approximately the same hop count as the Random Waypoint Mobility Model. As mentioned, both a group's movement and an MN's movement within a group in the DMM model is done via the Random Waypoint Mobility Model. Thus, we would expect the NODE counts for received packets to be similar between these two simulations. In DMM model within the cluster the transmission has a much lower data packet delivery ratio and higher end-to-end delay than the results for the Random Waypoint Mobility Model. Since all communication is between groups, the performance of the mobility model in terms of packet delivery, delay, speed, stability and randomness will suffer from transient partitions that exist in the network.

The DMM model with both intercluster and intra cluster communication has the lowest average hop count**,** since 70% of the packets transmitted are sent within the cluster(cluster stability). Low average hop count corresponds to a high data packet delivery ratio. The packet delivery to neighboring cluster is not however, as high as one would expect; since 30% of the packets are transmitted between groups, these packets are sometimes dropped due to the link failures and randomness of the nodes. Since the DMM model with clustering communication has the lowest hop count, this model requires the least amount of overhead. MNs moving with the Random Walk Mobility Model and the Random Direction Mobility Model have the highest average hop count, and as a result these two models require the highest amount of overhead.

## 6. CCA (Combined Clustering Algorithm)

CCA is the combination InterCluster and IntraCluster communication. CCA attempts to partition a number of mobile nodes into multi-hop clusters based on node speed, time and randomness(s,t,r) . The (s,t,r) criteria indicate that every mobile node in a cluster roaming randomly to a specific path to the destination that will be available over some time period *'t'*. The purpose is to support robust and efficient routing, and adaptively adjust its random routing scheme depending on the network mobility manner. Suppose the service time in any node being independent of the service time in other nodes. The data needing service can be at one of the '*m*' stages at a give time and no other data can be admitted for service until the data receiving service at one of the nodes has completed his service and departs from the system.

A data roaming around the network until reach the destination. After visiting the node *'i'*, the data may leave the system with probability $b_i$ or move for further to the next node *(i+1)* with probability $a_i$ , $a_i + b_i = 1$, *i=1,2,3…m;* we can include *i=0* such that $a_0 = 0$ indicates that the data does not visit any of the nodes and departs from the system without receiving any service. Whereas $a_0 = 1$ indicates that it needs to travel at least from the first node. After visiting the destination *'m'* then $b_m = 1$ . The distribution is denoted by $K_m$, the probability that the data moves from source to destination after visiting '*k*' nodes $(k \le m)$ and departs from the network having facility equals $A_k b_k$ . Where $A_k = a_0 a_1 .... a_{k-1}$ .We have $b_0 + \sum_{k=1}^{m} A_k b_k = 1$.

Let $\xi$ be the total service time of a information. The L.T. of the random variable $\xi$ is given by,

$$F^*(s) = b_0 + \sum_{k=1}^{m} A_k b_k \left\{ \prod_{i=1}^{k} \frac{\mu_i}{s+\mu_i} \right\} \quad (6)$$

$$= b_0 + A_1 b_1 \left\{ \frac{\mu_i}{s+\mu_i} \right\} + \sum_{k=2}^{m} \{a_1 a_2 .. a_{k-1}\} b_k \left[ \prod_{i=1}^{k} \frac{\mu_i}{s+\mu_i} \right] \quad (7)$$

The last term be written as

$$\sum_{k=0}^{m} \frac{b_k \mu_k}{s+\mu_k} \left[ \prod_{i=0}^{k-1} (1-b_i) \frac{\mu_i}{s+\mu_i} \right] \quad (8)$$

In general , we have $b_0=1$ , the $A_1=1$; the service is received at least at the first node.

We have,

$$F*(0)=1$$

$$E(\xi)=\sum_{k=1}^{m} A_k b_k \left\{\sum_{i=1}^{k}\frac{1}{\mu_i}\right\} \qquad (9)$$

and that the coefficient of variance $\sigma_\gamma / E(\xi)$ is not less than $1/\sqrt{c}$ , that is, it ranges from $1/\sqrt{c}$ to $\infty$ , depending on the values of the parameters involved. As a combined clustering scheme, CCA requires periodic re-clustering. When a mobile node is powered-on, it seeks a cluster to join by sending out Request message. A mobile node can join a cluster if it has a mutual path to satisfy (s, t, r) criteria between itself and the clusterhead of that cluster.

If a mobile node receives replies from different clusters indicating the availability of nodes, it chooses the cluster with the lowest nodes to join. If a mobile node does not receive any response message after a certain period of time, it will become a cluster head and creates its own cluster. As a clusterhead of such a single-node cluster, the mobile node monitors possible Request messages from others and successfully expands its own cluster or joins some other cluster as a cluster member. CCA can adaptively adjust its cluster size, considering the same level of stability. In a network with high randomness number of clusters are going to increases, but if low mobility means cluster size becomes large. Thus, a network can adaptively adjust its dominant routing mechanism according to its mobility features. As a multi-hop clustering scheme, clusterhead and its cluster members require no direct connection then mobile nodes' movement with less re-clustering. As long as there is a path to meet (s,t,r) criteria between the clusterhead and its cluster members, they can always be kept in the same cluster. In CCA each mobile node runs the clustering scheme independently and a clusterhead does not need to have specific attributes in its neighborhood. Hence, mobile nodes do not need to be stationary during cluster formation in order to get complete and accurate information of a local area. Because there is no hop limit between primary clusterheads and standby clusterheads in CCA, it is adaptive to the cluster size and there is no ripple effect as shown in Fig 1.

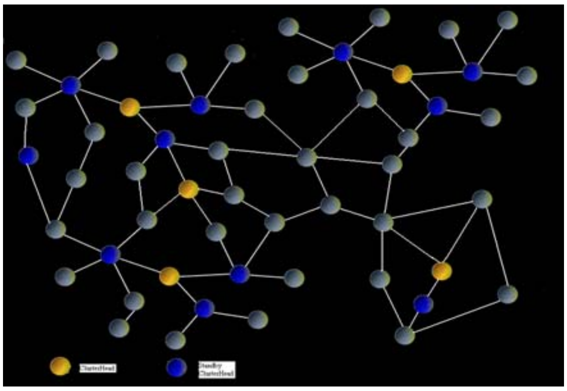

Fig .1 Clustering Model

## 6.1. Basic Mechanisms

When a node 'a' needs a route to some destination 'b', it broadcasts a REQ message to its neighbors, including the last known sequence number for that destination. The REQ is dispersed in a controlled manner through the network until it reaches a node that has a route to the destination. Each node that forwards the REQ creates a reverse route for itself back to node 'a'. When the REQ reaches a node with a route to 'b', that node generates a REPLY that contains the number of hops necessary to reach 'b' and the sequence number for 'b' most recently seen by the node generating the REPLY. Each node that participates in forwarding this REPLY back toward the originator of the REQ node 'a' creates a forward route to 'b'.

The link created in each node along the path from 'a' to 'b' is hop-by-hop state; that is, each node remembers only the next hop, the online(primary) and standby CLUSTER HEAD having the entire route, as would be done in source routing node periodically transmit a HELLO message, with a default rate.

## 6.2 Randomness

The random moment scenario is used for each simulation characterized by a pause time. Each node begins the simulation by remaining stationary for pause time seconds. It then selects a random destination and moves to the exact destination at a speed distributed uniformly between 0 and 10Mbps.Upon reaching the destination, the node pause time seconds and during this interval take decision to reach another destination, and proceeds there as previously described, repeating this behavior for the duration of the simulation.

Because the performance of the protocols we generated a different movement patterns, we experimented with two different maximum speeds of node movement. We primarily report in this paper data from simulations using a maximum node speed of 50 meters per second, but also compare this to simulations using a maximum speed of 5 meter per second.

6.3 Transmission

We are going compare the performance of each routing protocol; we chose our traffic sources to be constant bit rate (CBR) sources. When defining the parameters of the communication model, we experimented with sending rates of 5, 10 and 20 packets per second, networks containing different CBR sources, and packet sizes of 64 and 2Mb. Hence, for these simulations we chose to fix the sending rate at 5 packets per second, and used different communication patterns corresponding to the sources. When using large number of packets and out of range we found that congestion, because a problem for all protocols and tow or five nodes would drop the packets that they received for forwarding. All transmission patterns were peer-to-peer, and connections were started at times uniformly distributed between 0 and 300 seconds.

## 7. Discussion

In DMM maximum throughput can be achieved when nodes have less random mobility patterns. This paper focuses on the performance metric of speed, randomness, time and delay. The delay experienced by the packets under the strategy proposed in this paper is large, increasing with the size of the system. The result of this paper can be considered as an without any constraint on the delay.

Mobile ad hoc networking has been receiving increasing attention in recent years. New routing protocols concentrating specifically at the ad hoc networking environment have been proposed, but little performance information on each protocol and no detailed performance comparison between the protocols has previously been available. DMM including a realistic wireless transmission channel model. This new simulation environment provides a powerful tool for evaluating ad hoc networking protocols and other wireless protocols and applications. The DMM is a generic method for handling group mobility. We simulated each protocol in ad hoc networks of 150 mobile nodes moving about and communicating with each other, and presented the results for a range of node mobility rates and movement speeds. The network was unable to handle all of the traffic generated by the routing protocol and a significant fraction of data packets were dropped. The performance of DMM was very good at all mobility rates and movement speeds, although its use of source routing increases the number of routing overhead bytes.

## 8. Results

The Performance of DMM has been analyzed by using both Ns2 and Glomosim Simulator. Initially all the nodes are involved the communication by transferring the nodes as shown in Fig.2.During this period we can get the exact information for the first 10 seconds. Cluster formation begins after the transmission; whenever the online CH (Cluster Head) overloaded the standby CH take care of the process as shown in Fig 2, 3.After some period the fully inter connected network with minimal loss. Red line in the simulation process indicates the loss of packets. If the online CH is overloaded the standby CH is taking care of the network as shown in Fig 4. After all the nodes are involved in the communication the heavy dense network is found and overhead going to increases as shown in Fig 5. In Fig.6 the green signals shows the success of transmission.

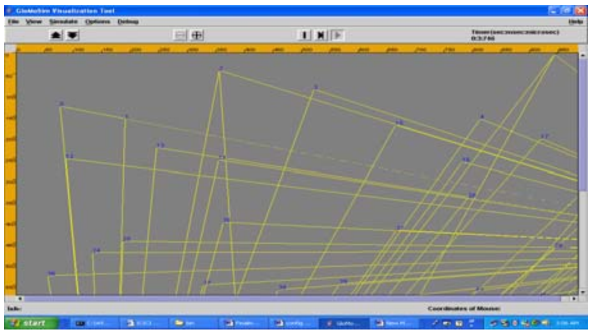

Fig. 2 Random Transmission of nodes-Glomosim

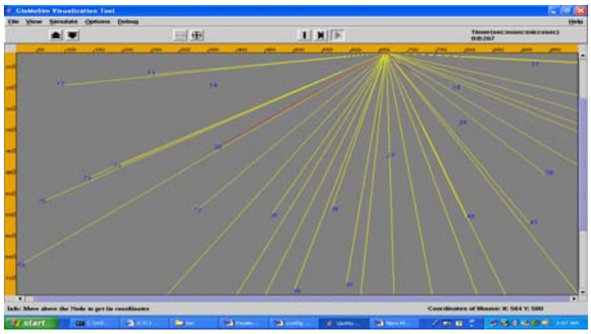

Fig. 3 Cluster Head Selection-REQ Signal.

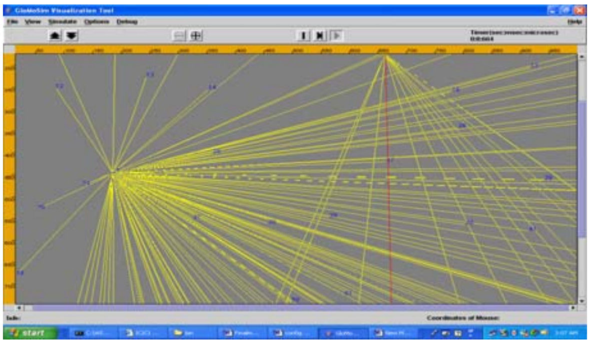

Fig. 4 Overhead in online CH-Standby CH starts Transmission

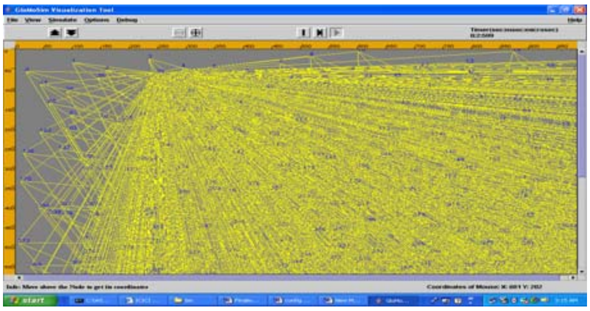

Fig. 5 Fully Inter Connected Network.

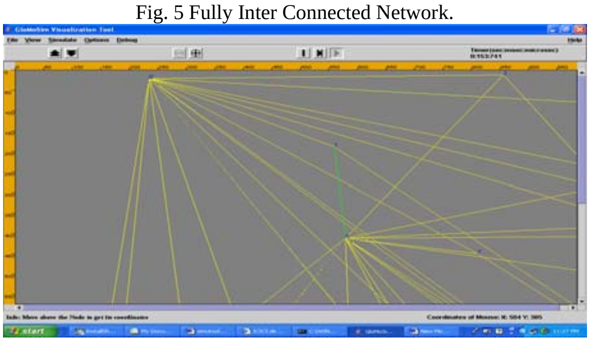

Fig. 6 Data delivered successfully-Green Signal

The performance of DMM has been evaluated by using Ns2 Simulator. Node creation and cluster formation are as shown in Fig 7, 8, 9. Nodes that are within the transmission range are going to receive the packets as shown in Fig 10 otherwise they are transmitted to their neighbor nodes. Acknowledgment packets confirming the packets are reached successfully as shown in Fig 11.Finally nodes that are within the range of communication link has been established to transfer the information and the routing details are maintained in the source as shown in Fig 12 and 14, If nodes are unreachable data loss is going to occur as shown in Fig 13 and 15.

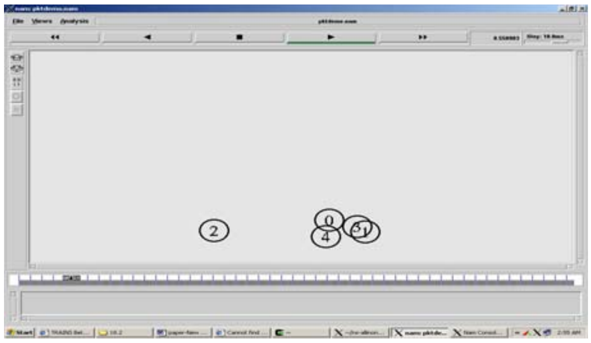

Fig. 7 Node Creation Begins-Ns2.

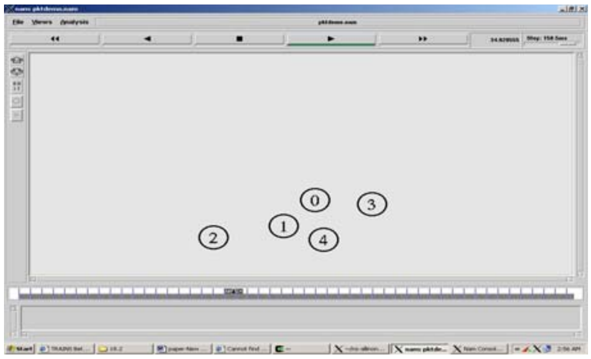

Fig. 8 Dispersion of Nodes in Ns2

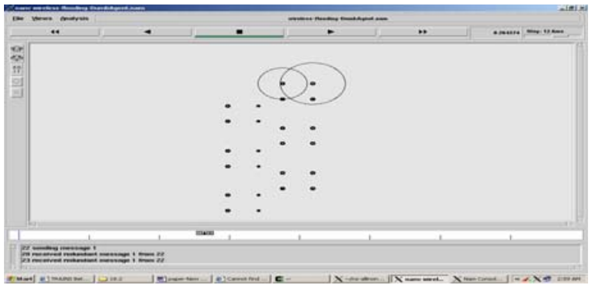

Fig. 9 Cluster Formation in Ns2.

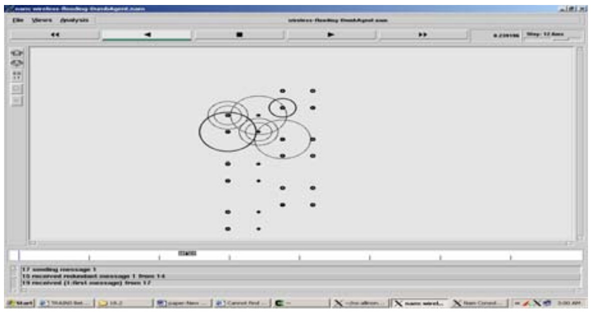

Fig. 10 Transmission of packets to Destination

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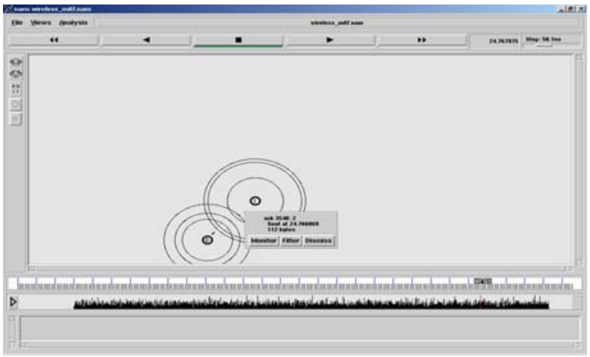

Fig. 11 Data Transmission and ACK packets.

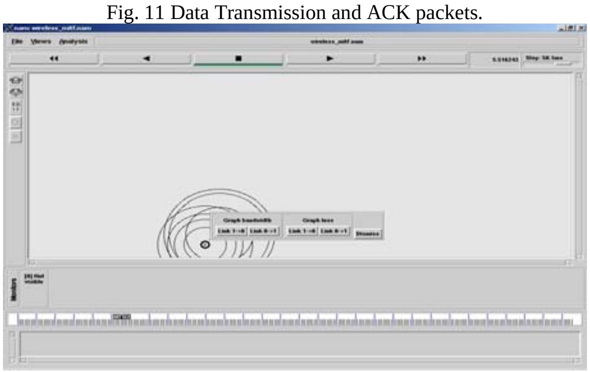

Fig.12 Link Establishment and Bandwidth

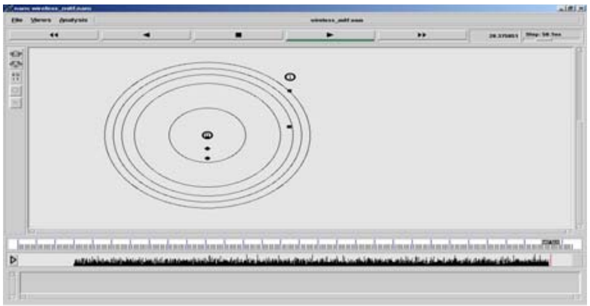

Fig. 13 Loss of Packets- Nodes Out of Range

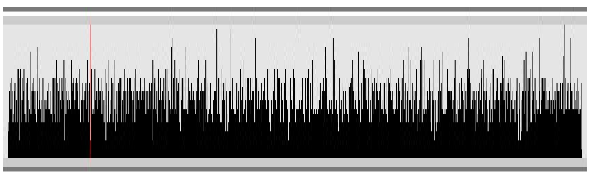

Fig. 14 Data Transmission- Peaks & Pause Time-Slopes

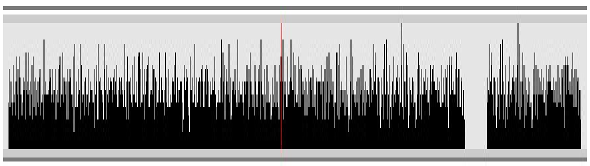

Fig. 15 Data loss- Nodes of Range-Blank Space

Given the diagram of user destinations, we need to define cluster regions by applying a stability values. Stability values that are too low may generate too many cluster regions. Some of these cluster regions may be in fact not popular locations. To observe the effect of routing, we calculate the number of stability clusters generated by varying the values nodes 10 to 70 in increments of 10. Fig 16 shows the result of clusterhead formation and stability of CH in DMM than other models. Fig 17 shows the delay in DMM is very low compare to other models, because there is continuous monitoring of nodes by clusterheads. The average number of control packets generated by DMM model has been reduced 30% by the faster cluster formation as shown in Fig 18.

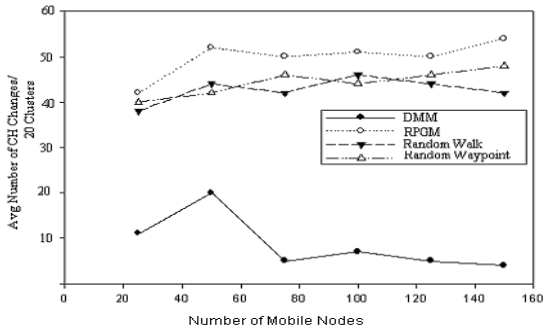


Fig. 16 Cluster Head Selection

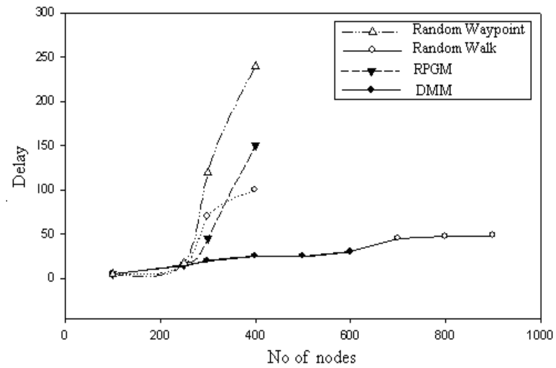


Fig. 17 Comparison of Delay of Transmission

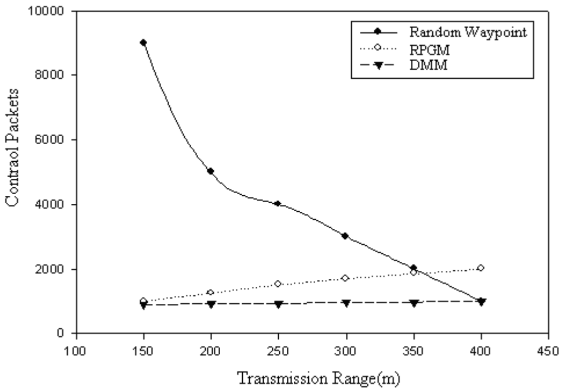


Fig.18 Control Packets Vs Transmission Range-
During Communication

The packet overhead shown in Fig 19 clearly exposes the characteristics of the mobility models. RPGM and RandomWayPoint models do not adapt to increased mobility; the update intervals remain constant. The DMM on the other hand detect and react to more link failures when mobility increases. The average throughput for the network is shown in Fig 20. With an offered load of 10 packets/s the maximum throughput is approximately 50% increased.

Fig. 19 Overhead/Node Vs Transmission Range

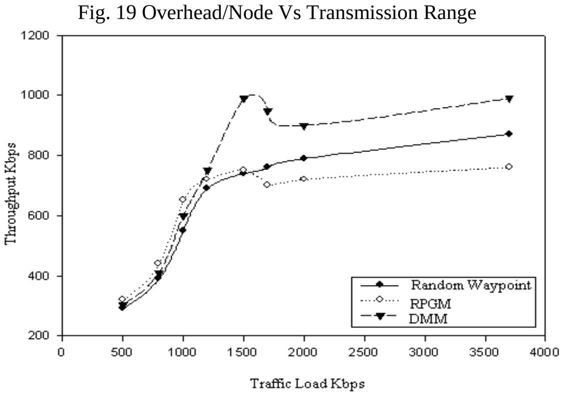


Fig. 20 Throughput in mobility models.

## 9. Conclusion

We have presented solutions to the problems of routing control and clustering in dynamic networks. Our approach provides an implicit and dynamic clustering of the network using different parameters. The clustered structure of the network is automatically manifested in the way routing is done. The protocol details of routing, speed, randomness and transmission are presented along with the architecture and the implementation details in the Glomosim and Ns2. Routing techniques strives to increase network capacity and optimal routing solution with respect to total power consumed in communication. Routing has been implemented at the network layer using hello packets only, without any support from the physical layer. The architecture works for any routing protocol.

Finally, DMM performs almost as well as other models at all mobility rates and movement speeds and accomplishes its goal of eliminating source routing overhead, but it still requires the transmission of many routing overhead packets and at high rates of node mobility is actually more expensive. Further research on mobility models for ad hoc network protocol evaluation is needed. DMM is developed as a new model that combines the best attributes of some of the models. DMM is to develop a minimum mobility model standard for performance evaluation. This minimum standard would allow us to examine different mobility models more thoroughly.

## 10. References

[1] Arvind Ramalingam, Sundarpremkumar Subramani, and Karthik Perumalsamy, "Associativity based cluster formation and cluster management in ad hoc networks", School of Computer Science and Engineering, Anna University, Chennai, India.2000.

[2] Feng Li and Jie Wu "Mobility Reduces Uncertainty in MANETs", Department of Computer Science and Engineering Florida Atlantic University Boca Raton, FL 33431.

[3] Geng Chen1 and Ivan Stojmenovic,"Clustering and routing in mobile wireless networks", SITE, University of Ottawa, Ottawa, Ontario K1N 6N5, Canada.

[4] E.M. Royer and C. Perkins. Multicast operation of the ad-hoc on-demand distance vector routing protocol. In *Proceedings of the ACM/IEEE International Conference on Mobile Computing and Networking (MOBICOM)*, pages 207–218, 1999

[5] E.Royer, P.M. Melliar-Smith, and L. Moser. An analysis of the optimum node density for ad hoc mobile networks. In *Proceedings of the IEEE International Conference on Communications (ICC)*, 2001.

[6] X. Hong, M. Gerla, G. Pei, and C. Chiang. A group mobility model for ad hoc wireless networks. In *Proceedings of the ACM International Workshop on Modeling and Simulation of Wireless and Mobile Systems (MSWiM)*, August 1999.

[7] G. Pei, M. Gerla, X. Hong, and C. Chiang. A wireless hierarchical routing protocol with group mobility. In *Proceedings of the IEEE Wireless Communications and Networking Conference (WCNC)*, September 1999.

[8] X. Hong, M. Gerla, G. Pei, and C. Chiang. A group mobility model for ad hoc wireless networks. In *Proceedings of the ACM International Workshop on Modeling and Simulation of Wireless and Mobile Systems (MSWiM)*, August 1999.

[9] D. Johnson and D. Maltz. Dynamic source routing in ad hoc wireless networks. In T. Imelinsky and H. Korth, editors, *Mobile Computing*, pages 153–181. Kluwer Academic Publishers, 1996.

[10] Tracy Camp,Jeff Boleng,Vanessa Davies," A Survey of Mobility Models for Ad Hoc Network Research," WCMC,Vol.2, no 5, pp.483-502,2002.

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