Available Online at www.ijcsmc.com

International Journal of Computer Science and Mobile Computing

A Monthly Journal of Computer Science and Information Technology

ISSN 2320–088X

IJCSMC, Vol. 2, Issue. 11, November 2013, pg.277 – 284

RESEARCH ARTICLE

Performance Evaluation of DSR and LAR Routing Protocols with MAC Layer in MANET's

Venkataramana Attada [1], Pallam Shetty S [2]

[1]Department of Computer Science & Systems Engineering, Andhra University, Visakhapatnam, India

[2]Department of Computer Science & Systems Engineering, Andhra University, Visakhapatnam, India

[1] venkataramana.a@gmrit.org; [2] drspsetty@gmail.com

Abstract— ***In the past two decades, we have seen a rapid development in the area of mobile computing and communications due to the explosion of inexpensive, broadly available wireless devices. A mobile ad hoc network is an independent collection of mobile devices that communicate with each other over wireless links and cooperate in a distributed manner in order to provide the necessary network functionality in the absence of a fixed infrastructure. Each device in a MANET is free to move independently in any direction, and will therefore change its links to other devices frequently. In this paper we have done the performance evolution of DSR and LAR routing protocols for MAC layer in MANETs with varying network size. Number of simulation scenarios was carried out by using Glomosim-2.03 with the simulation metrics like Throughput, End-to-End Delay and Packer Delivery Ratio. From simulation results we found that both 802.11 and CSMA is suitable for DSR where as only 802.11 is suitable for LAR.***

Keywords— ***AODV; LAR; CSMA; GloMoSim; PDR***

I. INTRODUCTION

The field of wireless and mobile communications has experienced an unprecedented growth during the past decade. Recently, an increasing number of wireless local area networks emerging, allowing travellers with portable computers to surf the Internet from airports, railways, hotels and other public locations. Broadband Internet access is driving wireless LAN solutions in the home for sharing access between computers. In the meantime, 2G cellular networks are evolving to 3G, offering higher data rates, infotainment and location-based or personalized services.

Mobile Ad hoc Network is an autonomous transitory association of mobile nodes that communicate with each other over wireless links. Nodes that lie within each other's send range can communicate directly and are responsible for dynamically discovering each other. In Mobile ad hoc network, nodes are having high mobility; because of this mobility routing is an important issue in Ad hoc network. An efficient routing protocol, which provides QoS by minimizing delay and power consumption while maximizing throughput and utilization of

resources, remains a challenge issue for the ad-hoc network. For these purpose we have considered capable and efficient routing protocols and we investigate their performance on a different MAC layer access mechanisms.

Medium Access Control (MAC), is part Data Link Layer (layerl-2 of the OSI reference model), this protocol is used for provide channel access mechanism when multiple users are trying to access the single channel [5]. Some of the MAC protocols are 802.11 DCF, CSMA and MACA. In this paper we investigate the impact of AODV and DSR routing protocols under the MAC protocol CSAM and 802.11. We observed that the performance of the protocols will be best when run over IEEE 802.11, comparing with CSMA, due to its channel acquisition characteristics. However, for some parameters CSMA also show good performance.

II. ROUTING PROTOCOLS

Routing is the act of moving information from a source to a destination in an internetwork. At least one intermediate node within the internetwork is encountered during the transfer of information. Routing Protocols plays crucial role in MANETS. Routing protocols of ad-hoc network can be categorized into different categories. These are Pro-active, Re-active routing, Hybrid, Topology based and Geographical based Routing protocols [10]. Pro-active routing is also called Table driven routing where as re-active routing is called On-demand & dynamic routing. LSR and DSDV are the pro-active routing protocols. AODV and DSR are the popular Re-active routing protocols [1][2]. LAR is Geographical based routing protocol. In this paper we studied two routing protocols DSR and LAR with MAC layer protocols like 802.11 and CSMA. These protocols are explained briefly in the following sub-sections.

II-A. LAR

Location-Aided Routing (LAR) is a mechanism which attempts to reduce the control message overhead of Ad-hoc on-demand distance vector (AODV) routing protocol by flooding only the portion of the network that is likely to contain the route to destination. LAR takes advantage of Global Positioning System (GPS) coordinates to identify a possible location of the destination node [7]. Based on this information, LAR defines a portion of the network which will be subject to the limited flooding, thus reducing the total number of the control packet travelling through the network during the route discovery process. The proposed approach is termed Location-Aided Routing (LAR), as it makes use of location information to reduce routing overhead. Location information used in the LAR protocol may be provided by the Global Positioning System (GPS) [3][4]. With the availability of GPS, it is possible for a mobile host to know its physical location_. In reality, position information provided by GPS includes some amount of error, which is the difference between GPS-calculated coordinates and the real coordinates.

Location based routing adresses the limitations of topology based routing with help of Add on information,They need data about the physical location of the participating devices available. In genaral every device decides its own location through the use of Global Positioning System or otherservice. Location service is useful to sender to identify the positin of the receiver.

II-B. DSR

Dynamic source routing protocol (DSR) is an on-demand protocol [2]. It deploys source routing. It is designed to restrict the bandwidth consumed by control packets in ad hoc wireless networks by eliminating the periodic table-update messages required in the table-driven approach. In DSR each node catches the specified route to destination during source routing of a packet through that node. This enables the node to provide route specification when a packet source routes from that node. The error packet is sent by reverse path in case it is observed by a router. DSR also user three types of packets like AODV. DSR ensures that each packet includes the routing-node address also. The major difference between this and the other on-demand routing protocols is that it is beacon-less and hence does not require periodic hello packet (beacon) transmissions, which are used by a node to inform its neighbors of its presence.

The basic approach of this protocol (and all other on-demand routing protocols) during the route construction phase is to establish a route by flooding Route Request packets in the network. The destination node, on receiving a Route Request packet, responds by sending a Route Reply packet back to the source, which carries the route traversed by the Route Request packet received. This protocol is truly based on source routing whereby all the routing information is maintained (continually updated) at mobile nodes. It has only two major phases, which are Route Discovery and Route Maintenance. Route Reply would only be generated if the message has reached the intended destination node.

III. MAC LAYER FOR AD HOC NETWORKS

MAC is a Media access Control Layer, The Media Access Control (MAC) sub layer is the part of the OSI network model data link layer that determines who is allowed to access the physical media at any one time. It acts as an interface between the Logical Link Control sub layer and the network physical layer [9]. The MAC sub layer is primarily concerned with recognizing where frames begin and end in the bit-stream received from the physical layer. It also deals with frame delimiters, i.e. inserting information into or among the frames being sent so that the receivers are able to recognize the beginning and end of the frames. Calculate checksum for error detection in frame is also responsible of Data Link Layer. The main job of the MAC protocol is to regulate the usage of the medium, and this is done through a channel access mechanism. A channel access mechanism is a way to divide the main resource between nodes, the radio channel, by regulating the use of it. It tells each node when it can transmit and when it is expected to receive data. The channel access mechanism is the core of the MAC protocol.

III-A. CSMA & 802.11

In CSMA (Carrier Sense Multiple Access) protocol, a station wishes to transmit, first it sense (listen) the channel for to check whether it is free or not. If it is free the station can access the channel, otherwise it will wait for a random amount of time then again sense the channel. Unfortunately, CSMA is restricted by two interference mechanisms: the hidden and the exposed terminal problems. In general, Due to hidden terminal collisions will occur and due to exposed terminals unnecessary delay will occur. Numerous attempts have been made to reduce the problem of hidden and exposed terminal problem. One of the mechanisms is the use of RTS/CTS (Request to Send / Clear to send) [6].

IEEE 802.11 is a set of media access control (MAC) and physical layer (PHY) specifications for implementing wireless local area network (WLAN) computer communication in the

2.4, 3.6, 5 and GHz frequency bands. They are created and maintained by the IEEE LAN/MAN Standards Committee (IEEE 802). The base version of the standard was released in 1997 and has had subsequent amendments. The standard and amendments provide the basis for wireless network products using the Wi-Fi brand.

IEEE 802.11 uses RTS/CTS mechanism to reduce the problem of hidden and exposed terminal problem 802.11 differ in its requirement of an acknowledgment (ACK) transmission by the receiver after the successful reception of the data packet [9]. 802.11 define two MAC protocols, i.e., Point Coordination Function (PCF) and Distributed Coordination Function (DCF), only DCF is used in MANETs since PCF requires base stations.

IV. SIMULATION ENVIRONMENT

In this paper we have done the performance evaluation of DSR and LAR routing protocols for r MAC layer. We used MAC layer protocols CSMA and 802.11. The simulation has been performed using the Global Mobile Information System Simulator (GloMoSim) which provides scalable simulation environment for wireless network systems [8]. For our simulation, we constructed a 1000 x 1000 m square topology. The node density (number of mobile nodes) is 20,40,60,80 and 100. The node aggregation technique is used to give significant benefits to the simulation performance. Traffic sources are Constant Bit Rate (CBR). Mobility model is Random Waypoint. Packet size is 512 bytes data. Simulation time is 300 sec. Routing protocols LAR and DSR are tested under the MAC protocols 802.11 and CSMA.

IV-A. GloMoSim

GloMoSim is a scalable simulation environment for wireless network systems. It is being designed using the parallel discrete-event simulation capability provided by PARSEC [8]. GloMoSim simulates networks with up to thousand nodes linked by a heterogeneous communications capability that includes multicast, asymmetric communications using direct satellite broadcasts, multi-hop wireless communications using ad-hoc networking, and traditional Internet protocols. The major advantages of GloMoSim are it is globally accepted for wireless simulations. Other advantages are Achievement of large scalability, good mobility models specify for wireless simulation, and support of many ad hoc networking protocols. GloMoSim models currently available under MAC layer are CSMA, MACA, TSMA, 802.11. In this paper we have tested CSMA and 802.11 for AODV and DSR routing protocols.

TABLE 1
SIMULATION PARAMETERS

Routing Protocols	LAR,DSR
Simulation Time	300s
Area (sq.m)	1000mx1000m
Propagation Model	Two Ray
Traffic	CBR
Packet Size	512 bytes
Nodes	20,40,60,80,100
Antenna Type	Omni directional

Transmission range	250m
Receiver range	250m
Pause time	0 sec
Minimum speed	1 m/s
Maximum speed	10 m/s
Mobility Model	Random Waypoint
MAC	802.11, CSMA

V. SIMULATION RESULTS AND DISCUSSION

The simulations were performed using GloMoSim, which provides a scalable simulation environment for wireless network systems. Number of simulation scenarios carried out by using simulation metrics like Throughput, End-to-End Delay and Packer Delivery Ratio. From simulation results, we found that LAR outperforms DSR. We also found that DSR is suitable for both 802.11 & CSMA protocols of MAC, where as LAR is only suitable for 802.11.

V-A. Results for Throughput

Throughput is the average rate of successful packets delivered over a communication channel. Figures 1 & 2 display Throughput results for AODV and LAR in 802.11 and CSMA. From the experimental results we found that in 802.11 both DSR and LAR shows similar performance in throughput by varying network sizes. i.e. for example when the network contains 60 & 80 nodes the throughput of both AODV and LAR is 4110 bits/sec. In CSMA DSR performs well when compared with LAR. LAR shows some up & downs in throughput.

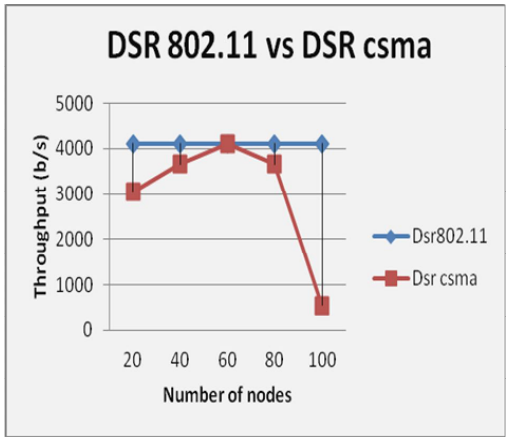

Figure 1 Variation of throughput for DSR with vayring netwok size under 802.11 and CSMA

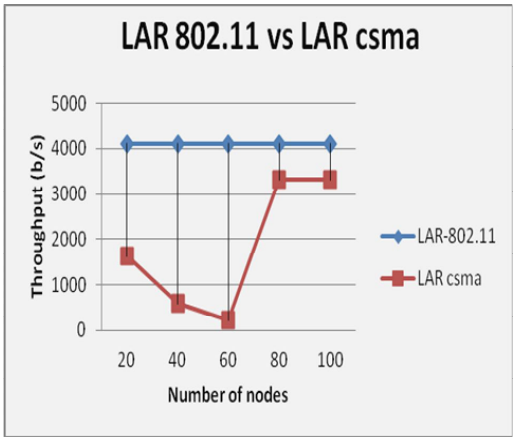

Figure 2 Variation of throughput for LAR with varying netwok size under 802.11 and CSMA

V-B. Results for Average End-to-End Delay

Average End-to-End Delay can be defined as a function of the signals travel time between the sender and the receiver. Figures 3 & 4 display the Average End-to-End delay graphs for both AODV and LAR. In the case of End-to-End delay also DSR performs better than LAR. For example from the Simulation experiments we found that, If the network contains 80 nodes the delay for DSR under 801.11 is 0.003891ms, but for same scenario delay for LAR is 0.005316 ms, so DSR is better in 802.11. In CSMA of MAC layer both DSR and LAR shows delays. But in the overall observations both DSR and LAR performs well under CSMA when compared with 802.11.

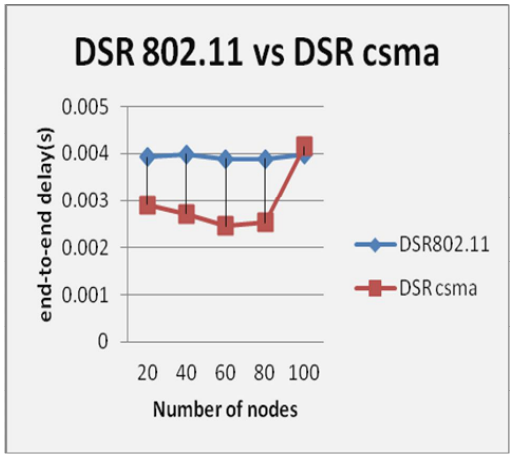

Figure 3 Variation of End-to-End Delay for AODV with varying netwok size under 802.11 and CSMA

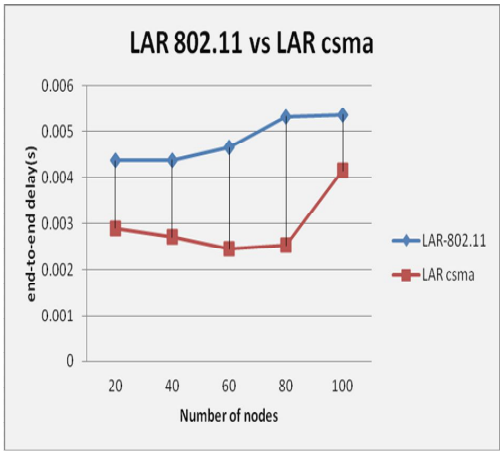

Figure 4 Variation of End-to-End Delay for LAR with varying netwok size under 802.11 and CSMA

V-C. Result for Packet Delivery Ratio

Figures 5 & 6 shows the results of Packer Delivery Ratio for DSR & LAR. Both DSR and LAR has maxmum PDR in 802.11when compared with CSMA. In CSMA DSR performs better than LAR.from figure 6 we found that Packer Delivery Ratio for LAR is showing frequent up and down performances in CSMA, i.e, When network contains 60 nodes PDR for DSR is 58.19% where as for LAR it is only 5.01%.

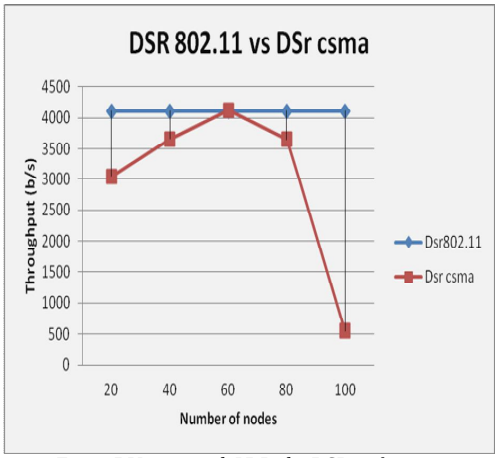

Figure 5 Variation of PDR for DSR with varying netwok size under 802.11 and CSMA

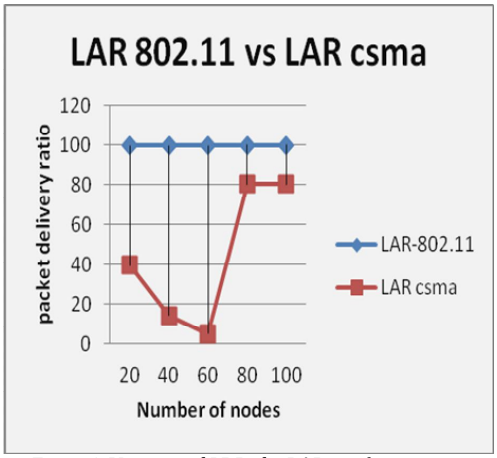

Figure 4 Variation of PDR for LAR with varying netwok size under 802.11 and CSMA

VI. CONCLUSIONS

In this paper we have done the performance analysis of DSR and LAR routing protocols for MAC layer in MANETs. We experimentally found that both 802.11 and CSMA is suitable for DSR where as only 802.11 is suitable for LAR. We have used various simulation parameters like Throughput, Average End-to-End delay and Packet Delivery Ratio. With respect to Throughput and Packet Delivery Ratio the two protocols perform well under 802.11 MAC protocol. End-to-End Delay is less for both protocols in CSMA of MAC protocol when compared with 802.11. DSR outperforms LAR under both 802.11 and CSMA protocols. This work can be extended by comparing the performance of other reactive, proactive and topology based protocols. This evaluation will be used to investigate the congestion related issues in Mobile Ad hoc Networks.

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Author Profiles

Mr.Venkataramana Attada is a Research scholar in the Department of Computer Science and Systems Engineering of Andhra University, under the supervision of Prof. S. Pallam Shetty. He received his M.Tech (CST) from Andhra University and presently working as Associate Professor in IT Department of GMR Institute of Technology. He is a Life Member of CSI and ISTE. He has presented more than 10 papers in various National and International Conferences. His Research areas include Computer Networks, Mobile Computing, Software Engineering and Data Mining.

Dr.S.Pallam Shetty is a Professor in the Department of Computer Science and Systems Engineering of AU College of Engineering, Visakhapatnam. He has guided 3 PhDs and right now he is guiding 18 PhD scholars. He has guided more than 100 M.Tech projects. He received many honours, received Gold Medal for securing first rank in M.Sc. He has been the member for expert committees and member of Board of Studies for various colleges and universities; He was the Resource person for various National and International Conferences and Workshops. He visited Berkley University, U.S.A. He is a Life Member of IETE. He is the Editorial Board Member of various International journals like IJCA, IJCIIS, and IJSAT etc.

