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Investigate the Performance of Mobile Ad Hoc Routing Protocols under Mobility Model Using OPNET

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Abstract: A Mobile Ad-Hoc networks (MANETs) is collection of autonomous wireless nodes that are arbitrarily located which move dynamically by changing its network connectivity without the use of any pre-existent infrastructure. The behavior of ad-hoc network is characterized as non-deterministic (interference, multipath, hidden and exposed node problem make wireless channel very difficult to predict). Its routing protocol should not only capable of finding the optimized routes between the source and destination, but should also be adaptive in terms of changing load conditions of the network, changing state of the nodes and changing state of the environment. In this paper we evaluate the performance the performance of ad hoc routing protocols i.e TORA (Temporary Ordered Routing Algorithm), OLSR (Optimized Link State Routing) and GRP (Gathering Based Routing Protocol) under Pathway Mobility model by undertaking three parameters such as delay, load and throughput.

Keywords- MANET, TORA, OLSR, GRP, OPNET, Pathway and Overlap Mobility Model

I.INTRODUCTION

A MANET is a multi hop ad-hoc wireless network and self configuring network of mobile routers connected by wireless links (sometimes called a Mobile Mesh Network) the union of which forms an arbitrary topology. Interest in MANETs is due to the promise of ubiquitous connectivity beyond that currently being provided by the Internet. Firstly, MANETs are easily deployed allowing a plug-and-communicate method of networking. Secondly, MANETs do not need central management so used in military operations where units are moving around the battle field and a central field cannot be used for synchronization [1]. Thirdly, MANETs need no infrastructure, thus reducing the cost of establishing the network so useful in disaster recovery where there is not enough time or resources to install and configure an infrastructure. The growth of technology and the increase in wi-fi capable laptops, mobile phones, MP3 players and other small portable devices has created a genuine reason for the population of MANET [2].

In mobile ad hoc network, nodes do not rely of any existing infrastructure. Instead, the nodes themselves form the network and communicate through means of wireless communications. Mobility causes frequent topology changes and may break existing paths. Routing protocols for ad hoc networks can be classified into two major types: proactive and on-demand. Proactive protocols attempt to maintain up-to-date routing information to all nodes by periodically disseminating topology updates throughout the network. On demand protocols attempt to discover a route only when a route is needed.

The general problem of modelling the behaviour of the nodes belonging to a mobile network has not a unique and straightforward solution. Mobility and disconnection of mobile hosts pose a number of problems in designing proper routing schemes for effective communication between any source and destination.

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In Pathway Mobility Model, Initially, the nodes are placed randomly on the edges of the graph. Then for each node a destination is randomly chosen and the node moves towards this destination through the shortest path along the edges. Upon arrival, the node pauses for T time and again chooses a new destination for the next movement. This procedure is repeated until the end of simulation.

II. SIMULATION SETUP

We check these protocols by three parameters such as throughput, delay and load. We used two scenarios i.e. 35 nodes, and 75 nodes.

Fig.1.1. Simulation Nodes (Pathway Model)

Parameter	Value
Simulator	Opnet 14.5
Area	3.5×3.5 Km
Wireless MAC	802.11
Number Of Nodes	35, 75
Mobility Model	Pathway Mobility
Data Rate	11 Mbps
Routing Protocols	TORA,OLSR and GRP
Simulation Time	300 seconds

Table 1.1: Simulation parameters

III. RELATED WORK

D geetha et al.[4] in this paper an attempt has been made to compare the performance of two prominent on demand reactive routing protocols for MANETs: Temporally Ordered Routing Algorithm (TORA), Dynamic Source Routing (DSR) protocols. This subjected the protocols to identical loads and environmental conditions and evaluates their relative performance with respect to quantitative metrics; throughput, average delay, packet delivery ratio and routing load. From the detailed simulation results and analysis of presented, we use NS-2 simulator for simulation of DSR and TORA protocol and variation occurs in mobility of packets, time interval between

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the packets sent and packet size of packets sent in throughout the protocols.

N. Adam et al.[5] in their paper described the formal evaluation of performances of three types of MANET routing protocols when the node density or the number of nodes varies. The protocols included the Dynamic Source Routing (DSR), Ad Hoc On-demand Distance Vector (AODV) and Temporally Ordered Routing Algorithm (TORA) protocol. The analysis had been done theoretically and through simulation using an Optimized Network Engineering Tools (OPNET) Modeler. Using OPNET Modeler software, these performances had been analyzed by the following metrics: packet delivery ratio, end-to-end delay, packet dropped, routing load and end-to-end throughput.

S. R. Biradar et al.,[6] have compared the performance of two on-demand routing protocols for mobile ad hoc networks Dynamic Source Routing (DSR)and Ad Hoc On-Demand Distance Vector Routing (AODV).They demonstrate that even though DSR and AODV both are on-demand protocol, the differences in the protocol mechanics can lead to significant performance differentials. The performance differentials are analyzed using varying mobility.

IV. RESULTS AND DISCUSSION

1. THROUGHPUT:

It is the total size of useful packets that received at all the destination nodes. It is the total number of bits (in bits/sec) forwarded from wireless LAN layers to higher layers in all WLAN nodes of the network.

It is observed that:

a) OLSR outperforms both TORA and GRP in overall performance for both models pathway and overlap.

b) As the number of nodes increase throughput for OLSR also increases. It is due to the availability of routing tables before the communication commences. On the other hand, TORA and GRP has to find the path spontaneously.

c) In case of TORA considerable time overhead occurs due to the Route creation process where a source broadcasting and destination reply establishes an acyclic graph.

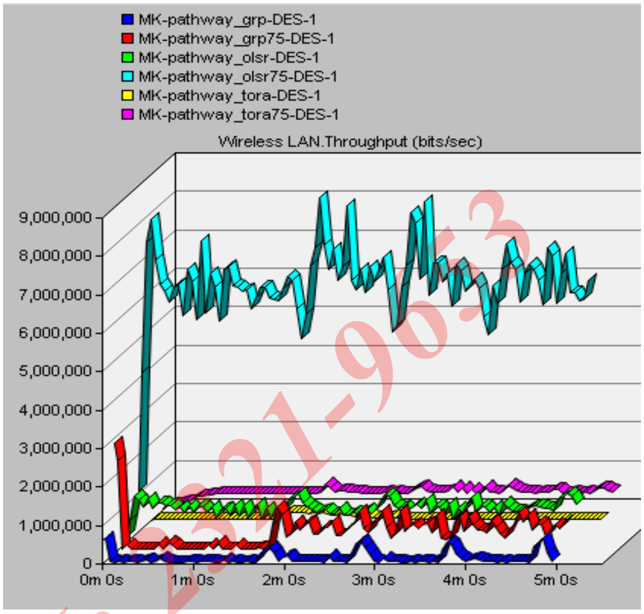

Fig. 1.2.Throughput (Pathway Model)

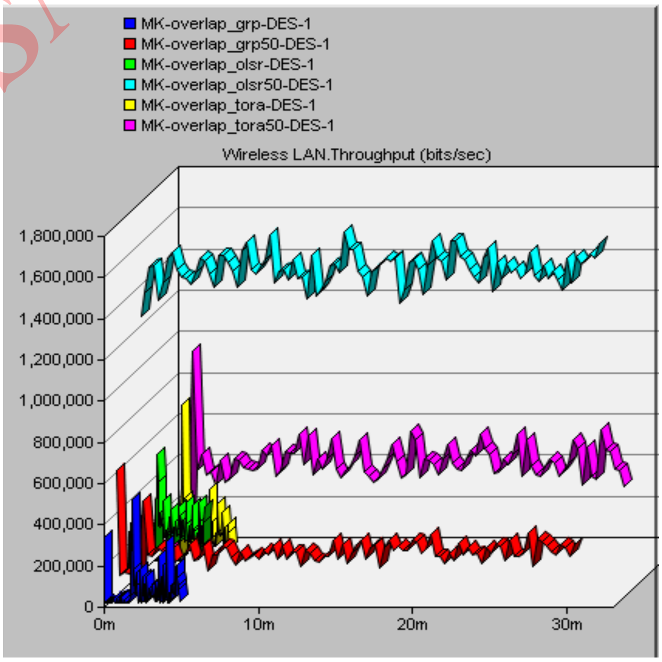

Fig. 1.3.Throughput (Overlap Model)

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2. Load:

It is the total data traffic (in bits/sec) received by the entire WLAN. Load represents the capacity and efficiency of network. More load means more capable is network of handling the data traffic.

It is observed that:

a) OLSR sends more data information as compared to TORA and GRP because in OLSR routing information is pre-maintained that reduces the amount of control information.

b) GRP being a hybrid protocol GRP Shows an average performance with unpredictable changes.

c) TORA reactive protocol is busier in maintaining control information than other two because every time data is to be sent, first the route has to be established.

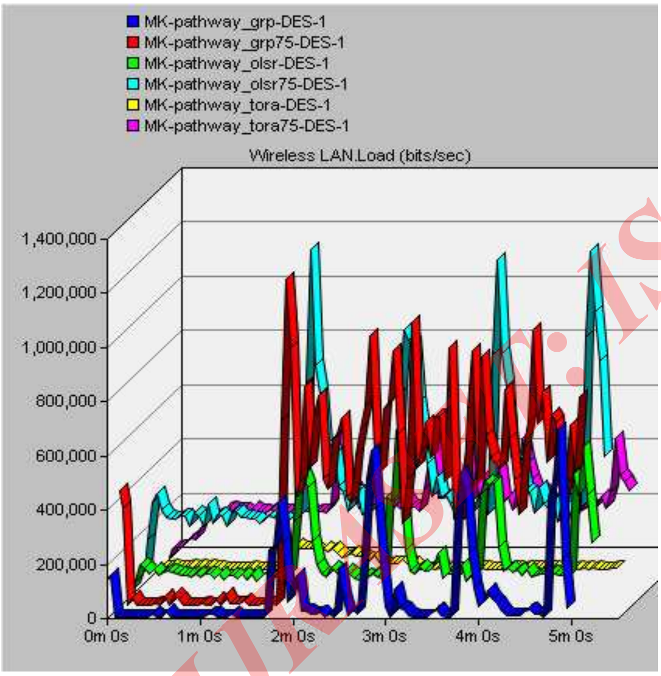

Fig. 1.3.Load (Pathway Model)

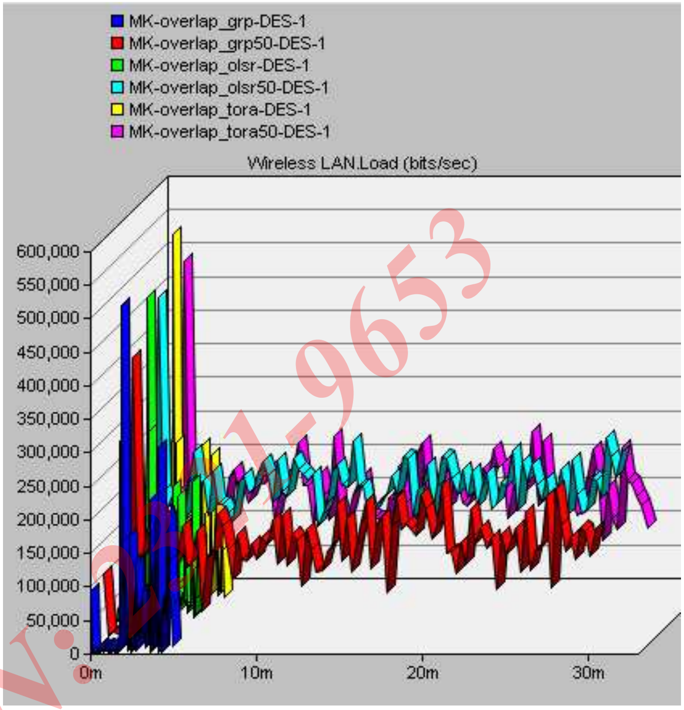

Fig. 1.4.Load (Overlap Model)

3. Delay:

The packet End-to-End delay is the time of generation of a packet by the source up to the destination reception. So this is the time that a packet takes to go across the network. This time is expressed in sec. Hence all the delays in the network are called packet end-to-end delay, like buffer queues and transmission time. Following figure provides a comparative analysis of Delay for GRP, TORA and OLSR for 25 and 75 nodes density.

It is observed that:

a. GRP has the minimum delay of all three protocols. Whereas TORA suffers from largest time overhead.

b. OLSR delay lies in between TORA and GRP.

c. We observe increase in delay as the number of nodes increase and this is particularly significant in case of TORA. For GRP this increase is relatively small and for OLSR this is medium.

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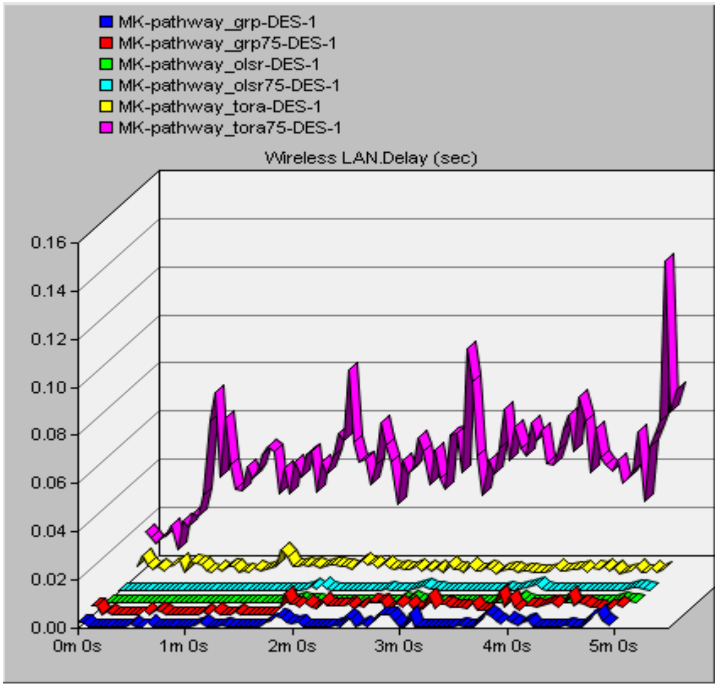

Fig.1.4 Delay (Pathway Model)

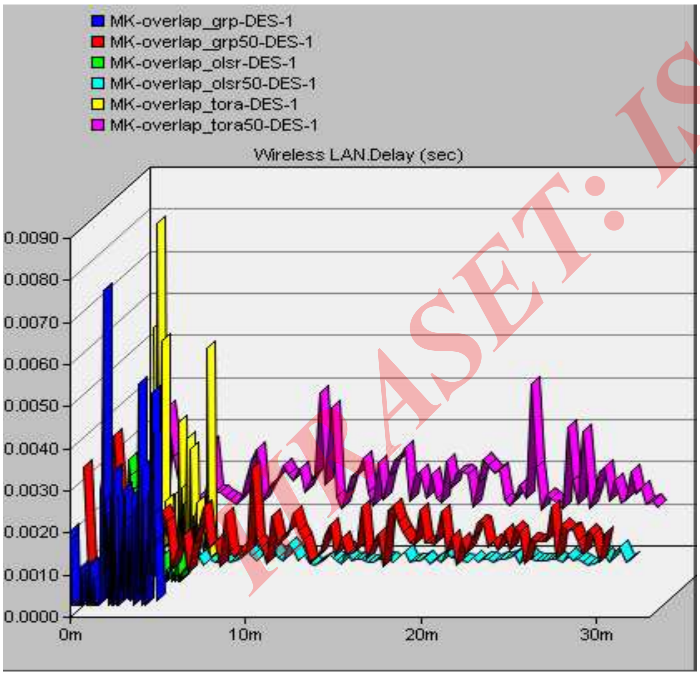

Fig.1.5 Delay (Overlap Model)

V. CONCLUSION

We have evaluated the three performance measures i.e. Load, End-to-end delay and Throughput with Pathway mobility model while taking 35 and 75 as the node density. From the extensive simulation results, it is found that OLSR shows the best performance in terms of throughput, and GRP in Load and Delay . Reactive protocol lacks behind Hybrid and Proactive protocols. The study of these routing protocols shows that the OLSR is better in MANET according to our simulation results but it is not necessary that OLSR perform always better in all the networks, its performance may vary by varying the network. At the end we came to the point from our simulation and analytical study that the performance of routing protocols vary with network and selection of accurate routing protocols according to the network, ultimately influence the efficiency of that network in magnificent way.In future, We will compare the performance of Pathway mobility model with Overlap mobility model for these three routing protocols and analyse the changes taking place in varying node density.

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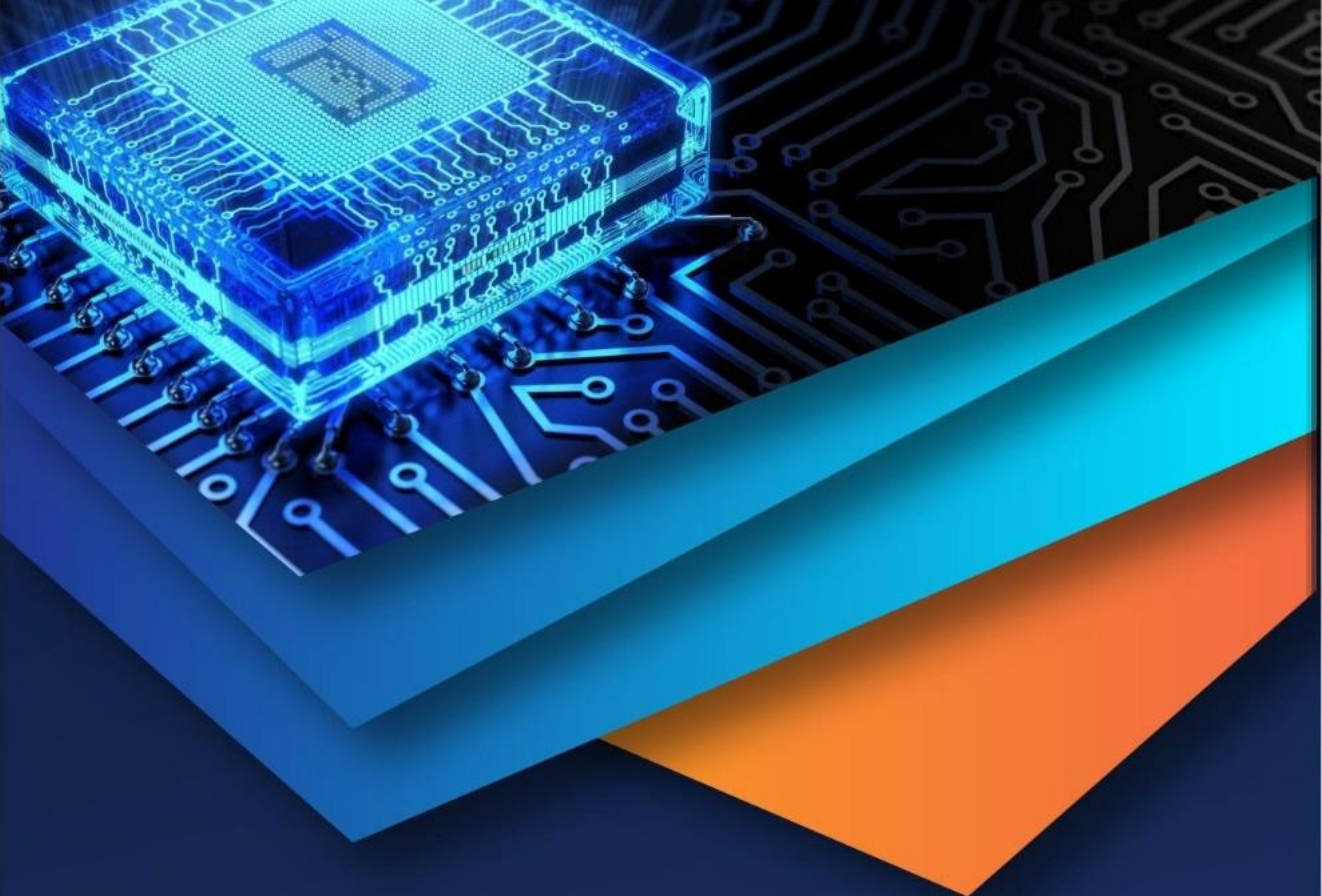

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