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Performance Analysis of DSR,LAR and STAR of MANETs for CBR traffic

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ABSTRACT: Mobile nodes have limited battery energy and in MANETs it is usually impossible to replace these batteries during emergency. So, energy efficient routing in MANETs is a very critical task. In this paper a comparative performance analysis of routing protocols (DSR ,STAR and LAR) has been done on the basis of energy consumption ,packet delivery ratio, jitter and end to end delay using QualNet 5.0.2. The obtained results indicate that STAR is more energy efficient than other two protocols.

KEYWORDS: MANET, QualNet, PDF, end to end delay, energy efficient, DSR, LAR, STAR

I.INTRODUCTION

Mobile Ad Hoc Network (MANET) [1] is an infrastructure less network in which nodes move randomly. It is useful when infrastructure is absent, destroyed or impractical (disaster area or war zone). Due to lack of infrastructure MANETs has to rely on limited battery resources and therefore energy efficient routing is necessary [2].The energy consumption in MANETs increases as the number of nodes increases due to increase in control packets and this need to be optimized.

In this paper three routing protocols (DSR, LAR and STAR) has been simulated and compared on the basis of energy consumption, packet delivery ratio, end to end delay and jitter under CBR traffic. It is observed that STAR is more energy efficient compared to the other two protocols. As STAR uses LORA technique instead of ORA technique it reduces the routing overhead significantly.

Section III describes the routing protocols that have been implemented in this work. Section IV elaborates the simulation scenario and set up used in QualNet. Simulation results and analysis is described in section V. Conclusion of this paper has been discussed in section VI.

II.RELATED WORK

The main focus is to analyse the effect of CBR traffic for various routing protocols of MANETs. Said El Kafhali et. al. [3] have performed a comparative analysis for MANET routing protocols on the basis of energy consumption under different mobility models and traffic models. From the simulation results it was concluded that for any routing protocol and mobility model the energy consumption will be maximum if traffic model is CBR. Dharam Vir et. al. [4] have compared DSR, STAR and ZRP protocols on the basis of energy consumption, packet delivery ratio, throughput, jitter,delay and routing power for CBR traffic.

Alka Chaudhary et. al. [5]have evaluated the energy metrics of OLSR, DSR, AODV, ZRP and LAR for stationary and mobile nodes and it was observed that in both cases AODV consumed minimum energy. Dhiraj Nitnaware and Ajay Verma[6] have compared the energy consumption AODV and DSR as a function of pause time, number of nodes, number of sources, speed ,sending rate and area shape. Simulation results show that DSR outperforms than AODV in terms of pause time, speed ,large number of sources and nodes, medium range of area and sending rate.

The work presented here compares DSR, STAR and LAR on the basis of energy consumption in transmit, receive and idle mode. It also compares the protocols on other QoS parameters like average end to end delay, average jitter and packet delivery ratio.

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III.ROUTING PROTOCOLS

MANET routing protocols can be basically classified into three categories: proactive, reactive and hybrid routing protocols. In proactive routing protocols [7], the nodes maintain topology information in form of routing tables whereas in reactive routing topology information is available on demand. Hybrid routing protocols is combination of reactive and proactive. This paper focuses on the following three routing protocols: DSR, STAR and LAR.

A. Dynamic source routing (DSR)

DSR [8] is an on-demand routing protocol that uses source routing, i.e., the source determines the complete sequence of hops that each packet should traverse to send packets. It primarily consists of two mechanisms: Route discovery and route maintenance.

Route Discovery: Whenever a node wants to send packet to destination, it looks in its route cache if a route already exists. If a valid route does not exist, a RREQ packet is broadcasted to its neighbors. A node that receives a RREQ message searches its route cache for a route to the destination. If no route is found, it adds its address to the message and forwards the message to its neighbors. When destination is reached, RREP is generated and unicast back to the source node.

Route maintenance: When a node encounters route break, it generates a RERR message and removes the route from its route cache. The route error message is sent to each node that has sent a packet routed over the broken link.

B. Location aided routing (LAR)

LAR [9] is a reactive routing protocol that is similar to DSR but with the additional requirement of GPS information. The source defines a circular area in which the destination may be located and determined by the destination location known to the source, the time instant when the destination was located at that position and the average moving speed of the destination. The smallest rectangular area that includes this circle and the source is the request zone. This information is attached to a route request by the source and only nodes inside the request zone propagate the packet. If no route reply is received within the timeout period, the source retransmits a route request via pure flooding.

C. Source tree adaptive routing (STAR)

STAR [10] is a proactive or table driven routing protocol in which the routers exchange only the changes in their own shortest path trees with their neighbors. STAR operates by least overhead routing approach (LORA) instead of optimum routing approach (ORA) in which STAR attempts to provide path which has least overhead to destination thereby reducing routing overhead to great extent.

IV.SCENARIO SETUP

The simulation was performed using QualNet [11] Simulator 5.0.2. The nodes moves randomly over the network and the mobility model used is random waypoint model in a rectangular filed of 1500m x 1500m .The traffic model used is constant bit rate (CBR) . We have compared the performance of DSR, STAR and LAR for 10, 20 and 30 nodes. Table I shows the simulation parameters set for analysis of routing protocols of MANETs.

The following performance metrics were analysed.

- Average jitter
- Average end to end delay
- Packet delivery ratio
- Energy consumed in transmit mode
- Energy consumed in receive mode
- Energy consumed in idle mode

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TABLE I. SIMULATION PARAMETERS

Parameter	**Value**
Qualnet	5.0.2
MAC Type	IEEE 802.11b
Simulation time	30 sec.
Mobility Model	Random Waypoint
Number of nodes	10 to 30
Topology area	1500 x 1500
Traffic Type	CBR
Propagation Model	Two ray ground
Routing protocols	DSR,STAR,LAR1
Battery Model	Linear
Energy model	Generic
Performance metrics in application layer	PDR, jitter, end to end delay
Performance metrics in physical layer	Energy consumed in transmit, receive and idle mode

Fig. 1 shows the scenario which was used for comparing the performance of DSR, STAR and LAR for CBR traffic for 30 nodes .

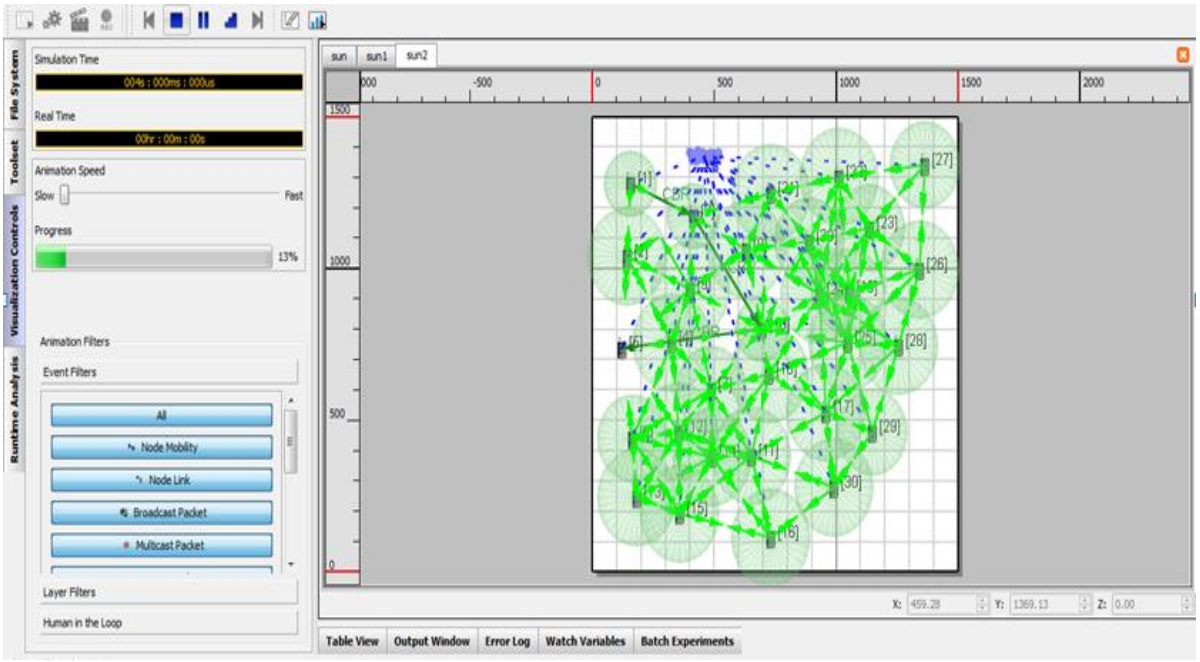

Fig. 1 Running snapshot of DSR protocol for 30 nodes in QualNet

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V. RESULT AND DISCUSSION

A. Packet delivery ratio (PDR): It is the ratio of number of packets delivered to the destination to the packets sent by the source. It is seen that packet delivery ratio for DSR is maximum and it increases as the network size increases. Packet delivery ratio for STAR is minimum and LAR1 has the PDR between DSR and STAR as shown in Fig. 2 .

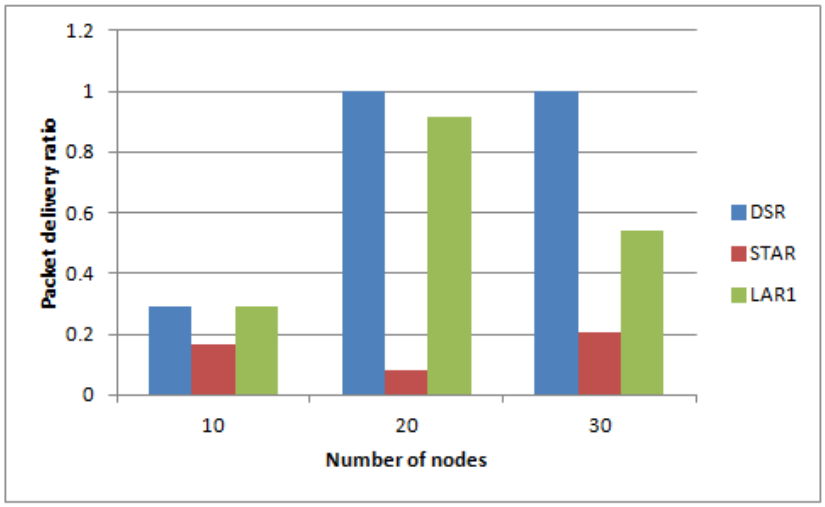

Fig. 2 Packet delivery ratio for DSR, STAR and LAR

B. Average jitter: Average jitter is the delay variation or variation in inter arrival times of packets. It is observed that average jitter increases as the number of nodes increases. From Fig. 3 it is observed that LAR1 is having maximum average jitter whereas STAR is having least jitter. DSR has average jitter between STAR and LAR1.

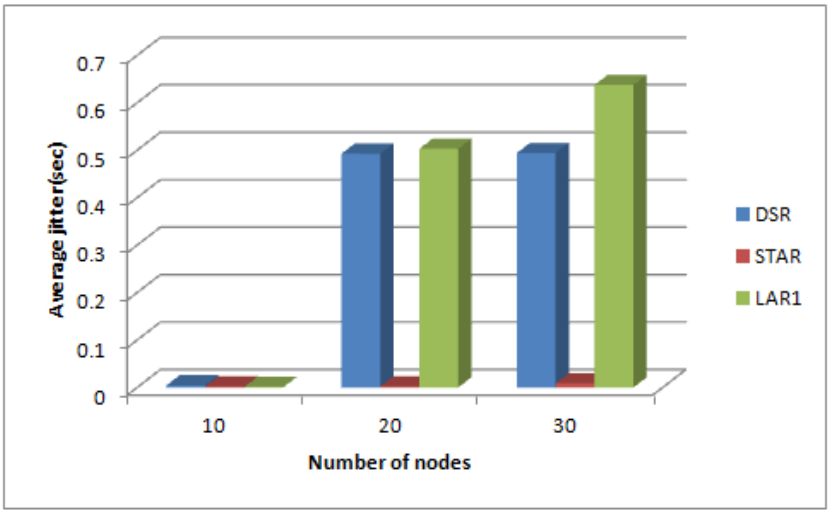

Fig. 3 Average jitter for DSR, STAR and LAR

C. Average end to end delay: It is the time taken for packet to reach from source to destination. Average end to end delay increases with increase in network size. Average end to end delay is maximum for DSR followed by LAR1 and is minimum for STAR as shown in Fig. 4.

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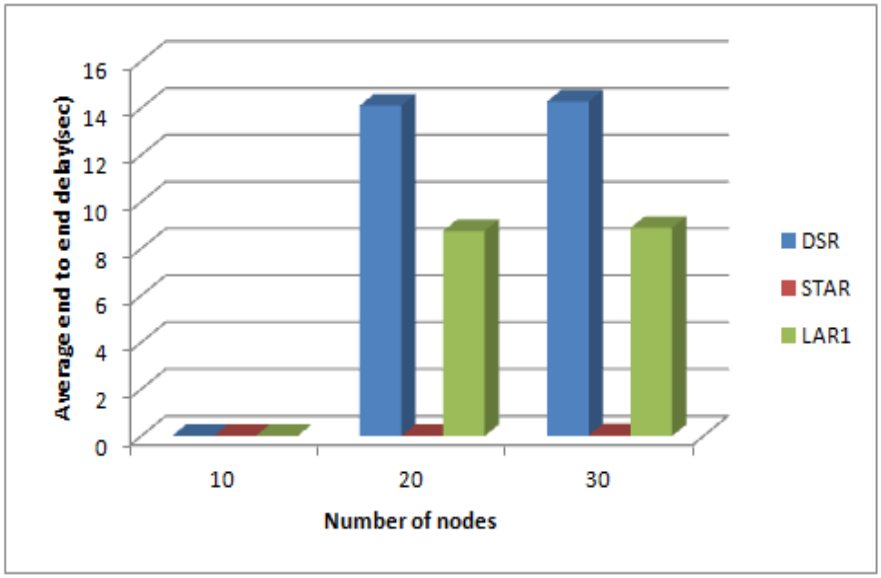

Fig. 4 Average end to end delay for DSR, STAR and LAR

D. Energy consumed in transmit mode: It is the total energy consumed during the transmission of data packet from source to destination by all nodes in the network. It is seen that energy consumption increases with increase in number of nodes. Energy consumption is maximum for LAR1, followed by DSR and is minimum for STAR. STAR uses LORA technique which reduces routing overhead thereby decreasing energy consumption as observed in Fig. 5.

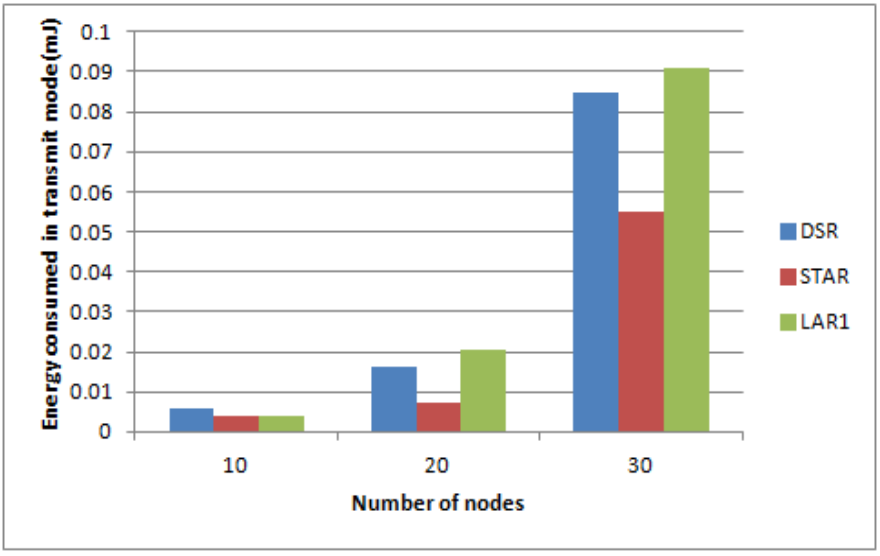

Fig. 5 Energy consumed in transmit mode for DSR, STAR and LAR

E. Energy consumed in receive mode: It is the total energy consumed during the receiving phase of data packets from source to destination by all nodes in the network. Energy consumption is maximum for LAR1 and for STAR is minimum as shown in Fig. 6.

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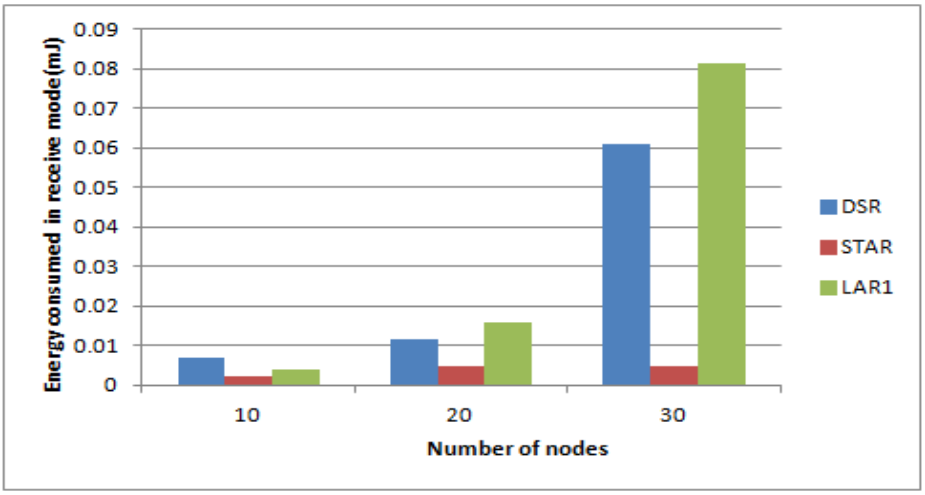

Fig. 6 Energy consumed in receive mode for DSR, STAR and LAR

F. Energy consumed in idle mode: It is observed that energy consumed in idle mode is maximum for LAR1 and minimum for STAR. In Fig. 7 it is observed that energy consumption for DSR is between STAR and LAR1.

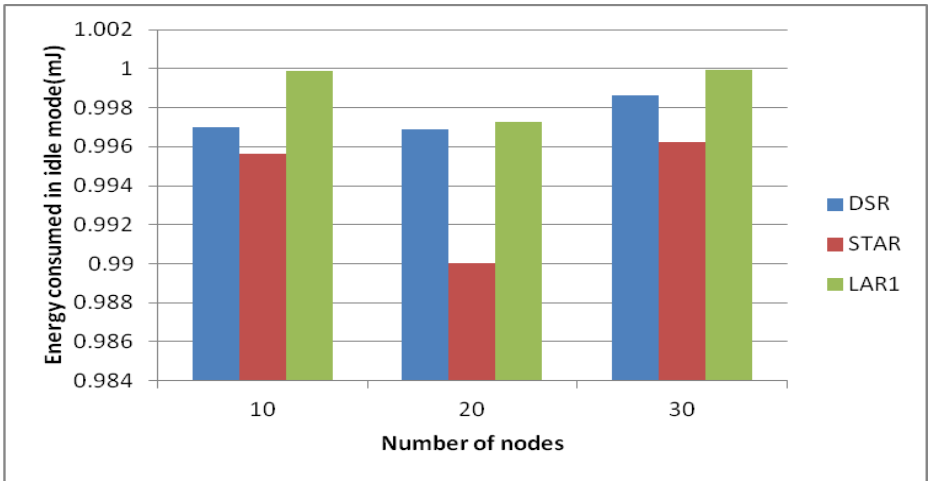

Fig. 7 Energy consumed in idle mode for DSR, STAR and LAR

VI.CONCLUSION

The energy metrics, PDR, jitter and end to end delay has been simulated and analyzed for DSR, STAR and LAR. It has been observed that STAR is more energy efficient compared to other two protocols as it uses LORA technique instead of ORA technique. PDR and average end to end delay is maximum for DSR. Average jitter is maximum for LAR.

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