ANALYZING THE IMPACT OF NODE DEPLOYMENT MODELS ON THE PERFORMANCE OF LAR1 ROUTING PROTOCOL IN MANETS

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Abstract
Wireless MANET consists number of nodes which move randomly. Due to the mobility of nodes, they change the routes frequently that need some mechanism for finding new routes. Number of routing protocols was defined for MANETs to improve the working capacity of routing protocols for Ad-hoc networks. The Location Aided Routing (LAR1) position based protocols reduces the search area for a new route to a smaller request zone of the Ad-hoc network and number of routing messages are reduced by using the location information. Continuous changes of network topology and determining routes in MANETS is a difficult task, due to the movement of hosts in MANETS. The packets are received and transmitted by the node with the help of routing protocols in MANET. The node placement models play the vital role in routing protocols. In this paper we analyze the impact of three node placement models random, grid and uniform on the performance metrics of LAR routing protocol by using EXata 5.4 simulator. Simulation result shows Random deployment model perform well than Uniform and grid.
Index Terms: Grid, LAR1, MANET, Random and Uniform.

I. INTRODUCTION

A mobile ad-hoc network (MANET) is a group of nodes, which have the possibility to connect on a wireless medium and form an arbitrary and dynamic network with wireless radio frequency links. That means the links among the nodes can change during time, new nodes can add in the network, and the other nodes can move out the network [1]. The number of average connected paths is affected by the mobility of the nodes and this also affects the performance of the routing algorithm. MANETs are self-organizing and self-configuring multi-hop wireless networks where, the structure of the network varies dynamically. Due to the dynamic topology, effective and efficient routing protocol is required, which provides QoS by reducing delay and power consumption while increasing throughput. In MANETs all the nodes share the available resources. These networks are generally characterized by bandwidth constrained, variable capacity links and unpredictable dynamic topology. Environmental monitoring, Rescue operation in remote areas, Remote construction sites, and Personal area Networking, Emergency operations, Military environments, Civilian environments are the some of the applications of mobile adhoc networks[2].

II.LITERATURE REVIEW

Dr.S.P. Setty et. al.[10] presented the performance analysis of the AODV at random waypoint mobility with varying environment like Grid, random and Uniform and cleared that AODV works very well in Grid environment. To check the QoS of the AODV, they investigated AODV on Average jitter, Average End-to-End delay, Packet delivery ratio and Throughput with varying number of nodes in different environments.

Nitin H. Vaidya et. al[5] they suggested an approach to utilize location information to improve performance of routing protocols for ad hoc networks and their simulation results indicated that using location information results in significantly lower routing overhead, as compared to an algorithm that does not use location information.

Prof.S.P.Setti et al.[1] they evaluated performance of DSR routing protocol in three different placement environments like Random, Grid and Uniform and also they investigated the QOS metrics Average jitter, Average end-to-end delay and Throughput by varying network size. . The results showed that the performance of DSR is better in Uniform Environment comparative to other environments.

.M.Uma and Dr.G.Padmavathi et al.[9] in their work entitled "A comparative study and performance evaluation of reactive quality of service routing protocols in mobile ad hoc networks" studied a comparison and performance evaluation of three reactive routing protocols AODV, DSR and LAR1 are done using qualnet simulator to identify the protocol that is best suited for MANETs**.**

A.V.N.C. Sekhar et. al.[11] investigated the impact of three node deployment models on the performance of OSPF routing protocol and showed that Random deployment model perform better than grid and circular deployment models and also they concluded that as simulation time increases throughput decreases and maximum for circular, minimum for random and moderate for grid node deployment model

LijiMerin, Vimlesh Kumar et.al[12] in their work entitled "Performance Analysis of DSR,LAR and STAR of MANETs for CBR traffic" compared DSR, STAR and LAR on the basis of energy consumption in transmit, receive and idle mode also compared the protocols on other QoS parameters like average end to end delay, average jitter and packet delivery ratio.

Anuj K. Gupta, Harsh and Anil K. Verma [2013], have made an attempt to compare different mobility models and provide an overview of their current research status. The main focus is on Random Mobility Models and Group Mobility Models. Firstly, they present a survey of the characteristics, drawbacks and research challenges of mobility modeling. At the last they present simulation results that illustrate the importance of choosing a mobility model in the simulation of an ad hoc network protocol. Also, they illustrate how the performance results of an ad hoc network protocol drastically change as a result of changing the mobility model simulated.

III. ROUTING PROTOCOLS OF MANET

We can classify the routing protocols in MANETs in many ways depending on routing strategy and network structure [1][3][8].Depending on the network structure routing protocols can be categorized as flat routing, hierarchical routing and geographical position based routing shown in the fig.1.

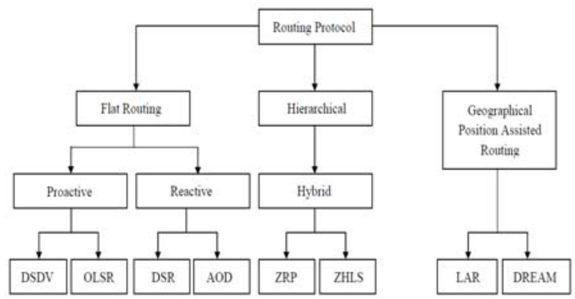

Fig.1 Types of Routing Protocols.

Flat routing protocols again classified into two classes: Proactive (table driven) routing protocols and Reactive (on-demand) routing protocols. In both the cases every node participating in the routing has equal importance.

A. Proactive (table driven) routing protocols

Proactive routing protocols sustain information regularly. Generally, a node has a table having information on how to reach every other node and the algorithm attempts to keep this table up-to-date. Changes in network topology are communicated throughout the network [3].

B. Reactive (on demand) routing protocols

Route discovery and Route maintenance are the two operations in On demand protocols. In this Routing information is acquired on-demand in the route discovery operation. Route maintenance is the process of responding to change in topology that happen after a route has initially been created [3].

C. Hybrid routing protocols

Hybrid routing protocols are advanced version protocol, which are both are Proactive and Reactive. Mostly, these protocols are zone based, which means that the network is divided into a number of zones. Usually, these routing protocols for MANETs use hierarchical network architectures.

D. Geographical position based routing protocol

Position based routing protocols presents better performance, scalability and robustness than the dynamic topology of MANETS. In order to reduce overhead, power utilization and enhance performance of the network , position based LAR1 uses possible information to direct the target [4][5]. Location Aided Routing Protocol is an on-demand geographical position based routing protocol.

Location Aided Routing (LAR1):

This is a source based reactive routing protocol which needs GPS information. The source describes an area which is circular in shape; in this the terminal is detected and fixed by the terminal location. This is also called as Expected zone. The source also knows the time instant when the terminal was detected at that place and the mean mobility of the terminal. The request zone is rectangular in shape, comprising both source and Expected zone. This information can be added in the route request packet by the source node and only nodes within the request zone will be spreading the packet. After receiving route request, the destination node sends route reply packet that comprising the current location and speed. The source redelivers a route request if route reply is not collected within the given period of time [4][5].

IV. NODE PLACEMENT MODELS

A. Random Node Placement Model

In this model, within the terrain region nodes are placed randomly.

B. Grid Node Placement Model

Node placement starts at (0, 0). The nodes are placed in a grid format with each node a grid-unit away from its neighbor. Depending on the value of coordinate-system, Grid-unit must be specified numerically in meters or degrees.

C. Uniform Node Placement Model

This node placement model is based on the number of nodes in the simulation. The terrain region is divided into a number of cells, a node is placed randomly.

V. SIMULATION ENVIRONMENT

The aim of this simulation study is to evaluate the performance of existing wireless geographical routing protocol LAR in various nodes placement models like Grid, Random and Uniform i.e. the nodes are placed in various arrangements and moves arbitrarily. The simulations have been performed using EXata version 5.4, software that provides scalable simulations of Wireless Networks. For this, the simulation is carried out within a 1000m X 1000m area for different network sizes and keeping the mobility speed, simulation time and pause time constant. Table 1 shows the simulation parameters used in the evaluation.

The three node placement models are shown in the Figures.2, 3 and 4 and the running scenario is shown in the Fig 5.

Table-1

Simulation Parameter	**Parameter Value**
Simulator	EXata-5.4
Radio propagation model	Two Ray Ground
Mobility Model	Random Way Point
Simulation time (s)	900
Pause time (s)	0
Speed (m/s)	10
Mac Layer	IEEE 802.11
Traffic	CBR
Packet Size (bytes)	512
Antenna type	Omni directional
Terrain Region	1000 X 1000 m^2
Battery model	Linear
Radio type	802.11b
Data rate	2 Mbps
Node Deployment Models	Random, Grid and Uniform
Network Size	30,60 and 90 nodes

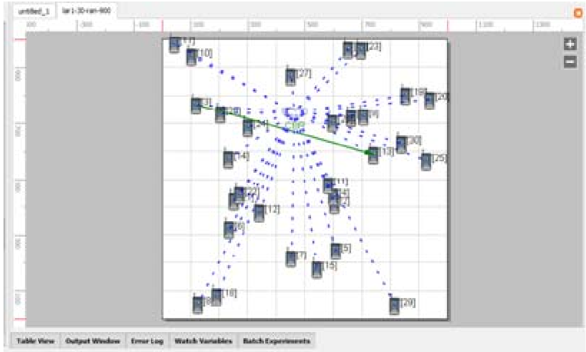

Fig2. shows simulation scenario of Random node placement model.

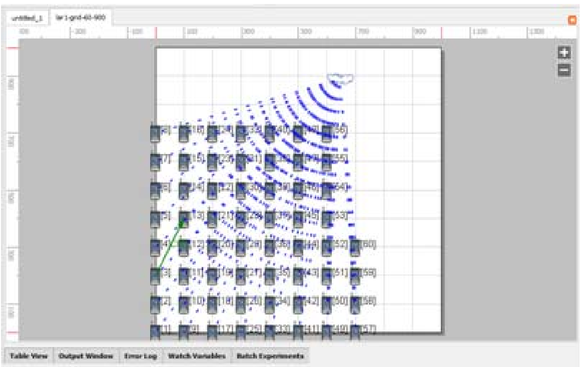

Fig3. Shows simulation scenario of Grid node placement model.

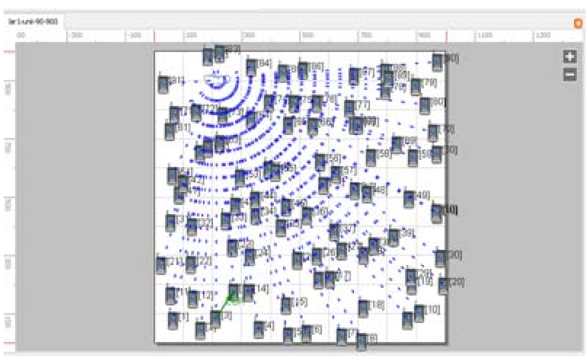

Fig4. Shows simulation scenario of Uniform node placement model.

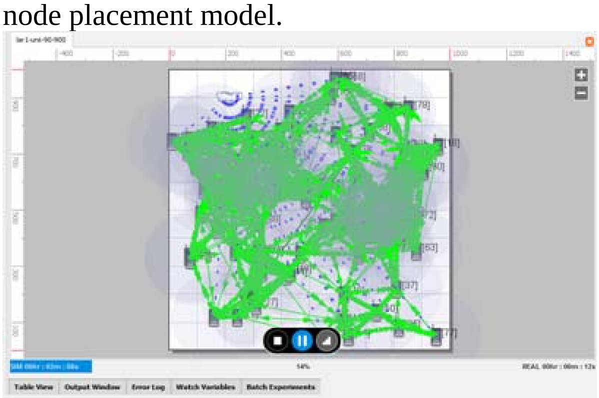

Fig5. shows running simulation scenario

The following performance metrics are considered for evaluation:

Throughput: The amount of data transferred over the period of time expressed in kilo bits per second (Kbps). The variation of Throughput with varying network size for different node deployment models is shown in the Fig 8.

Average End-to-End Delay: This comprises of all possible delays produced by route discovery latency, re-transmission on delays at MAC and queuing at the interface queue etc. The variation of Average End-to-End Delay with varying network size for different node deployment models is shown in the Fig 7.

Average jitter: Average Jitter is the variation (difference) of the inter-arrival times between the two consecutive packets received. The variation of Average jitter with varying network size for different node deployment models is shown in the Fig 6.

VI. RESULTS AND DISCUSSION

The following metrics are taken to evaluate the performance of the routing protocol.

A. The variation of Average Jitter with varying network size is shown in Fig 6.

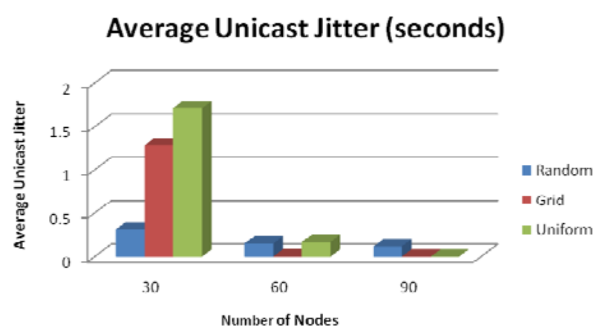

Fig 6. Shows the Average Jitter for LAR1 protocol with varying network size using different node deployment models.

From the simulation results we analyzed that Average Jitter is very low for medium and large networks in all node placement models. For smaller networks it is more in Uniform node placement model when compared to other node placement models.

B. The variation of Average End-to-End Delay with varying network size is shown in Fig 7.

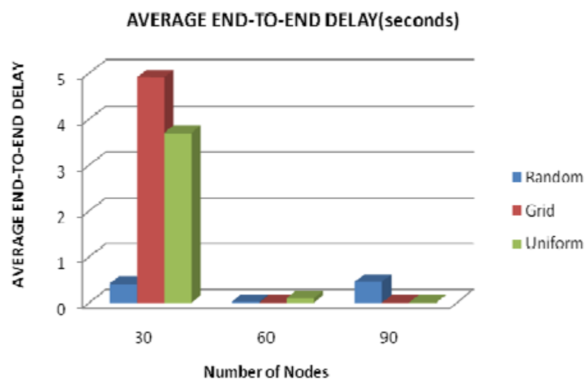

Fig. 7 shows the Average End-to-End Delay for LAR1 protocol with varying network size using different node deployment models.

From the simulation results we analyzed that End-to-End Delay is very low for medium and large networks in all node placement models. For smaller networks it is more in Grid node placement model when compared to other node placement models.

C.The variation of Throughput with varying network size is shown in Fig 8.

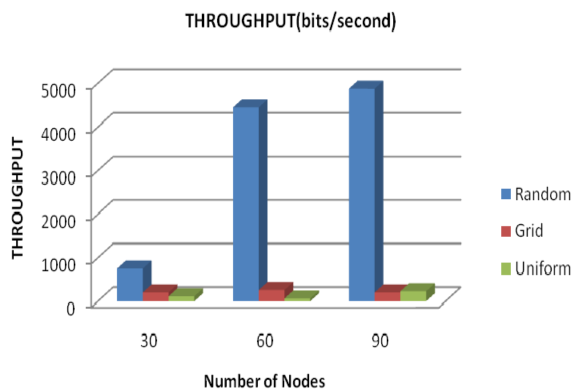

Fig. 8 shows Throughput for LAR1 protocol with varying network size using different node deployment models.

From the simulation results we analyzed that, Throughput is very high for medium and large networks in Random node placement model. For smaller networks it is more in Random node placement model when compared to other node placement models.

VII. Conclusion and Future Scope

The performance of LAR1 is studied by placing the nodes in various arrangements. The simulation results shows that LAR1 achieves better performance in Random Environment in the combination of metrics such as throughput and delay. We observed that, the location aided routing protocol (LAR1) is suitable for medium and large networks. Our future research work is to study the behavior of LAR1 with various mobility models and simulation times.

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