A Novel Approach For Random Walk -Buffer Relaying Performance With AODV- Implementation In Manets

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***Abstract* -In a mobile ad hoc network consisting of three types of nodes: source, goal, and relay nodes. All the clients are working over a bounded area with possibly different mobility patterns. We introduce and consider the notion of relay throughput, energy, end to end delay. The maximum rate at which a client can relay information from the beginning to the terminus. Our findings include the results that (a) the relay throughput depends on the node mobility pattern only via its node position distribution, and (b) delay depends upon the difference between simulation time at the reception and generation, (c) a routing protocol is as good as it causes less energy consumption, (d) that a node mobility pattern that results in a uniform steady-state dispersion of all nodes achieves the lowest relay throughput. The relay buffer occupancy is examined for the random walk mobility models with AODV [Ad hoc on demand distance vectoring routing protocol] have been nominated. This research work evaluates throughput, energy and End to End delay for random walk buffer relaying with AODV and a random direction mobility model with AODV routing protocol is simulated in NS 2 simulation environment.**

***IndexTerms* — AODV, Buffer Behavior, Delay, Energy, Mobile Ad hoc Networks [MANETs], Random Direction Mobility Model, Random Walk Mobility Models, Throughput, Two- Hop relay.**

I. INTRODUCTION

In mobile ad hoc networks (MANETs), since there is no set up infrastructure and nodes are mobile, routes between nodes are set up and turn down dynamically. For this reason, MANETs oftenexperiences route failures and network disconnectivity which induce two of the principal problems of MANETs. In order to overcome these problems, proposed to exploit the node mobility in MANETs to increase the network throughput. Their thought was to attend at the diversity gain achieved by utilizing the mobile nodes as relays [1].

The relay mechanism proposed in [9], called the two-hop relay mechanism, is simple: if there is no way of life between the root node (s) and the address node (d), the source node sends its packets to one of its neighboring nodes (say, r) for deliverance to the node d. it was then shown that a bounded delay can be ensured under the two-hop relay mechanism.The use of these studies (see also [10]) is the scaling property of the throughput or delay as the number of nodes in the network grows bigger.Our participation in the present work is in the implementation of the above mentioned relay mechanism in a net consisting of a defined and finite number of nodes.It was then shown in [5] that a bounded delay can be guaranteed under this relaying mechanism.The purpose of these fields is the scaling property of the throughput or energy or delay as the number of clients in the network gets bigger.

Our participation in the present work is in the implementation of the above mentioned relay mechanism in a net consisting of a defined and finite number of nodes.It is important to mention that most of the open areas of scaling laws of delay or throughput in wireless ad hoc networks assume a uniform spatial distribution of nodes, which is the case, for example, when the nodes perform a symmetric random walk over the neighborhood of interest [3].In the present report, we study the upshot of the node mobility pattern on the throughput,energy and delay performance of the relaying scheme of [7-8],[10]. We are interested in the maximumrelay throughput of a mobile node, i.e., The maximum that a node can pass as a relay to the communication between two other nodes. The relaying of data to other nodes requires a relay node to allocate its own resources. In particular, a relay node has to keep the data to be relayed in its buffer. Hence, the region of the buffer behavior of a relay node forms an important theme of research. The present study addresses the above two matters, i.e.,The maximum relay throughput and the relay node buffer behavior. Our degree of divergence is a simple observation which connects the evolution of a relay node buffer at certain time instants, called cycle times, to the evolution of the workload process in a G/G/1 queueing system [15]. The inspection and repair requirements and inter-arrival times in this queueing system are influenced by the characteristics of the mobility pattern.

An important point that needs to be emphasized is that, unlike [5],[9],[10] which study the system functioning when the number of nodes is large, we are interested in a relay node performance while it is involved in relaying data between two particular nodes.Preparing models for performance analysis of a relay node buffer and the relay throughput can help in dimensioning a relay node buffer size and on reaching an optimal performance using relaying mechanisms.We acknowledge that the model analyzed in this writing is not fixed to three nodes, nor that the model affects the same mobility pattern for all of the nodes.

The rest of the composition is organized as follows: Section II describes the existing model-the random direction mobility model is considered [2],[4]. In Section

III, describes the proposed model is considered and we develop a queueing model for the relay buffer (RB). We obtain expressions for the relay throughput for the random walk models in two dimensions with AODV protocol. In Section IV, describes the performance metrics are selected from both random based mobility models. The RB behavior for the random walk and random direction model and we report numerical results on the dearly, relay throughput, energy distribution in the probability of a 2-hop itinerary. In section V, we validate our findings by simulations and provide performance ratings. In section VI concludes research works.

II. EXISTING MODEL: THE RANDOM DIRECTION MOBILITY MODEL

The Random Direction Mobility Model [16] was created to overcome density waves in the median number of neighbors produced by the Random Waypoint Mobility Model. A density wave is the clustering of nodes in one portion of the simulation area. In the case of the Random Waypoint Mobility Model, this clustering occurs near the middle of the simulation area. In the Random Waypoint Mobility Model, the probability of an MN choosing a new destination that is situated in the heart of the simulation area, or a goal which requires travel through the heart of the simulation area, is high.

In club to ease this type of conduct and promote a semi-constant number of neighbors throughout the simulation, the Random Direction Mobility Model was produced [18]. In this model, MNs choose a random direction in which to travel similar to the Random Walk Mobility Model. An MN then travels to the perimeter of the simulation area in that way. In one case the simulation boundary is reached, the MN pauses for a fixed time, chooses another angular direction (between 0 and 180 points) and extends the operation. Image 6 presents an example itinerary of an MN, which commences in the middle of the simulation area or position (150, 300), using the Random Direction Mobility Model. The points in the Fig. 1 illustrate when the MN has reached a border, paused, and then picked out a fresh focal point. Since the MNs travel to, and usually pause at the perimeter of the simulated country, the average hop count of data packets using the Random Direction Mobility Model will be much higher than the average hop count of most other mobility models (e.g., Random Waypoint Mobility Model). In increase, network partitions will be more likely with the Random Direction Mobility Model compared to other mobility models.

A little modification to the Random Direction Mobility Model is the Modified Random Direction Mobility Model [18]. In this modified version, MNs continue to pick out random directions, but they are no longer impelled to travel to the simulation boundary before stopping to shift management. Rather, an MN chooses a random direction and picks out 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.

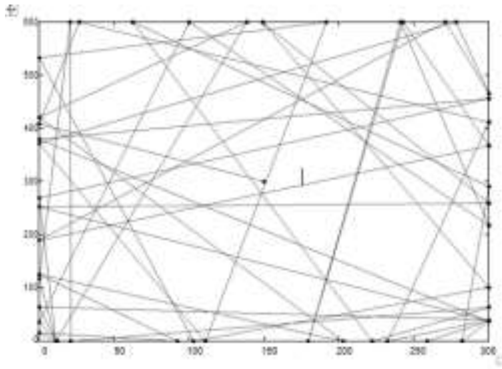


Figure 1.Traveling pattern of an MN using the Random Direction Mobility Model.

Mobility metric is computed as the amount of the relative speed averaged over all node pairs and over all time. The formal definition is as follows

$$M = \frac{1}{|i,j|}\sum_{i=1}^{N}\sum_{i=i+1}^{N}\frac{1}{T}\int_{0}^{T} RS(i,j,t)\,dt \qquad (1)$$

The (1) describes the mobility metric. Where |I, j| is the number of distinct node pair (I, j), n is the total number of nodes in the simulation field (i.e., ad hoc network), and T is the simulation time.

III. PROPOSED MODEL: RANDOM WALK REALY BUFFER MOBILITY MODEL WITH AODV

A. Description Of Protocols: Aodv

This protocol performs Route Discovery uses control messages route request (RREQ) and route reply (RREP) whenever a node wishes to send packets to the destination. To control network wide broadcasts of RREQs, the source node uses an expanding ring search technique. The forward path, sets up an intermediate node in its routetable with a lifetime association RREP. When either destination or intermediate node using moves, arouteerror (RERR) is transmitted to the affected source node. When source node receives the (RERR), it can initiate route if the itinerary is even required. Neighborhood information is obtained from the broadcast Hello packet. As the AODV protocol is a flat routing protocol, it does not need any central administrative system to handle the routing process. AODV tends to reduce the control traffic messages overhead at the cost of increased latency in finding new routes. The AODV has great advantage in having Less overhead over simple protocols which need to keep the entire route from the source host to the destination host in their messages. The RREQ and RREP messages, which are responsible for the route discovery, do not increase significantly the overhead from these control messages. AODV reacts relatively quickly to the topological changes in the network and updating only the hosts that may be affected by the change,using the RRER message.The Hello messages,which are responsible for the route maintenance, are also limited so that they do not create unnecessary overhead in the network[14].

B. Mobility Models

There are two types of mobility models used in the simulation of networks: traces and synthetic models [8-9]. Traces are those mobility patterns that are observed in real life systems. They provide accurate information when they involve a large number of nodes and an appropriately long observation time. Different synthetic entity mobility models for adhoc networks are [18]

1. Random Walk Mobility Model (including its many derivatives): A simple mobility model based on random directions and speeds.
2. Random Waypoint Mobility Model: A model that includes pause times between changes in destination and speed.
3. Random Direction Mobility Model: A model that forces MNs to travel to the edge of the simulation area before changing direction and speed.
4.A Boundless Simulation Area Mobility Model: A model that converts a 2D rectangular simulation area into a torus-shaped simulation area.
5. Gauss-Markov Mobility Model: A model that uses one tuning parameter to vary the degree of randomness in the mobility pattern.
6. A Probabilistic Version of the Random Walk Mobility Model: A model that utilizes a set of probability determine the next position of an MN.
7. City Section Mobility Model: A simulation area that represents streets within a city. Analyzing the first two models.

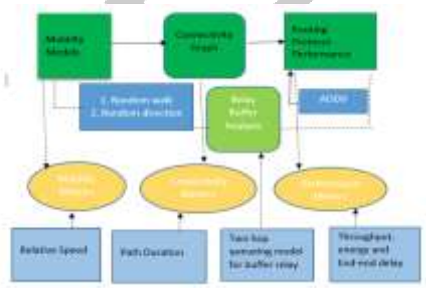


Figure 2. Framework for RWRBAODV-
(Random walk relays buffer AODV protocol)

These frameworks describes the
1.mobility model & metrics
2.relay buffer analysis&metrics
3.Routing protocol performance & metrics

Mobility model random walk and random direction are considered, in these model mobility metrics is relative speed, after that it is analyzed with two hop relay buffer, these mobility model is connected to routing protocol AODV through connectivity graph & connectivity metric is path duration. Performance metrics throughput, energy &end to end delay is simulated in the NS-2 environment.

C. Random-Based Mobility Models

In random-based mobility models, the mobile nodes move randomly. Then, two variants of the Random Waypoint model, namely the Random Walk model and the Random Direction model, are described in section II, respectively

D. Random Walk Mobility Model

The Random Walk model was originally proposed to emulate the unpredictable movement of particles in physics. It is also referred to as the Brownian Motion. Because some mobile nodes are believed to move in an unexpected way, Random Walk mobility model is proposed to mimic their movement behavior. The Random Walk model has similarities with the Random Waypoint model because the node movement has strong randomness in both models. We can think the Random Walk model as the specific Random Waypoint model with zero pause time. However, in the Random Walk model, the nodes change their speed and direction at each time interval.

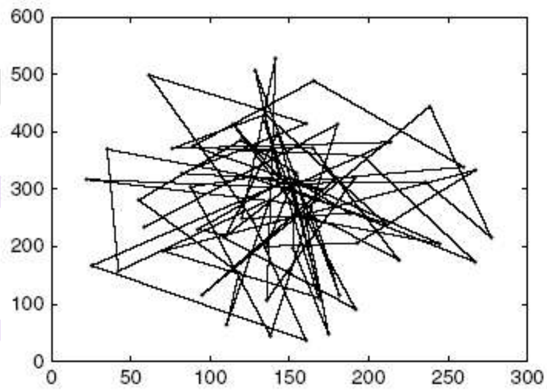


Figure 3. node movement in the Random Walk Model

Parameters:
- Speed =[Speed_MIN,Speed_MAX]
- Angle = $[0,2\pi]$
- Traversal Time (t) or Traversal Distance (d)

a. Characteristics of Random Walk Mobility

1.Nodes change their speed and direction each time interval, and this mobility model has zero pause time.
2. Random walk can have retained barriers that imply that mobile nodes cannot move past them.
3. Random walk can also have absorbed barriers from where mobiles cannot leave.
ie, it is impossible to leave and absorbing barrier.
4. Speed v(t) can be chosen from the predefined ranges $[v_{min}, v_{max}]$ by each node.
5. Like speed, each node, choose its new direction θ (t) randomly and uniformly from the ranges $[0,2\pi]$.
6.A Node moves with the velocity vector [v (t) cos, v (t) sin] during the time interval.
7. Each movement occurs either in constant time interval t or in a constant distance traveled d (say, distance or Range between the two mobile nodes) or M movements completed within a certain distance at the each of which a new direction and speed are calculated.
8. Each mobile node bounce off the simulation boundary with an angle of $\theta(t)$ *or* $[\pi - ((t))]$ or determined by the incoming direction when the node reaches the boundary.
9. The model is memory loss because it does not retain knowledge related to its past speed and direction, and

itselfFuture velocity is independent of the current velocity, and it then continues to move along this new path.

10. The mobility of a node is analyzed by fixing the reference frame of one with respect to another as the link or Connectivity between the two mobile nodes is dependent on the relative movements of the nodes, is translated an equal distance in the opposite direction

11.Mobility vector [v (t), $\theta(t)$] of a node during time interval can be obtained as the difference of the mobile vectors of the two nodes. The velocity vector of a mobile node seen in the other's reference frame will be double the actual velocity because a reference frame with respect to another node is to be considered.

b. Stationary Distribution of Random Walk Mobility

The exact modeling and calculation of the RW mobility may be cumbersome. A more attractive approach is to provide approximate modeling schemes that can be effectively used for low cost computer simulations without compromising the technical accuracy of the real-life mobility patterns in MANETs. It is shown that the mobility models of RW mobility belong to a mobility class that is specified by the conditional distribution of destination points given source points, the distribution of speed, and the distribution of pause times for each mobile link. The continuous-time distributions of mobile node locations and velocities are thin derived from the mobile link steady-state distributions.

c. Continuous-Time Steady-State Distribution Approximation

We now derive expression for the continuous-time steady-state densities for the random variables of mobility models as well as conditions for the existence of these distributions. The continuous-time steady-state distribution of random variables is the distribution of the random variable when sample at a single random time instant after the mobility model has entered its steady state. All expressions are represented in the continuous-time steady-state distribution of X and Y locations of mobile nodes from the mobile link random process densities.

d. Steady-State Mobile Link Distribution

We describe a generalize method for converting the specification of the relationship between start and end position into a steady-state distribution of source and destination positions. This dispersion is applied to estimate the density of mobile terminal location and velocity in continuous time at a randomly selected time instant after the mobility model has come in steady state [2]. It is assumed what the mobile node speed is independent of position. Let us consider the following hypothetical.

- (Sx, Sy) are random variables specifying the start point coordinated for a mobile connection with (Sx, Sy) indicating the respective sample values.
- (D_x, D_y) are random variables specifying the endpoint coordinated for a given mobile link with (d_x, d_y) specifying the sample values.
- The random variable S designated the speed for a mobile link with a sample value given by s.
- A mobile link probability density function for random variable X is specified as $\int_X^L(x)$ (x) Where the superscript L denotes that this is a mobile link density and

The steady-state distribution of the start positions of the mobile links is designated $\int_{s_x, s_y}^{Lss}(s_x, s_y)$which is the density of the starting positions of mobile terminal for a mobile link as the number of mobile like transitions goes to infinity. There is no guaranty that there will be such a steady-state distribution of start positions which is independent of the initial distribution of mobile terminal locations. The probability density function for the mobile terminal start positions for link to is given$\int_{s_x(n)s_y(n)}^{L}(s_x, s_y)$, And the density of mobile node end positions for link and after the commencement of the simulation is presented by

$$e_i^x(t) = \left\{ \sqrt{\tfrac{N-2}{a}}\ u((t-(i-2)a/N-2) \right. \left[u(t-(i-1)a/N-2) \right] \qquad \begin{array}{l} for\ i=1 \\ for\ i=2,3\ldots N-1--2 \\ for\ i=N \end{array} \qquad (2)$$

$$e_i^y(t) = \left\{ \sqrt{\tfrac{N-2}{b}}\ u(t-(i-2)b/N-2) \right. \left[u(t-(i-1)/N-2)] \right] \qquad \begin{array}{l} for\ i=1 \\ for\ i=2,3\ldots N-1--3 \\ for\ i=N \end{array} \qquad (3)$$

The (2) & (3) describes basis functions for X- and Y-coordinates, The accuracy of this assumption at the edge of the network areas,.delta function are added at the ends of the X and Y domains for the network areas.

For any density function$f_{s_x}^L(S_x)$, we can compute its continuous integral dot product with each basis function. The function can then be approximated as follows

$$f\int_{s_x}^{L}(s_x) \approx \sum_{i=1}^{N} c_i^X e_i^X(s_x) \qquad (4)$$

$$\text{Where } c_j^X = \int_0^a e_i^X(t) \int_{s_x}^{L}(t)\, dt \qquad (5)$$

The (5) describes about density function for x coordinates.A similar approximation of density functions $f_{s_x}^L(s_y)$ Integral dot products with the basis functions can likewise be manufactured. We compute matrices as follows:

$$A_{ij}^{X} = \int_0^a \int_0^b \int_{D_x}^{L} (d_x|s_x) e_j^X(t) ds_x e_i^X(d_x) dd_x$$

$$= \int_0^a [T^X e_j^X(d_x)] e_j^X(d_x) dd_x \qquad (6)$$

$$A_{ij}^{Y} = \int_0^a \int_0^b \int_{D_y}^{L} (d_y|s_y) e_i^Y(t) ds_y e_i^Y(d_y) dd_y$$

$$= \int_0^a [T^Y e_j^Y(d_y)] e_j^Y(d_y) dd_y \qquad (7)$$

The (6) & (7) describes density function of x & y coordinates in matrix fromat .Where A_{ij}^{X} Specifies the jth element in the ith row of the matrix A^X. If we calculate a vector $r^X = A^X C^X$, where C^X is calculated with (5),then

$$\sum_{i=1}^{N} r_i^X e_i^X(s_x) \approx T^X \int_{s_x}^{L} (s_x) --7$$

The equation 7 describes the conditional density of destionation points.With the approximation improving as $N \rightarrow \infty$. This demonstrated how we can approximate the linear integral transformation produced by the conditional densities of destination points given source points as a matrix and vector generation. We can then compute approximate eigenvalues and eigenfunctions for the integral operators based on $\int_{D_x}^{L} (d_x|s_x)$ and $\int_{D_y}^{L} (d_y|s_y)$ by computing the eigenvalues and eigenfunctions of A^x and A^y, respectively.

e. Stationary Distribution Of Random Mobility

We can calculate approximations to the steady state of the starting X and Y-coordinated for the motion links by obtaining the eigenvectors for A^x and A^y corresponding to the eigenvalue of one and using the approximation formula show in below Equation. The eigenvectors are first multiplied by a scalar constant to normalize the total of their constituents, this condition being imposed by the orthonormality of the basis functions and the requirement that the steady-state densities integrate to unity. If c^x and c^y are the suitable normalized eigenvectors corresponding to eigenvalues of 1, then the approximate steady-state distributions are given by

$$f \int_{Sx}^{Lss} (sx) \approx \sum_{i=1}^{N} r_i^X e_i^X(s_x) \qquad (8)$$

$$f \int_{Sy}^{Lss} (s_y) \approx \sum_{i=1}^{N} r_i^Y e_i^Y(s_y) \qquad (9)$$

The (8) & (9) describes joint denstity functions of x any y locations.To calculate approximate of the continuous-time steady-state joint density of X and Y locations, we need an estimate of the steady-state joint density of the outset and end locations for a single motion link. The firm-state joint density of both start and close positions for each motion link is made by

$$\int_{Sx,Sy,Dx,Dy}^{Lss} (S_x, S_y, d_x, d_y) = \int_{D_x,D_y}^{L} (d_x, d_y | S_x = s_x, S_y = S_y) \int_{S_x,S_y}^{Lss} (S_x, S_y) \qquad (10)$$

The (10) describes the joint density functions for mobilie link.If the X and Y-coordinate mobilities are independent of the mobile link level we obtain the expression

$$\int_{S_x S_y D_x D_y}^{Lss} (s_x, s_y, d_x, d_y) = \int_{D_x}^{L} (d_x|s_y = s_x) f \int_{S_x}^{Lss} (s_x) \times \int_{D_y}^{Lss} (d_y|s_y = s_y) \qquad (11)$$

The (11) describes the joint density functions for independent mobile link.Where the condition densities are determined as function of the motion model and the steady-state motion link densities can be estimated utilizing the methods identified above. The next section will employ this formulation to calculate continuous-time steady-state densities for motion models.

f. Continuous-Time Distribution Of Mobile Node Speed

We will practice a standardized construction, as was indicated in equation to develop an aspect for the continuous time steady state density of speed. We define S as the speed random and S (j) as the speed of the get mobile link. This permits us to compose an aspect for the steady-state cumulative distribution function of the speed for moving mobile nodes as follows:

$$P^C(S \le s) = \lim_{M\to\infty} \frac{\sum_{j=1}^{M} ddist(j) I(S(j) \le s)}{\sum_{j=1}^{M} d\, dist(j)} \qquad (12)$$

$$= \lim_{M\to\infty} \frac{\frac{1}{M}\sum_{j=1}^{M} \frac{D(j)}{S(j)} I(S(j) \le s)}{\frac{1}{M}\sum_{j=1}^{M} \frac{D(j)}{S(j)}} \qquad (13)$$

$$= \frac{E^L\left[\frac{D}{S} \middle| S \le s\right] P^L(S \le s)}{E^L\left[\frac{1}{S}\right]} \qquad (14)$$

The (12),(13) & (14) describes cumulative distribution function Where we call forth the independent of D and S. All expectations in the equation are considered with regard to motion link densities. By taking the derivatives of the equation are taken to s ,we obtain the continuous-time probability density function of the speed as follows:

$$f_S^C(s) = \frac{f s^L(s)}{s E\left[\frac{1}{S}\right]} \qquad (15)$$

The (15) describes continuous-time probability density function, where the expectation is taken with respect to the motion link distribution of speed. If mobile terminals that are passed are included, the continuous time steady-state cumulative distribution function of speed becomes

$$P^C(S \le s) = \frac{E^L[D] E^L\left[\frac{1}{S} \middle| S \le s\right] P^L(S \le s) + E^L(P)}{E^L[D] E^L\left[\frac{1}{S}\right] + E^L[P]} \qquad (16)$$

for $s \ge 0$ and is zero otherwise. The (16) describes continuous time steady-state cumulative distribution function .The compactness of the velocity of the mobile terminals for both paused and moving mobile terminals is then rendered in (17).

$$f_S^C(s) = \frac{E^L[D]\frac{1}{s} f_S^L(s) + E^L(P)\delta(s)}{E^L[D]\, E^L\left[\frac{1}{S}\right] + E^L[P]} \quad (17)$$

g. Queueing Model For The Relay Buffer

Later directing the event where there are only three mobile nodes in which we investigate the spot of an arbitrary number of source/destination/ relay nodes, under the additional premise that all source and destination nodes are specified.

h. Relay Buffers Behavior

In this part, the gist of the mobility model on the relay buffer occupancy is studied [17]. We accept that the mobility models under consideration have stationary node location distributions.

1) Conventional Relaying:

For comparison purpose, we provide the throughput of two baseline schemes. Thereby, we assume that the transmit power as the source and the relay are fixed,

i.e. , P_S (i) = P_S , P_R(i) = P_R,

Conventional relaying without buffer: The instantaneous throughput of conventional relaying without buffer, where the relay has a packet in one time slot and sends it in the next, are given in [5], and the corresponding average throughput is

$$T_{conv,1}, \lim_{N\to N-1} \frac{1}{X_i} \frac{N}{2} \min\{log_2\left(1+ s(2i-1), log_2\left(1+r(2i)\right)\right\}$$

$$= \frac{1}{2} \mathrm{E}\{\min\{log_2(1+s(i), log_2(1+r(i))\}\} \quad (18)$$

The (18) describes average throughput foconventional relaying without buffer .Here the ergodicity of us(i) and r(i) was exploited. Note that conventional relaying without buffer introduces a time lag of one time slot since the relay has to await until the entire codeword is received and decoded before sending the code word to the address.

2) Conventional relaying with buffer [13]:

In conventional relaying with buffers as proposed in [13],The relay receives data from the origin in the first N/2 (N is even) time slots and sends this cumulative Information to the destination in the next N/2 slots. The corresponding maximum achievable average throughput is obtained for N → ∞ and given by

$$T_{conv,2}, \lim_{N\to\infty} \frac{1}{X_i} \min \frac{N}{2} \{log_2\left(1+s(i), log_2\left(1+r(i)\right)\right\}$$

$$= \frac{1}{2} \{\min \mathrm{E}\, \{log_2(1+s(i), log_2(1+r(i))\}\} \quad (19)$$

The (19) describes throughput for conventional relaying with buffer .Comparing (18) and (19), we observe that $\tau_{conv,2} \geq \tau_{conv,1}$ holds Nevertheless, to realize this performance increase, the relay has to be fitted with a buffer of infinite size and an infinite delay is brought out.

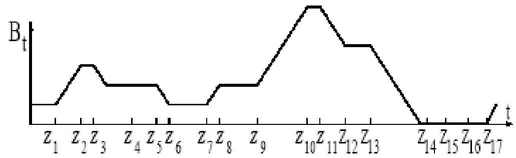


Figure 4. Development of {St} and relay node buffer occupancy

The phylogeny of the discrete indexed process {szk, k≥1} consists of sequences of 1,0 and -1. This naturally motivates us to await at the times when the relay node returns to the root node after being neighbor of the destination node at least once.

j. Monitoring And Modelling The Relay System

To examine the maximum rate at which a client can relay data, we start out by seeing the scenario where three nodes move in a two-dimensional bounded region. One of these nodes is the source of packets, one is the destination, and the third one is the relaying node. The mobility patterns of the three guests are independent and may be different from each other; this is in contrast with [5],[9] where the authors accept that the mobility design of the nodes is such that the steady-state distribution of the location of all the nodes is uniform over the area of interest. In fact, El Gamal et al. [5] Assume that nodes perform random walks (at that place are other mobility models which also result in a uniform stationary distribution, e.g., The random direction model).As noted earlier, we are interested in the maximum relay throughput of a relay node.As a starting point we will confine ourselves to the case where there is only one relay node.At a later point we will relax this assumption.Likewise, we want to examine the dependence of the relay node buffer behavior of the mobility model. We assume that a node detects its one-hop neighbor(s) by sending periodically Hello messages. However to detect two-hop neighbors, nodes exchange the addresses of their neighbors. The model predicts the wind field and turbulence parameters:

1. The three nodes move independently of each other according to a (possibly client-dependent) Mobility model inside a bounded two-dimensional region.
2. The source node has always data to impart to the destination node. This is a standard assumption, too constructed in [5],[9],[10], because we are interested in the maximum relay throughput of the relay node.
3. When the relay node comes within the broadcasting range of the source node (we will also articulate that the nodes are in contact in this case), and if the end node is outside the transmission range of the beginning and of the relay node, then the relay node accrues packets to be relayed to the destination node at a constant raters. [We could pull up stakes for a stochastic nature of traffic generated by the source by assuming that rise is an independent stochastic process. Even then, such a work is out of the scope of this work.
4. When the destination node comes within the broadcasting range of the relay node, and if the terminus and the relay node are outside transmission range of the source node, then the relay node sends the relay packets (if any) to the destination node at a constant rate read.
5. If the relay node is within transmission range of both the source node and the destination node, then the relay node does not contribute to relaying. In this case, there is

either a direct communication between the source and destination or there is a two-hop route via the relay node so that the relay node acts as a forwarding node and not as a relay.

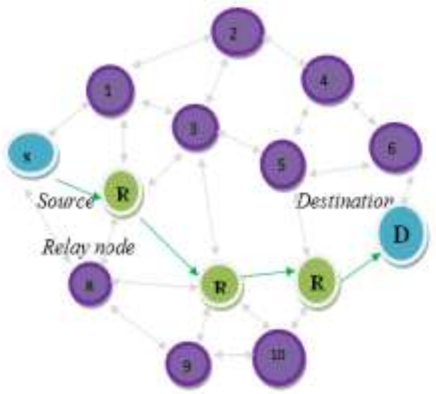


Figure 5. Schematic diagram for relay node selection using buffer size

Our aim is to study the properties of the relay buffer (stability, stationary occupancy distribution, throughput). To this end, we first develop a queueing model that will give many insights into the system behavior.

k. Comparison Of Mobility Models

We see the scenario where nodes move independently of each other according to the same mobility pattern. Presume that the node position, distribution is stationary. The nodes position can contain values in a discrete set X with cardinality #X = G. Let G (x), x € X denote the circle of all peaks in the transmission range of a node located at x. We take for granted that there is perfect symmetry, so that #G (x) = #G (y) for all x, y € X and that if x G (y) then why € G (x). This can be taken for granted when there is no boundary effect, for instance, as is the case of motion over a torus or over a set (representing, respectively, operate over a plane or line with wrap around). Let P be the probability measure over X that represents the stationary node location distribution. As the cardinality of X is equal to G, P can be symbolized as a G-dimensional (column) vector. The uniform stationary node location over X, called you, is a G-dimensional vector whose first appearances are totally equal to 1/G.Let ex, x € X, denotes a probability measure over X which gives all Masses to position x, i.e., Ex is a G-dimensional vector whose first appearances are all equal to 0 except for the cost components which is equal to 1.

For any stationary node location, distribution P over X, let g (P) denote the chance that two nodes are neighbors of each other. Let H denote the neighborhood matrix, i.e., Hx, y = 1 if you€ G (x)and Hx, y = 0 otherwise. Note H is a symmetric matrix. In terms of Px (resp. Pi), the probability that a client is on location x (resp. Y) in the stationary regime's g (P) writes

$$g(P) = \sum_{x \in X} P_x \sum_{y \in G(x)} P_y = P^T HP \qquad (20)$$

Where PT is the transpose of P and we use the fact that the locations of the nodes are independent.The (20) describes probability for node location x.

l. Simulation Algorithm For Random Walk –Relay Buffers with AODV

1. Generate random, initial location for the first mobile node.
   a. Sample(s_x,s_y)from density $f^L s_x s_y$ (s_x,s_y).
2. Generate random destination function for current mobile connection.
   a. Sample(d_X,d_Y)from the conditional density $f^L_{Dx,Dy}(d_X,d_Y\ S_X=s_x,S_y=s_y)$.
3. The state of the relay node at time t is represented by the random variable (r.v.) St {-{-1, 0, 1,2,3,4} where:
   - St = -1 the relay node is unavailable for both origin and destination. Neither source nor destination has a relay node in its coverage area;
   - St = 0 in this case the buffer size of the client does not satisfy the relay status;
   - St = 1 denotes that the relay node is present in the coverage area of the source client. Here the destination node cannot reach the relay node.
   - St=2 indicates that the destination node has relay nodes in its reporting, though the source node cannot reach it.
   - St=3 is the event where both the origin and destination node receives the relay node in its coverage area. It is the most preferable case as it guarantees the immediate transmission.
   - St=4 This is the condition where the transmission of data takes place from source to terminate through the relay node.
4. Generate random speed of the mobile node for the current mobile connection.
   a.Sample s from density $f_s^L(s)$.
5. Move mobile terminal from (s_x,s_y) to (d_X,d_Y) at speed s with PREQ Packet to itsupstreamneighbour.
6. Set starty point for mobile link to destination point current mobile link.
   a.Sets_x=d_x and s_x=d_y.
7. If the packet acknowledgement received(PREP) positively ,update the routing table.
8. Pause random time period before moving again (if applicable, otherwise skip this step).
   a. Sample p from density $f_p^l(p)$.
   b. Wait p unit of time.
9. Go to step 2 and generate next mobile links.

IV. PERFORMANCE METRICS

Ad hoc networks are designed to be scalable. As the web develops, various routing protocols perform differently [4,10]. More or less important measures of the scalability of the protocols are,

- Throughput.
- End to End delay.
- Energy.

A Throughput

End-to-end throughput: Since the available bandwidth in a mesh is fairly well known, it is interesting to find out what the actual throughput achieved in a simulation is. Lifeguard estimation of this value can be extracted it would be

Statistic	Value
Operating system	FEDORA 8 linux
Scripting	Tool command language
Simulator	NS 2.33
Routing protocols	AODV
NODE	100
Scenario size	1000*1000m
Channel type	Wireless
Simulation time	1000sec
Performance metrics	Throughput, stability, energy

TABLE I. SIMULATION PARAMETERS

possible to see how efficient the routing protocol is. The higher the average throughput. The less routing overhead consuming the bandwidth. Each time a network node successfully receives an information packet, a global counter tallying the number of correctly received information packets is incremented. The global counter wifi is an integer state variable. The end-to-end throughput 'rcan then be computed by $r = \frac{SuccessfullyReceivedPackets}{SimulationTimeElapsed} * 100$.

B End To End Delay

A packet should be time stamped when it is generated. When a packet reaches its final destination,the end-to-end delay b can be computed by Delay=(Simulation Time at Reception) — (Simulation Time at Generation).

C Energy

Designing energy-efficient routing protocols for mobile ad hoc networks is necessary for pervasive acceptance of portable, self-networking devices[11,12]. We target networks that are cared about energy use of commodities and services, but still also need a reasonable layer of performance. A great deal of the work on adhoc networks has concentrated on amending the routing properties and routing efficiency.

V. SIMULATION RESULTS AND ANALYSIS

The number of nodes used in the simulation is 100. The protocol used is AODV. The algorithm is simulated in NS2 and the terrain size is 1000*1000. In MANET, nodes are distributed and also highly mobile. Hence connectivity is a major issue. Also in large scale networks since multi hop paths are there, they will be less energy efficient. Nodes communicate with one another based on their remaining energy level. Referable to the presence of loops, packets may lose. The following QOS parameters considered.

- Throughput
- Energy
- Delay

Grounded on this, several results are analyzed. From the result, it was clear that performance of network using AODV was better than when using existing algorithm. As nodes move, the links and routes get disrupted. As a resolution re-route discovery process will be evoked. So overhead, stop to end delay etc. Will they be affected too?

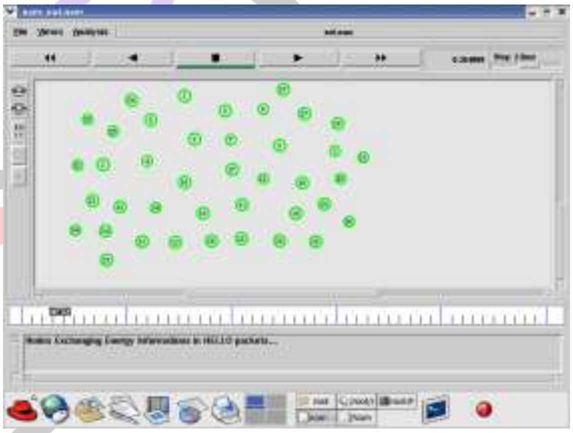
Also certain parameters like packet drop varied significantly for nodes near the root and nodes away from the beginning. So it was broken down individually for both types of clients.

Performance Metrics / No of nodes: 100	AODV with random direction mobility model	AODV with random walk mobility model with buffer relaying
Energy (Per Node)	4.0 J	3.8 J
Throughput	0.35	0.55
End To End Delay	2.2 seconds	1.8 seconds

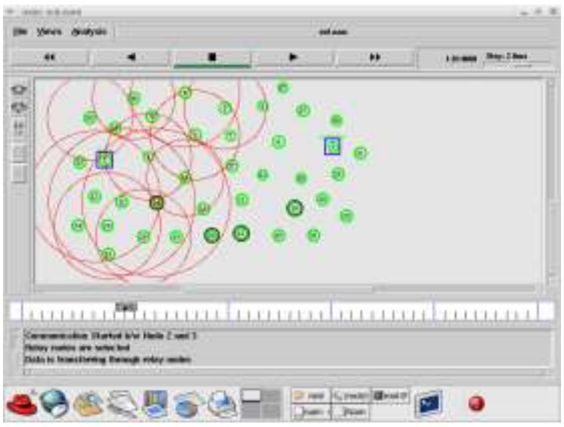
TABLE 2. SIMULATION VALUE ANALYSIS

From the table comparasion 63% throughput, 9% less energy and 81 % less delay in random walk buffer relay model in AODV were implementation was better than a random direction mobility model.

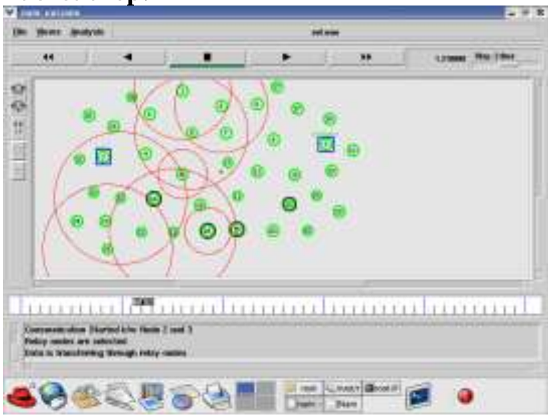
Node Creation:



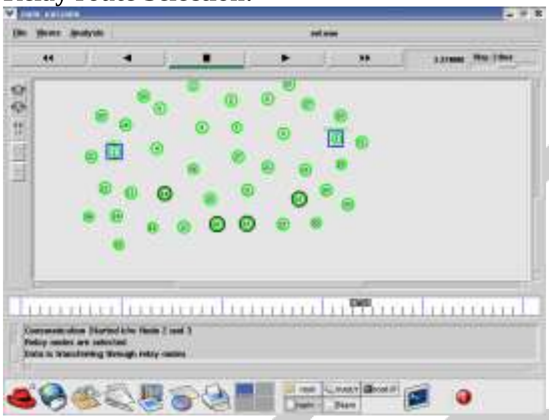
Hello Packets:



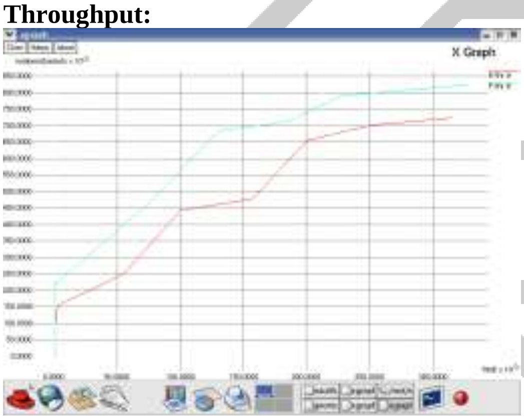
Packet drop:



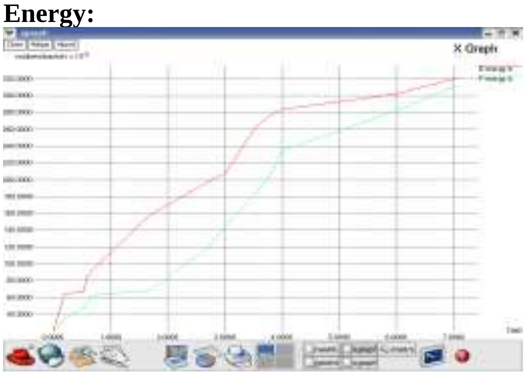
Relay route Selection:



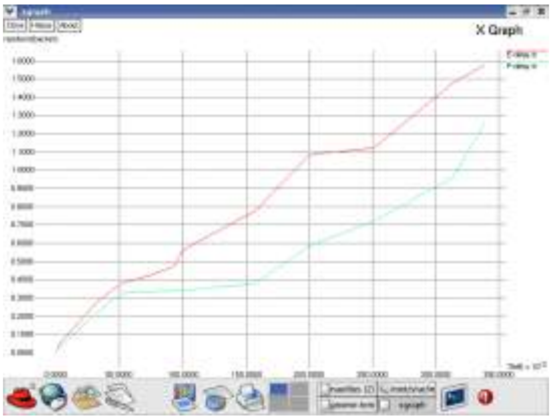
Throughput:



Energy:



Delay:



VI. CONCLUSIONS

We have examined the performance of relaying in mobile ad hoc networks by developing a queueing model [13],[15]. The parameters of the queueing model depend on the node mobility pattern. Our primary findings are that (under the assumptions placed on our model) the relay throughput depends only on the stationary node location, distribution, and that the uniform stationary distribution of nodes results in the smallest relay throughput.Approximate throughput formulas have been gained for both the random walk and the random direction mobility models; these patterns have been found to be in agreement with simulation results.The approximation formula for the mean buffer occupancy of the relay node has been obtained for the random walk mobility model and the random direction in two dimensional movements. It can be concluded, these research work proves the high throughput, less average end to end delay, less energy consumption.This plausible performance improvement sacrifices the survivability of wireless adhoc networks. Future work includes adding more optimization to these works in multiple hop environments to support node mobility even better.

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