Effect of Mobility on Energy Consumption of OSLR Protocol in MANET's

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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 established infrastructure OLSR routing protocol using Random Waypoint Mobility Model, RPGM, Gauss Markov Mobility Model, and Manhattan Grid Mobility Model for energy consumption in different modes: transmission, receive, and idle. OLSR is a proactive, table-driven, link state routing protocol. In the Mobility models generalized movement of nodes. In these routing protocols over mobility models which reflect real world scenarios are very important as it affects the overall performance of the network. In this research paper want to show energy consumption have been considered by varying the mobility speed and the traffic load in the network. The aim of this research work is to study the impact of mobility model on the energy consumption in MANET routing protocols. The energy consumption under different mobility models is evaluated through simulation using NS2. The well-known OSLR protocol is taken as the candidate protocol for performing experiments under different scenario*

Keywords- Mobile Ad hoc Networks, MANET, Mobility Models, OSLR, MH, GM, RWM, RPGM.NS2

I. INTRODUCTION

This Advances in wireless communications and small, lightweight, portable computing devices have made mobile computing possible. In coming years, information technology will be mainly based on wireless technology. One of the unique features of wireless networks compared to wired network is that data is transmitted from one point to another through wireless links i.e. there is no need of wired link between the two nodes for transmission. Communication takes place through wireless links using antennas. Network nodes just need to be in the transmission range of each other. But due to transmission limitations all the nodes may not be able to communicate with one another directly. Hence a multi-hop scenario occurs, and several nodes may need to relay a packet before it reaches to its final destination. MANETs are complex distributed systems consist of wireless links between the nodes and each node also works as a router to forwards the data on behalf of other nodes. Whenever a node is in the range of several base stations then it connect to any one of them on the bases of some criteria [1]. The nodes are free to join or left the network without any restriction. Thus the networks have no permanent infrastructure.

Routing is an important process for the operations of MANETs [2]. A number of routing protocols have been proposed in the literature. AODV [3] is one of the most widely used routing protocols in MANETs. It minimizes the number of broadcasts by creating routes based on demand. When any source node wants to send a packet to a destination, it broadcasts a route request (RREQ) packet. The neighboring nodes in turn broadcast the packet to their neighbors and the process continues until the packet reaches the destination. During the process of forwarding the route request, intermediate nodes record the address of the neighbor from which the first copy of the broadcast packet is received. This record is stored in their route tables, which helps for establishing a reverse path. If additional copies of the same RREQ are later received, these packets are discarded. The reply is sent using the reverse path for route maintenance.

All the nodes in MANETs are independent moving nodes that rely on batteries for energy. It is highly important to use energy in an economical way to ensure durability of the network. The nodes may move randomly in different directions. In this paper, the effect of mobility on the energy consumption is studied. One frequently used mobility model in MANET simulations is the Random Waypoint model [4], in which nodes move independently to a randomly chosen destination with a randomly selected velocity. The simplicity of Random Waypoint model may have been one reason for its widespread use in simulations. However, MANETs may be used in different applications where complex mobility patterns exist. Hence, in this research, different mobility models are used to analyze the impact of mobility on the energy consumption in routing. The rest of the paper is organized as follows. In Section 2, a review of the related work is provided. Section 3 describes various mobility models used in this research, experimental results are given in Section 4, and finally Section 5concludesthework

II. REVIEW OF WORK

A number of studies evaluating the performance of traditional ad hoc routing protocols like DSDV, DSR etc. under different mobility models are found in literature. Madhusudan Singh et al [5] has discussed some Mobility Models and their impact on various networks and routing parameters. They used discrete-event simulation language PARSEC for the following simulation and used AODV, DSR, and ZRP protocols for the experiments. Authors found that the topology and movement of the nodes in the simulation are key factors in the performance of the network protocols under study.

May ZinOo et al [6] evaluated and compared AODV and AOMDV protocols under Manhattan Grid mobility model. They used TCP as a source traffic and measured the performance in terms of throughput, packet loss rate, average delay, and normalized routing load by varying node speed, offered traffic load and node density. Authors found that as the number of nodes increases, maintaining multiple routes to destinations in the routing tables and bringing next hop routes in RREQ message significantly reduces routing load of AOMDV. On the other hand, the throughput of AOMDV is significantly higher than AODV in all background changes, whereas the average delay and packet loss rate of AOMDV is not good enough under the variations of the offered traffic loads.

Doshi et al. [7] extended the DSR protocol to support energy efficient routing. A working path is first identified through a power-unaware route-discovering circle. Each node that is not on the identified working path sends a reply message to the source node if it would be power-efficient by inserting itself onto the route. The source can then draw a partial view of network state by using information extracted from the received reply.

Hrudya et al. [8] studied the impact of mobility on the performance of various routing protocols in terms of different parameters. Authors found that mobility greatly affects the performance of routing. Among the studied routing models, the RPGM model was found best.

III. MOBILITYMODELS

To thoroughly and systematically study a new Mobile Ad hoc Network routing protocol, it is important to simulate the protocol and evaluate its performance. Among other parameters mobility is an important parameter for MANETs routing protocols evaluation

Gauss-MarkovMobilityModel

The Gauss-Markov Mobility Model was first introduced by Liang and Haas [10] and widely utilized. In this model, the velocity of mobile node is assumed to be correlated over time and modeled as a Gauss-Markov stochastic process. Initially for each node position, velocity, and direction are chosen uniformly distributed. The movement of each node is variated after an interval δt .Velocity and direction of the future depend on the current values. Velocity of mobile node at time slot t is dependent on the velocity at time slot t-1. Therefore, the Gauss-Markov model is a temporally dependent mobility model whereas the degree of dependency is determined by the memory level parameter α. α is a parameter to reflect the randomness of Gauss-Markov process

Manhattan Mobility Model

An approach to restrict the movement area geographically is to use information from road maps. Manhattan model was introduced to emulate the movement pattern of mobile nodes on streets. It can be useful in modeling movement in an urban area [9].

The scenario, as shown in Figure. 3.1 [10], is composed of a number of horizontal and vertical streets. Nodes are modeled as pedestrians moving on the vertices of the squares (streets). Initially the nodes are randomly distributed on the streets. Each node chooses a direction and a velocity. At an

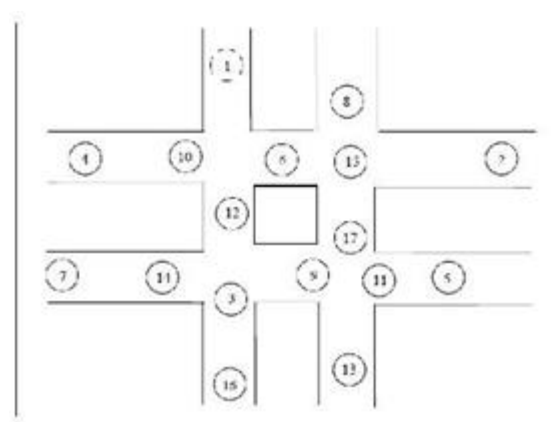

Figure 3.1 Movements of Nodes for Manhattan Mobility Model

Intersection of a horizontal and a vertical street, the mobile node can turn left, right or go straight with certain probability.If a node reaches a corner, the node changes direction with a certain probability. The velocity is changed over time.

The Random Waypoint Model

The Random Waypoint Model was first proposed by Johnson and Maltz [14]. Soon, it became a 'benchmark' mobility model to evaluate the MANET routing protocols, because of its simplicity and wide availability. The random-waypoint model is a simple stochastic model in which a node perpetually chooses destinations (waypoints) and moves towards them. After waiting for a constant pause time, each node chooses a waypoint and moves towards it with a speed chosen from an interval [umin; umax]. After arriving at the waypoint, the node again waits for a constant pause time and chooses the next waypoint. Figure 1.6 [15] shows the node movement in the Random Waypoint model. As the nodes are initially distributed randomly, it takes some time until the nodes reach a stationary distribution. Thus, a long enough initial period should be discarded.

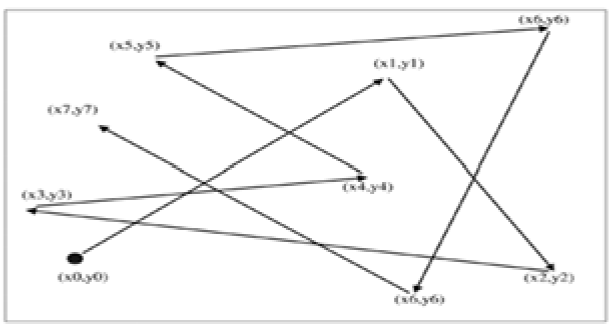

Figure 3.2: Node Movement in Random waypoint Model

The Random Waypoint model and its variants are designed to mimic the movement of mobile nodes in a simplified way. However, they may not adequately capture certain mobility characteristics of some realistic scenarios, including temporal dependency, spatial dependency and geographic restriction. Random Waypoint model and its variants fail to 11represent some mobility characteristics likely to exist in Mobile Ad Hoc networks. Thus, several other mobility models were proposed. In the following few sections, we shall discuss those models, according to the classification in Figure 3.2. In the next chapters, we aim to systematically analyze the impact of those mobility models on routing protocol performance, and propose several metrics to quantify those mobility characteristics.

Reference Point Group Mobility Model

One approach to realizing spatial dependence is the use of reference points. The Reference-Point-Group-Mobility model (RPGM) [18] models the movement of groups of nodes. The movement of the groups is modeled according to an arbitrarymobility model. The movement of the nodes inside a group is realized using a reference point for each node as shown in Figure 1.7 [15]. The actual position of a node is a random movement vector added to the position of his reference point. The absolute positions of the reference points do change according to the arbitrary mobility model, but the relative positions of the reference points inside a group do not change. Hence, the spatial dependence is realized using the reference points.

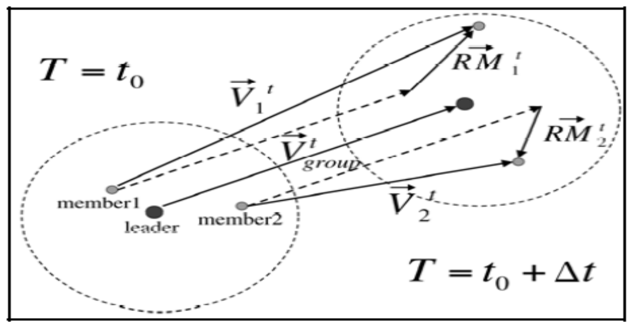

Figure 3.3: Node Movement in Reference Point Group Mobility Model.

IV. EXPERIMENTRESULTSANDANALYSIS

TABLE4.1Simulationparameters

Mobility Model	Manhattan Grid, Gauss Markov
Queue Length	50
Interface Queue	Drop Tail/Priori Queue
Traffic Type	CBR
Number of Connection	70% of the nodes
Packet Rate	8 packets/second
Pause Time	10 seconds
Speed of Nodes	20 m/s
Antenna	Omni directional
Simulation Area	1000m x 1000m
Number of Nodes	10, 20, 30, 40, 50
Initial Node Energy	1000 joules
Simulation Time	900 seconds

Transmission energy: It is the energy consumed by a network node in transmitting packets across the network. The total network energy utilized in transmitting different packets by the network nodes is calculated by taking the sum of transmission energy of individual nodes. Average transmission energy is defined by the equation (4.1).

$$\text{Average Transmission Energy} = \frac{\text{Total Transmission Energy}}{\text{Total number of nodes}} \quad (4.1)$$

Receiving energy: It is the energy consumed by a network node in receiving different packets from other nodes. The total network energy consumption in receiving the packets is computed by taking the sum of energy consumed by individual nodes in receiving the packets from other nodes in the network. Average energy used in receiving is defined by the equation (4.2).

$$\text{Average Receiving Energy} = \frac{\text{Total Receiving Energy}}{\text{Total number of nodes}} \quad (4.2)$$

Idle energy: The network nodes do not always transmit or receive; sometimes they just do nothing but still consume some energy. The total idle energy is the sum of the energy consumed by all the individual network nodes in idle state. Average idle energy consumed is defined by the equation (4.3).

$$\text{Average Idle Energy} = \frac{\text{Total Idle Energy}}{\text{Total number of nodes}} \quad (4.3)$$

Remaining energy:This is the energy left with the network nodes at the end of the simulation time. The total remaining energy is the sum of the remaining energies of all the individual network nodes. Larger remaining energy indicates longer the network lifetime. Average remaining energy is given by equation (4.4).

$$\text{Average Remaining Energy} = \frac{\text{Total Remaining Energy}}{\text{Total number of nodes}} \quad (4.4)$$

The routing protocols are simulated using NS-2 and results are obtained by varying number of nodes, speed (m/s), and transmission range. The performance metrics are average energy consumed, average remaining energy

Figure 4.1, figure 4.2, figure 4.3 and figure 4.4 summarizes the Average consumed energyunder four different mobility models. It can be observed that Average consumed energy OSLR protocol for two models Manhattan mobility model best among the two mobility models studied in different scenario

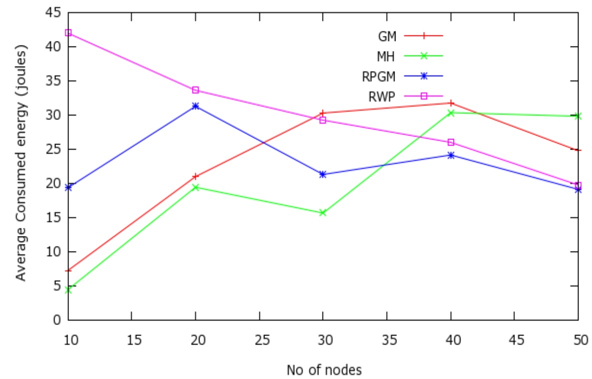

Figure 4.1 Energy consumption on transmission mode

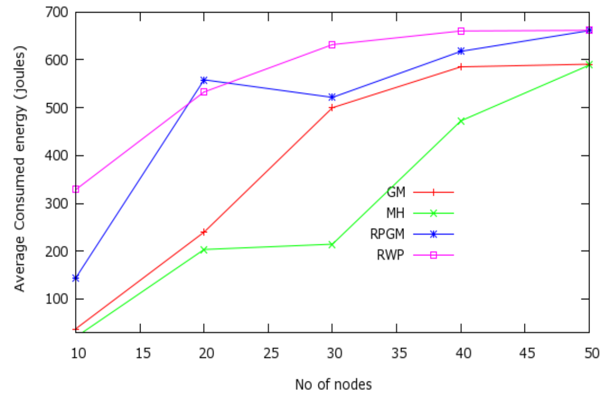

Figure 4.2 Energy Consumption in Receive Mode

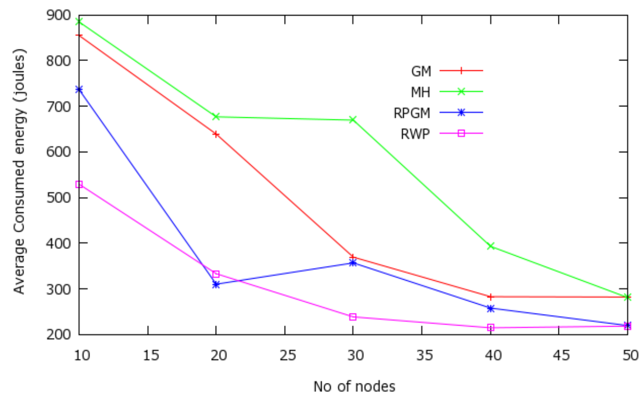

Figure 4.3 Energy Consumption in Idle Mode

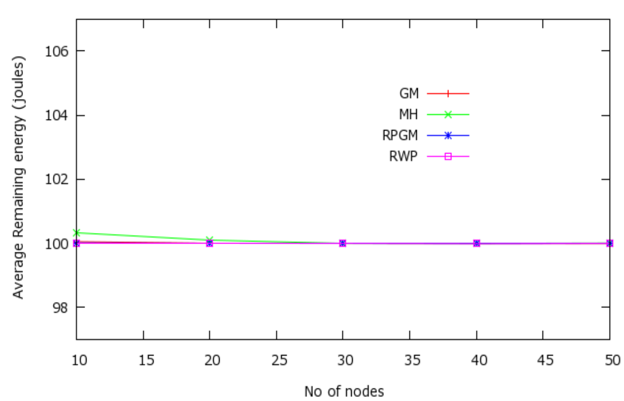

Figure:4.4AverageRemainingEnergy

V. CONCLUSION

In this research work, the impact of mobility on the energy consumption of routing protocols in mobile ad hoc networks have been analysed through extensive simulation studies

The OSLR routing protocol have been evaluated over different mobility models Gauss Markov, and Manhattan Bonnmotion tool was used to generate node movements for different mobility models. The results were obtained for different modes of energy consumption by varying node density from 10 nodes to 50 nodes in a simulation area of 1000m×1000m. By analyzing the results obtained, the following conclusions are drawn:

Transmission Mode: It is found that Manhattan grid is the most efficient model for this mode of operation. Only at high node density and high transmission range RPGM outperforms Manhattan grid. The RWP is clearly worst model in the simulated scenario.

Receive Mode: Like transmission mode, the Manhattan grid and RWP are again the most efficient and worst models respectively for receiving operation.

Idle Mode: In idle mode the energy consumption of Manhattan grid and RWP models is interestingly reversed. RWP is most efficient while Manhattan grid is poorest model in the idle mode.

Comparison of protocols: It is found from the results obtained that LAR protocol is clearly the most energy efficient protocol. It is due to its flood limiting capabilities. Due the less number of flooded packets the nodes need to respond less number of times therefore resulting in the low energy consumption.

Overall it is found that Manhattan mobility model best among the four mobility models studied. So it can be concluded that energy consumption is very much affected by the mobility model in use and Manhattan grid is the most

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