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Performance Comparison of Geographic LAR1 with On-demand AODV and DSR Routing Protocols for MANETs

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Abstract— MANET is a self organizing, infrastructure-less network, that consist number of low power mobile nodes connected by wireless radio frequency signals. These nodes in this dynamic environment move freely in any direction, which leads to change in network topology. It is very difficult to recharge or replace the battery of the nodes. To maximize the battery life and lifetime of the network, the nodes are required to be energy conserved. The mobile node energy can be affected by the performance of the routing protocol. We have considered three routing protocols, one is location based protocol - LAR1 and the other two are non location based protocols - AODV and DSR. The energy performance metrics, routing power and residual energy in all the three modes –transmitting, receiving and idle mode are evaluated using these routing protocols in Mobile Ad-hoc Networks and also other performance metrics in application layer are evaluated, which are throughput, end-to-end delay and average jitter. The simulation is carried out by using EXata -5.4.

Keywords-*component; MANET, throughput, delay, jitter,Power consumption, EXata-5.4*

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I. INTRODUCTION

Mobile Ad-hoc Network is a group of wireless mobile nodes that interact with each other utilizing multi hop wireless links where there is no importance for the network foundation or compact supervision. Every node acts as a router in transmitting packets to other nodes. Basically, the protocol explains the conveyance that is, transmitting and receiving packets from each node to every node in a network [1][2]. For the required data shifting, MANETs impart either by using single hop or multi hops with reinforce of the mediator nodes. Wireless ad-hoc networks have limited power sources. Energy efficiency of the network is one of the major issue mobile ad-hoc networks.

During processing and communication most of the energy is consumed. The energy consumed during communication is more than the energy consumed during processing. So, energy efficient communication system is required to optimize the energy consumption at different states of the communication. The life time of the nodes in wireless networks is reduced due to the unnecessary usage of battery power. A normal restriction of wireless communication is the short lifetime of mobile terminals, because batteries provide limited power to operate the nodes. Thus, in wireless communication, power management is one of the most difficult tasks [9][10].

In this paper performance of three different types of routing protocols are compared with scenarios of same number of nodes using EXata 5.4 Simulator. The simulator setup and finally the results are discussed.

II. PROTOCOLS ANALYSED

The following protocols are considered for analysis:

- LAR1
- AODV
- DSR

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. 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, comprising both source and circular shape is in the rectangular shape. 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].

Adhoc on demand routing (AODV):

AODV has a routing table and all the entries in the routing will be reliable by a sequence of numbers. The routing table is updated when all nodes receive the route request control packet. The AODV routing protocol is mostly developed for ad hoc mobile networks. It is able to manage unicast and multicast routing. The AODV is running only on demand. Some of the advantages of AODV protocol are loop free and self starting. The AODV enhances a route utilizing two routers, route reply and route request. The route is sustained only at the time when it is being utilized by the router and if it is not exactly sustained the probability of getting expired is more This protocol is totally based on source-initiated on-demand routing. Only when the source node is wanted the routes have been generated. The route discovery process

begins when source demands. This process is finished once a route is found or each and every possible route have been considered. It yields unicast, broadcast, along with multicast communication in networks. Routes are sustained by the source node. AODV nodes sustain a route table in which succeeding hop routing information for destination nodes is stored [5][6].

Dynamic Source Routing (DSR) :

Dynamic Source Routing (DSR) is a wireless networks reactive routing protocol. Its execution is based on a procedure named source routing. DSR supports the network to be totally self-configuring and self-organizing.

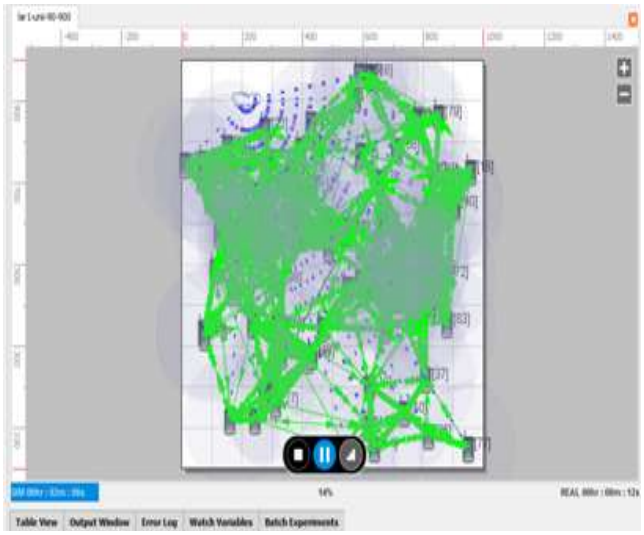
This is a reactive routing protocol. Without utilizing the periodic table upgrades, this protocol can organize Mobile Ad-hoc Networks in multi-hop way. The prevailing network foundation is not required which ultimately conveys that MANET allows the network to be self organizing and self configuring. Predominantly this protocol concentrates on two parts, route finding and route preservation. The route request packets are moved from source node to the terminal node in the route finding part. The protocol locates and determines whether a suitable route is to be utilized or the route finding protocol should begin to discover the fresh route, when the topology of the network has varied in the route preservation part [6][7][8].

III. SIMULATION ENVIRONMENT

The overall goal of this simulation study is to evaluate the performance of existing wireless routing protocols AODV, DSR and LAR1 is evaluated by varying the different simulation time, over an area of 900×900 m^2 keeping the speed and pause time constant. All the nodes in the depicted scenario are given a mobility using the protocol of Random waypoint mobility model. The simulations have been performed using EXata version 5.4 for 60 nodes. Table 1 shows the simulation parameters used in the evaluation and running scenario is shown in the fig. 1

Table -1

Simulation Parameter	Parameter Value
Simulator	EXata-5.4
model	Two Ray Ground
Mobility Model	Random Way Point
Routing Protocols	AODV, DSR and LAR1
Simulation time (s)	900
Number of Nodes	60
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 m X 1000m
Battery model	Linear
Radio type	802.11b
Data rate	2 Mbps



Fig, 1 shows the running scenario using 60 nodes.

With the help of simulation results we have analyzed application layer metrics like Average Jitter, Throughput, End-to-End delay and physical layer metrics like power consumption in transmit, receive and idle modes for AODV, DSR and LAR1 protocols. These performance metrics are defined below:

IV RESULT ANALYSIS WITH GRAPHS

I. Average Jitter(s):

Average Jitter is the variation in the expected time of arrival of packets. Average jitter is caused by network congestion and delays in the packet network. To minimize the delay variations, a jitter buffer are implemented which temporarily stores arriving packets [10] [16]

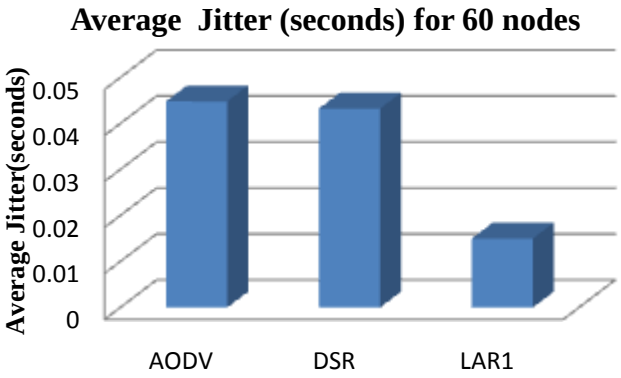


Figure. 2. Shows the Average End-to-End Delay for AODV, DSR and LAR1 protocols using 60 nodes.

Performance of different routing protocols based on average jitter is shown in the Fig. 2 for 60 nodes. The simulation results of average Jitter shows that LAR1 protocol outperforms all other protocols.

II. Average End-to-End delay(s):

The average end to end delay of a data packet is calculated by subtracting time at which first packet was transmitted by source from time at which first data packet arrived to destination [16].

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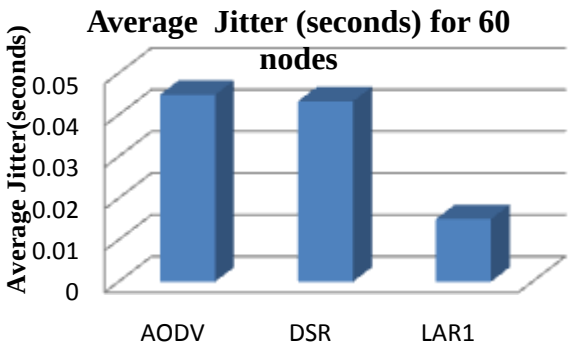

Figure. 3. Shows the Average End-to-End Delay for AODV, DSR and LAR1 protocols using 60 nodes**.**

Performance of different routing protocols based on average jitter is shown in the Fig. 3 for 60 nodes. The simulation results of average Jitter shows that LAR1 protocol outperforms all other protocols.

III. THROUGHPUT

Average rate of successful messages delivered over a communication channel. This data may be delivered over a physical or logical link, or pass through a certain network node. It is usually measured in bits/sec and sometimes in data packets/sec.

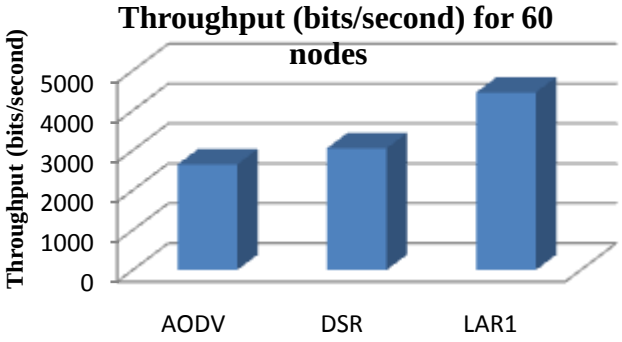

Figure.4 shows Throughput for AODV, DSR and LAR1 protocols using 60 Nodes.

Performance of different routing protocols based on Throughput is shown in the Figure 4 for 60 nodes. The simulation results of Throughput show that LAR1 protocol outperforms all other protocols. AODV protocol shows lower Throughput than DSR.

Energy Consumption Modes: (Receive, Transmit & Idle)

The mobile nodes in wireless networks are linked between source to destination nodes. These nodes transmit (Tx) and receive (Rx) the data packet to or from other nodes and need energy for such action. The total energy of nodes is utilized in the subsequent modes. The different modes of energy consumption are: (1) Transmission Mode (2) Reception Mode (3) Idle Mode [9].

Transmission Mode:

A node is assumed to be in transmission mode when it communicate data packet to other nodes in network. These nodes require energy to transmit data packet, such energy is called Transmission Energy (Tx) of that node. Transmission energy is depended on size of data packet which is transmitted (in Bits).The energy required for transmission is increased when the size of data packets is increased. The amount of energy required to transmit and receive the packets is determined by using the following equations:

Energy Tx = (330*Packet Size)/2*106

Where, Packet size is specified in bits, Tx is transmission Energy.

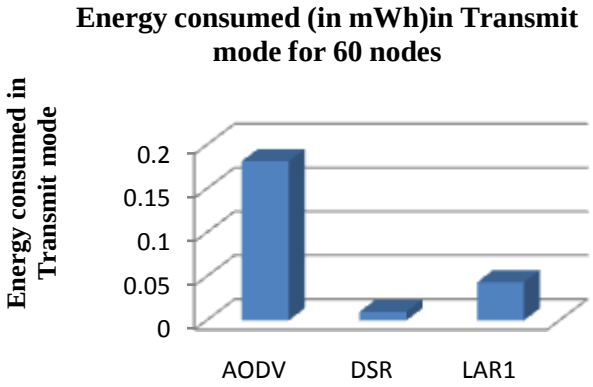

Figure.5 shows Energy Consumed in Transmit mode for AODV, DSR and LAR1 protocol using 60 nodes.

On analyzing the results for energy consumption in transmit mode it is noted that there is minimum consumption in DSR, maximum consumption in AODV and medium in LAR1.

Reception Mode:

A node is said to be in Reception mode, when a node communicates and receives a data packet from other nodes. The energy required to receive packet is called Reception Energy (Rx). Then Reception Energy can be given as:

Energy Rx = (230* Packet Size)/2*106

PR= Rx/Tr

Where Rx is Reception Energy, PR is Reception Power, Tr is time taken to receive data packet.

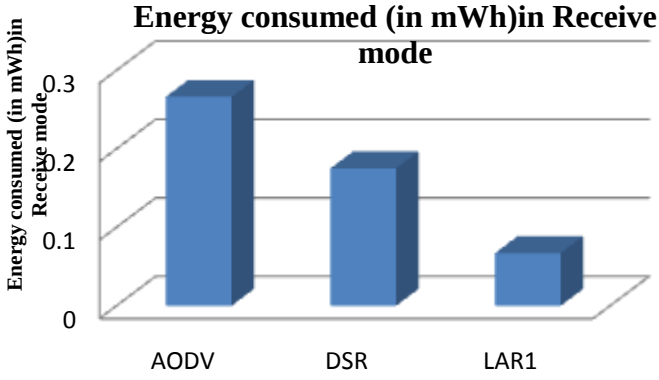

Figure.5 shows Energy Consumed in Receive mode for AODV, DSR and LAR1 protocol using 60 Nodes.

On analyzing the results for energy consumption in Receive mode it is noted that there is minimum consumption in LAR1, medium in DSR and maximum in AODV.

Idle Mode:

A node is said to be in the Idle mode, when the node is neither transmitting nor receiving any data from source to destination. But in this mode node consumes power because the nodes communicate in wireless medium continuously. When a node finds a data packet to transmit or receive, then the node can be switched to receive mode from idle mode. Idle energy is completely used up energy that should be reduced or eliminated. The power consumed in Idle Mode is:

PI= PR

Where PI is power consumed in Idle Mode and PR is power consumed in Reception Mode.

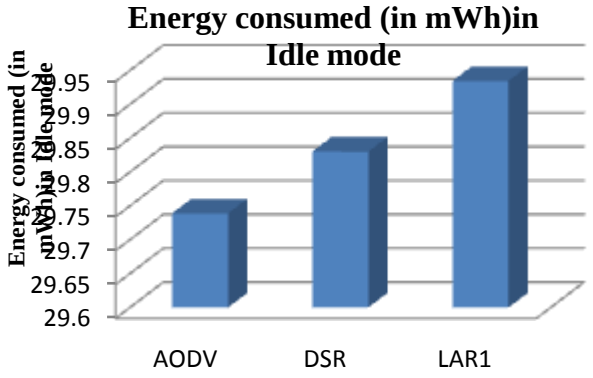

Figure.6 shows Energy Consumed in Idle mode for AODV, DSR and LAR1 protocols using 60 nodes.

Total Energy Consumed:

Total Energy Consumed is equal to the sum of power consumed in the transmit mode, power consumed in the receive mode and power consumed in the idle mode.

On analyzing the results for energy consumption in idle mode, it is noted that there is minimum consumption in AODV, medium in DSR and maximum in LAR1.

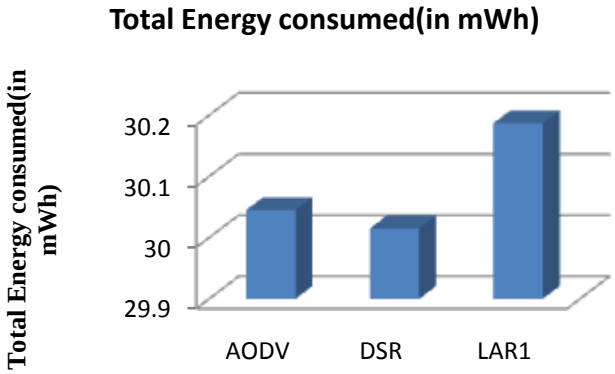

Figure.7 Shows Total Energy Consumed in AODV, DSR and LAR1 protocols for 60 Nodes.

On analyzing the results for Total Energy consumption is minimum in DSR, medium in AODV and maximum in LAR1.

V.CONCLUSION AND FUTURE SCOPE

This paper presents a performance comparison of AODV, DSR and LAR1 routing protocols in mobile ad-hoc networks for fixed number of nodes. We measure End-to-End delay, Average Jitter, Throughput and power consumed in transmit, receive and idle modes as performance metrics. Our simulation results shows LAR1 performance is best under QoS metrics like End to End delay, Average Jitter and Throughput. The total energy consumption is maximum in LAR1 when compared with AODV and DSR, minimum in DSR and medium in AODV.

In future we will design and implement an algorithm to minimize the energy consumption of LAR1 routing protocol in MANETs using soft computing techniques.

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