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Improved Mobility Model Performance using Wireless Ad Hoc Network

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Abstract*: This paper has reported an improved process for an optimized and effective node management model for mobile wireless ad hoc networks. The improved technique is based on optimized and route maintenance of the network. The proposed method aims to overcome the problem when the movement of nodes happens during the routing process. Mobility Models' performance has been estimated using parameters like Packet Delivery Ratio (PDR), Average Latency, Throughput, etc., usingNS-3.0.*

Keywords: MANET, Mobility models, Mobility sample, NS-3.0, Performance.

I. INTRODUCTION

The main concern in an ad hoc wireless network is ad hoc routing because of its ad hoc nature, like dynamic (frequently changing) network topology, a shared medium partial bandwidth, and multimode characters, etc. There is a need for an efficient mobility management scheme. Node mobility has been frequently used for simulation functions, while new conversation or direction-finding methods are considered. Node mobility in the network is the wireless capability that nodes are free to travel in any direction. This free node can purpose hyperlinks between nodes to alternate pretty regularly, and the topology is self-motivated and irregular. Access to data in the free traveling node is essential for the ad hoc wireless network's normal working. Constructing and keeping hyperlinks between nodes is an overwhelming venture and warm lookup topic in ad hoc network. So an improvement in the node management scheme is needed. In Mobility Management, there are two directions of research. One approach is designing a new Mobility Model that predicts a new era of mobility. Another method is to enhance mobility on account of manipulating routing protocol parameters such as interruption, jitter, and throughput. The network routing protocols are affected by nodes' movement, linked failure, bit error rate degradation, enhancement in routing overhand, etc. When cellular nodes' velocity enhances, the wide variety of cell nodes below any transmission varies is decreased [1–3].This paper is focused on enhanced node mobility patterns in wireless ad hoc

networks. This manuscript aims to define an effective node movement pattern with Random Waypoint, one of the efficient node mobility management models for Wireless ad hoc network. The last cause to plan amobility structure is to depict movement samples of persons in action and calculate how their velocity, place, and acceleration trade over time. It is ideal for mobility fashions to consider the movement sample of centered practical software in a real-looking way. Motion patterns play a vital function in identifying protocol performance. When evaluating a wireless ad hoc network protocol, it is essential to pick the acceptable underlying mobility management model [4, 5]. For instance, the Random Waypoint model's node works pretty in another way than the occupation cluster or group. It's no longer relevant to gauge the purposes that the place nodes tend to maneuverer collectively using the Random Waypoint Model. Therefore, there shall be a method to improve mobility management models' right understanding and their effect on protocol performance

II. RELATED WORK

Mobile ad hoc networks are divided into two types which are infrastructure network and ad hoc networks. Infrastructure networks use gateways to connect them with other networks (or internet) which are fixed one. Nodes are free to move around and establish a connection with base station which is very close to its range. A node lost a connection with its current base station and look for other base station on its range to establish a connection to ensure seamless communication. Other type of network is ad hoc networks which has no infrastructure and don't need routers to establish a communication. All participating nodes will act as routers and a simple node as well. These networks have limited transmission range which forces for the need of multiple hopes. Every node has routing details since all nodes will act as a router, in this way these networks are dynamic in nature and changes its topology very often.

An event that is attempted to compromise the integrity, confidentiality and availability of a resource is called as intrusion. Lot of research works have been conducted on computer network security in last four decades and lot of intrusion detection system (IDS) prototypes has been developed and published. Way back in 1980 one researcher called J. Anderson started a research in this area and published an article [1]. After this lot of prototypes and proposals have been developed and published. Many of them have been documented by an author called Michael Sobirey[2]. An IDS monitors network traffic and looks for suspicious activity, then it alerts the system or network administrator when it detects any suspicious activity. In some cases the IDS may also respond to anomalous or malicious traffic by taking action such as blocking the user or source IP address from accessing the network

M. Medadian [18] discussed about traffic analysis and location finding.Tracing algorithm were developed and tested with the help of simulation tools. This system was evaluated and discussing about passive routing attacks. Authors developed a routing protocol for passive attacks.

W. Scheirer [22] discussed an effective technique to detect denial of service attack and proposed a solution to this attack. The availability of node is checked with help of various parameters used i.e. battery power, RTT, total time taken by packets, total number of packets forwarded, blacklist used for attackers. The attacker is detected by setting different threshold values for each category. These threshold values are compared with number of packets delivered, further nodes are checked forthe status of blacklist. But this detection technique was specific to AODV and DSR protocols in MANET. Marti et al [23] proposed a mechanism to mitigate the effect of packet dropping, which has two mechanisms called watchdog and pathrater. This mechanism mitigates number of misbehaving nodes in MANET. G.Xiaopeng [24] proposed a method to detect suspicious node, this technique identifies the node that drops packets using global trust value of neighbor nodes. This method showed an improvement in terms of low false alarm rates and compared with watchdog algorithm [23].Black Hole Attack. Blackhole attack is one type of denial-of-service attack in which a router drops packets instead of forwarding it. This will happen if the router becomes compromised node for various reasons. Emma Ireland [23] described in detail about black hole attack in AODV protocol network. A node sends RREQ if it wants to know the route to the destination. An intruder broadcasts itself as having fresh route and sends reply to this RREQ to become a member of that route. By repeating this to more RREQ's this intruder becomes a intermediate node and starts dropping packets instead of forwarding it. In this way, the intruder becomes part of the route to destination.

Jing Nie [24] summarized the survey of existing routing protocol used in wireless mobile ad hoc networks. Togbad [40] describes a black hole detection mechanism, which uses topology graph to detect attacks. This method was developed for the OLSR proactive routing protocol, however it would not be effective for reactive routing protocols because of acquiring entire topology information is not feasible. DharaBuch [36] proposed a black hole detection method for AODV. Theconcept in this technique is that on receiving a reply, the receiver node initiates a judgment process about the replier. A neighbor shares their opinion about the replier. A decision is made based on number (a fixed threshold) of packets, if a node receives many packets but does not forward certain number of packets then it is considered to be malicious.

Above intrusion detection systems work with specific attack based detection methods and not able to detect more attacks [14]. Anomaly intrusion detection works efficiently for detection of all kind of attacks. Anomaly detection techniques for ad hoc networks depend on the characterization of normal behavior pattern of wireless nodes. This research work focuses on wireless node behavior based detection technique. Most of the anomaly intrusion detection systems are focusing on upper layers traffic to profile normal behavior of wireless node. This research work focus on only MAC and network layer of wireless nodes. It is inefficient to use a large feature set of MAC layer and network layer due to energy limitation in ad-hoc network.

III PROBLEM STATEMENT

The node movement pattern is the main problem in wireless ad hoc networking and plays an essential role in available throughput, PDR, and Quality of Services (QoSs). The function of mobility models is to express a common workstation node movement pattern procedure so that the analysis for these purposes may be made concerning the mobility model. Thus, nodes' mobility performs a vital position in the overall performance evaluation of ad hoc wireless networks. The most frequently used mobility model is the Random Waypoint mobility model. So the next section deals with explaining the mobility model. It has been verified why it is no longer appropriate to model a human being's motion or transportation means. Therefore, new mobility models are very much needed.

IV. PROPOSED METHDLOGY

The Random Waypoint Mobility Model (RWP) consists of pauses time between transformation in route and speed. A node starts evolving by settling in one areafor a unique time (recess time). As soon as this factor terminates, the node opts foran arbitrary vacation spot inside the simulation region and a velocity is unvaryingly disbursed between [least-speed, utmost-speed]. Then, it voyages toward the recently elected vacation spot at the selected speed. Upon appearance, the node breaks for a designated duration earlier than beginning the technique once more. However, given that its overall performance is unbiased of previous action (memory-less), it creates very impractical or non-realistic displacements. The visiting sample is accompanied by using a node. The usage of this mobility management model is plotted. The mobility of RWP continuously motives topology exchange [1, 4–7]. The pause time and the utmost pace have an impact on the mobility conduct of the nodes. If the maximum speed is short and the break time is increased, a community topology becomes distinctly stable. On the contrary, if the utmost velocity is excessive and the break time is little, the topology is hugely self-motivated. Two simple issues of the Random Waypoint mobility management model are sudden flip and surprising give up [8]. A sharp flip happens on every occasion; there is a path alternate inside the range. Sudden give up that takes place on every occasion is a trade of velocity. This aspect is not relative to the preceding speed. These issues are frequently minimized by permitting the previous pace and course to affect the longer time pace and route [9–11]. Most researches have been characterizing the individual mobility models followed by the nodes. However, a single node's routing consideration is rare, as most of the nodes' traffic shows unity property in wireless ad hoc networks.

4.1 Proposed Model

After improving the mobility model, the proposed problem of getting more practical mobile nodes can be solved. The mathematical hypothesis and complete analysis of this model are explained besides the above-said limitation and requirements. We aim to provide a solution to the random movement of nodes, which may cause the link to break. Here, we are proposing our node movement method in realistic scenarios like university sites and shopping malls, etc. Our main objectives of the research are to improve random waypoint performance in terms of delay, latency, throughput,
reliability and reduce overhead by finding the best path for transferring packets to their destination. The mobility model plays a significant role in the assessment of wireless network protocols. Within the network, wireless mobility models vary from other existing networks. The connectivity and capacity of the network repeatedly depend on the nodes' mobility performance. Compared to other presented models that require Base Stations (BSs), the wireless mobility models need to cooperate with two or more communicating nodes [5, 7]. Although separate models exist for other presented models and ad hoc wireless mobility models, there are some resemblances between the two categories. The Random Waypoint Model is one of the most extensively used models among ad hoc wireless models for ad hoc wireless simulation and has been put into practice in lots of network simulators. The movements of nodes are self-regulating in many mobility models; it has to be described in the past few research papers. But the movements of nodes are obsessed with one another in group mobility models. In this paper, a new mobility model is proposed as a replacement for the ad hoc wireless network. The mobility model is tested and analyzed with a real-life setup. First, people move toward definite destinations as an alternative to arbitrarily deciding the destination.

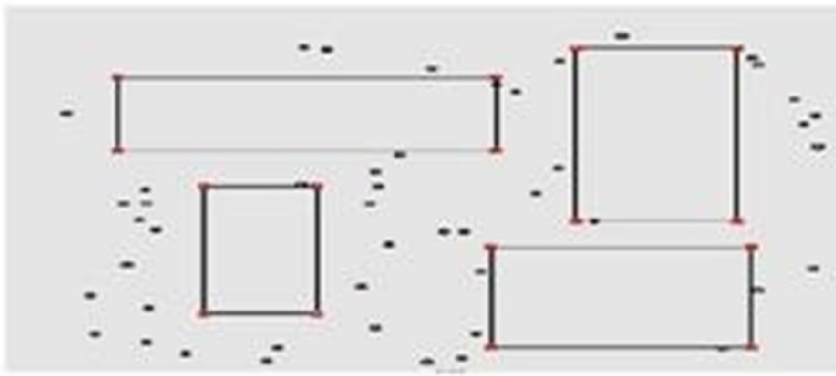

Figure 1: Proposed Mobility Model

Second, there are some barriers to the setup. Third, the human tendency usually is to pass through a pathway and select the shortest paths; they do not stroll alongside unsystematic trajectories [12, 15]. The developed improved mobility model would disagree with the graph. Movement sample of nodes from a supply place to a rest spot one, every node has to discover apposite passageway via the surroundings. The barrier-free node moments are allowed by using a direction discovering algorithm. This algorithm uses a ray launching method that includes an optimized line algorithm for the quick beam meeting point search calculation (Fig. 1).

4.1 Parameters Defined In Weighted Average Method

A. The Path Finding Algorithm

A route may also be a set of vicinity factors that shape adjoining sections, and nosection overlaps with an impediment inside the surroundings. Here is an algorithmto satisfy this fact.

(a) In the first step, we initialize the starting and ending points. After initializing source and target points, we draw a tracing line between source and rest point.

(b) Now we observe the striking objects. If the first object is struck, draw another tracing line from the striking or hitting position to the rest position, i.e., destination position.

(c) Else we add rest position to the path and stop the procedure.

(d) Now we check the first edge of the obstacle strike.

(e) If there is any strike, then add a hit position to the path.

(f) Else again observe the first striking object.

Initially, the opening role and, consequently, the authentic function are equivalent. We initiate a beam from supply to a rest spot and seem for the predominant impediment strike by using this beam. Now we insert the foremost strike factor to the trail and look at out to body this obstacle. For doing this, we seem for the main area hit at some point of this barrier. Suppose a foothold is struck the unique strikes to the meeting point on this edge. We opt for the closest facet of the strike side up to attenuate the final direction length. We repeat till the impediment is encountered. It suggests that the beam from the node role to the rest spot does not strike this barrier's fringe.

V. RESULT AND DISCUSSION

NS-3.0 simulator [1] is used for the simulation and analysis of the proposed algorithm. UBUNTO 14.04 LTS is basic hardware and operating system used in simulation work. The performing configuration is described in Table 1. The BONNMOTION 2.0 is a fundamental mobility state of affairs technology tool [11, 13, 14]. According to the result given below, we have produced mobility scenarios for RWP and enhanced mobility model using NS-3.0 to integrate into TCL scripts. Unsystematic traffic acquaintances of CBR can be group between mobile nodes with the usages of a traffic scenario generator script. Our study used the random waypoint model and enhanced mobility model for the node with a pause time of 15±3 s. and speed varying between

Table – 1 Simulation Parameters

Constraints	Value
Type of channel	Wireless channel
Simulator	NS3.5(Version3.5)
Protocols	DSR-Routing Protocol
Time Duration for Simulation	400s
Amount of nodes	20,30,40,50
Range of Transmission	250m
Movement management Model	Proposed Model
MAC Layer Protocol	802.11
Break Time(s)	15±3s
Utmost speed	35
Least speed	0.5
Packet Rate	4packets
Type of traffic	CBR(Constant Bit Rate)
Data Payload	512bytes/packet
Max of CBR connections	(10,20,40,60,80)
Sizeonan environment	(700m*700m)

0 and 100 m/s with a minimum speed of 5 m/s and a maximum speed 20 m/s for a simulation time of 300 s. Table 1,which is given below, demonstrate the performance constraint. For each simulation process, nodes' position, their movement, and traffic between

them are located arbitrarily. BONNMOTION-2.0 is accountable for the unsystematic residences of the nodes' locations and actions, and the site visitors, NS-3.0 arbitrary variables are utilized. Putting the unsystematic variables is the main factor as otherwise, it may land up in excessive simulations without any meaningful results.(a) Packet-Delivery-Ratio (PDR): PDR is the proportion of records packets

transported to the rest spot to these produced from the starting places. It is estimated by dividing the variety of packets acquired through the rest spot through the range packet originated from the supply [11, 13].PDF = (Packet acquired/Packet sent) ∗ 100

(b) Throughput: It is a common variety of messages efficiently delivered per unit time quantity of bits transported in each second [13, 14].Throughput = Total Received Packets/Total Simulation Time (Kbits/s)(c)Average End-to-End Delay: This is consists of every possible set-back precipitated

with the aid of buffering throughout route-finding latency, which is waiting in line at the boundary queue, re-transmission set-back at the MAC, and broadcast and switch times. It is described as the time taken for an information packet to be transmitted throughout an ad hoc from supply to rest spot [11, 13, 14].Delay D = Get Hold of Time – Dispatch Time.

5.1 Result and Analysis

In terms of overall performance evaluation, we think above the general concert constraint. In Figs. 2, 3, and 4, the simulations focus on inspecting the usual overall performance on end-to-end delay, throughput, and packet transport ratio. The effects contrast with two mobility models that we had chosen, i.e., the Random Waypoint Model and Enhanced Mobility Model. The outcome will exhibit overall performance for mobility fashions with admire to DSR protocol that had been chosen below distinctive mobility model, which is proven in Figs. 2,3, and 4.corresponds to the continuous motion of the node and a pause time of 200 seconds corresponds to the time that node is stationary and following scenario is assumed.5.1 Dynamic Source Routing (DSR) The DSR is a direction-finding protocol for those networks which is wireless. It makes use of supply routing instead of counting on the routing desk at every intermediate device. We can say that Dynamic Source Routing (DSR) is an autonomous routing protocol for those networks which is wireless. In Dynamic Source Routing, every supply determines the route to transmit its packets to pick destinations. There are two predominant components, known as path finding and path preservation.

5.2 Packet Delivery Ratio (PDR)

The PDR is the number of packets lucratively transported to the targeted or sink node, to the whole group of data packets transmitted by different sensor nodes. In Fig. 2,at nodes 20, the PDR is 0.18 in RWP and 0.21; at nodes 30, PDR is 0.27 in RWP and 0.30 for the proposed mobility model. At node 30, PDR is again in the increasing stage. However, at nodes, 50 PDR is 0.37 in RWP and 0.22, i.e., there is a decrease in PDR compared to RWP. It can be seen that between nodes 20–40, PDR's performance is increasing in the proposed model compared to the Random Waypoint Model. At node 50, it's a bit decreasing, but whenever the node increases, it'll increase further.

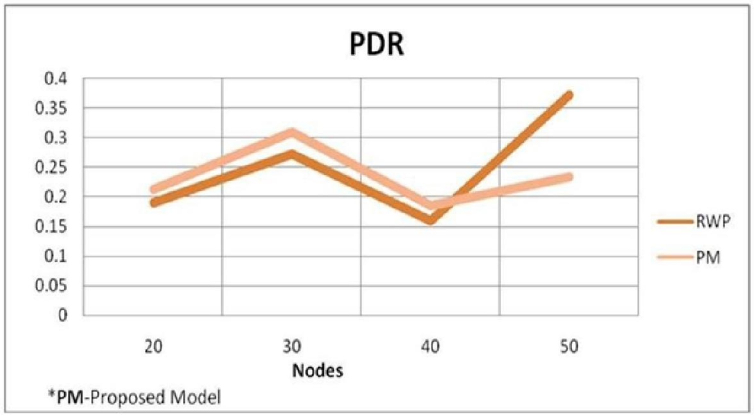

Fig. 2 Packet delivery ratio versus number nodes

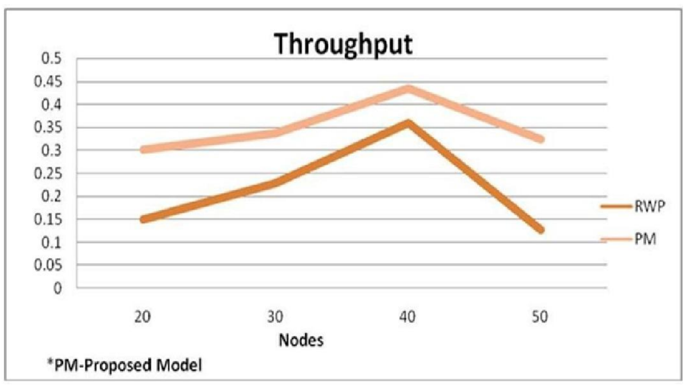

Fig. 3 Throughput versus number nodes

5.3 Throughput

Throughput can be described as the ratio of data packets sent out successfully and calculated in bits/sec. It is to be noted that that higher values of throughput indicate better performance. In the given Fig. 3, at nodes 20 throughput is 0.15 bits/s for RWP and 0.3 bits/s for the proposed mobility model. And at nodes 30 throughput is 0.22 bits/s for RWP and 0.33 for the proposed mobility model. Here, we can analyze that the throughput is continuously increasing whenever nodes increase compared to the Random Waypoint Model in the improved model.

5.4 End-to-End Delivery

An End-to-End delay is the amount of time a packet requires to arrive at its target location after leaving its source. Figure 4 at nodes 20 end-to-end delays is 0.220 bits/s for RWP and 0.219 bits/s for the proposed mobility model. And at nodes, 30 end to- end delays are 0.178 bits/s for RWP and 0.169 for the proposed mobility model.Here, we can analyze that the time taken through a packet from source to targeted
spot is equal or slightly decreased.

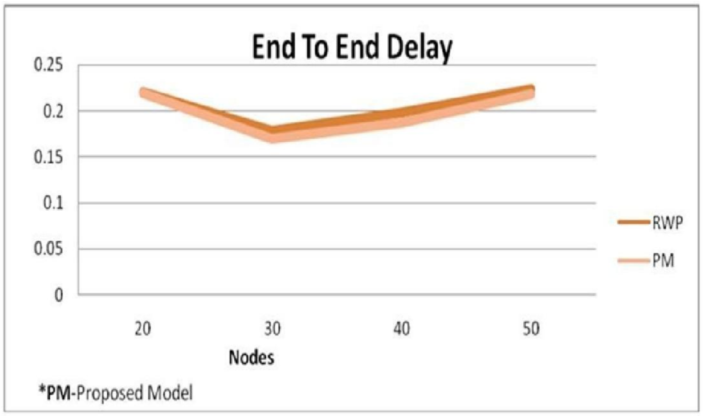

Fig. 4 End-to-end delay versus number nodes

VI. CONCLUSION

In this paper, for a node which we viewed right here is wireless ad hoc routing protocol like DSR. Here, we also considered RWP and proposed mobility models. Here, we observed that for different ad hoc protocols, the performance of mobility models could change drastically. Our investigational outcomes point up the better performance of ad hoc network direction-finding protocol with dissimilar mobility models. According to our outcomes, the performance of the protocol is exaggerated by the mobility model. The mobility models' performance should be estimated with the wireless ad hoc network protocol (like DSR routing protocol on our experimental basis) in the sense that most strictly equivalent with a predictable real-world scenario. There are three parameters End-to-End delay, throughput, and PDR, for which we have made a comparison in this paper. The routing protocol which we considered here is DSR for our comparative study. The proposed mobility model carried out improved outcome compared to the random way point mobility model on set constraints like packet delivery ratio, end-to end delay, and throughput for movement sample of the node. It is to be observed that based on evaluation between two models, the Throughput and PDR of our proposed model shows better at 20, 30, 40, and 50 nodes. But in the case of End-to-End Delay, our pattern's performance is just equal, or we can say a little bit well. Based on these performances parameter, we can say that it will give better results when we apply our small organization model. The outcome also illustrates that a wireless ad hoc network's previous setup in a real-life scenario is not adequate to investigate its performance with a particular mobility model. The preference for mobility patterns has a significant impact on performance.

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