



Performance Evaluation of CSMA (Carrier Sense Multiple Access) and MACA (Multiple Access with Collision Avoidance) over DSR

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ABSTRACT

Problem statement: Ad hoc wireless network (AWN) is a collection of mobile hosts forming a temporary network on the fly, without using any fixed infrastructure. QoS (Quality of Service) is the idea that transmission rates, error rates, and other characteristics can be measured, improved, and to some extent guaranteed in advance in ad hoc network however in particular concern for the continuous transmission of high bandwidth video and multimedia information this kind of content dependably transmitting is difficult in public networks using ordinary "best effort" protocols. Carrier Sense Multiple Access (CSMA) refers to a family of protocols used by stations contending for access to a shared medium like an Ethernet cable or a radio channel. MACA (Multiple Accesses with Collision Avoidance) Protocol is a Contention based Sender initiated Protocol which uses Three way handshaking means that RTS—CTS—Data packet exchange. It used in network congestion avoidance to help in determining the correct sending rate by binary exponential back off (BEB) Algorithm in which if any packet transmitted by a node is lost, the node uses the binary exponential back-off (BEB) algorithm to back off a random interval of time before retrying which is also inadequate trustworthy because of data sending acknowledgement is not received. **Results:** Packet delivery ratio (PDR) of the network decreases as the nodes are increases. CSMA gives constant PDR with different nodes while MACA gives higher PDR with minimum number of nodes and lower PDR as we increase the number of nodes. Average End-to-End delay increases as the number of nodes are increase but after certain number of nodes it's again decreases as the nodes increases. CSMA gives better (lower) delay in comparison to MACA. Throughput are decreases as the nodes are increases in MACA, and in CSMA throughput are increases as the number of nodes are decreases. CSMA gives better throughput in comparison to

MACA. **Conclusion:** The results obtained show that the analysis and performance evaluation of CSMA and MACA over DSR routing protocols. The performance has been measured with three parameters like packet delivery ratio, end-to-end delay and throughput.

Keywords: MANET; CSMA; MACA; DSR; PDR

1 INTRODUCTION

Mobile Ad Hoc Networks are wireless networks which do not require any infrastructure support for transferring data packet between two nodes [7], [8], [9], [10]. In these networks nodes also work as a router that is they also route packet for other nodes. Nodes are free to move, independent of each other, topology of such networks keep on changing dynamically which makes routing much difficult. Therefore routing is one of the most concerns areas in these networks. Normal routing protocol which works well in fixed networks does not show same performance in Mobile Ad Hoc Networks. In these networks routing protocols should be more dynamic so that they quickly respond to topological changes.

Ad hoc wireless networks (AWNs) are zero configurations, self organizing, and highly dynamic networks formed by a set of mobile hosts connected through wireless links [4], [5], [6]. As these are infrastructure less networks, each node should act also as a router. Hence they, the termed "mobile host", "node", and "station" and used interchangeably. As a router, the mobile host represents an intermediate node which forwards traffic on behalf of other nodes. If the destination node is not within the transmission range of the source node, the source node takes help of the intermediate nodes to communicate with the destination node. Tactical communication required on battle-fields, among a fleet of ships, or among a group of armored vehicles are some of the military applications of these networks. Civilian applications include peer-to-peer computing and file sharing,

collaborated computing in a conference hall, and search and rescue operations.

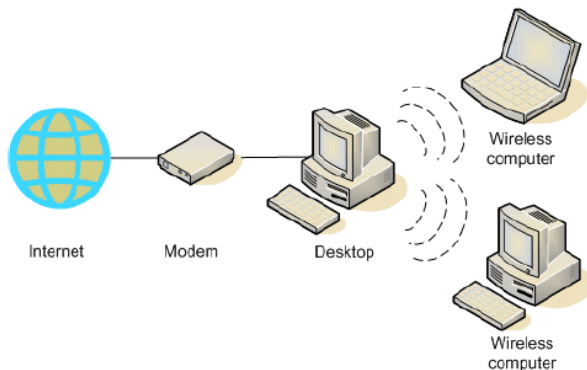


Figure 1: Mobile Ad Hoc Network

Quality of service (QoS) is the performance level of a service offered by the network to the user. The goal of QoS provisioning is to achieve a more deterministic network behavior, so that information carried by the network can be better delivered and network resources can be better utilized [4], [7], [8]. A network or a service provider can offer different kinds of services to the users. Here, a service can be characterized by a set of measurable Pre specified service requirements such as minimum bandwidth, maximum delay, maximum delay variance (jitter), and maximum packet loss rate. After accepting a service request from the user, the network has to ensure that service requirements of the user's flow are met, as per the agreement, throughout the duration of the flow (a packet stream from the source to the destination).

Related works: There are tremendous works on define CSMA, MACA and ALOHA over AODV routing protocols with performance metrics like packet delivery ratio, End to End delay and Throughput.

Neeraj Agrawal [2][3] worked with CSMA, MACA & ALOHA to Support Quality of Services (QoS) under varying conditions of no. of nodes in Ad Hoc Wireless Networks.

In our previous paper [1], we have studied CSMA, MACA over DSR routing protocols. The work presented here mainly concerned with A Comparative Analysis and Performance Evaluation of CSMA, MACA over DSR Routing Protocols.

2 MATERIALS AND METHODS

Simulation Settings: The experiments were conducted by using Glomosim [10] as a simulator. We created 8, 16, 24, 32, 40 and 50 nodes on a 1032*1032, 1460*1460, 1790*1790, 2065*2065, 2310*2310 and 2582*2582 tertian area respectively. Among these nodes a pair of nodes has been chosen to be measured. Constant Bit Rate (CBR) was used as a traffic pattern. There were six sets of experiments (a) Packet Delivery Ratio with Varying Network Sizes of DSR Routing Protocol (b) Average End-to-End Delay with Varying Network Sizes of DSR Routing Protocol (c) Throughput with Varying Network Sizes of DSR Routing Protocol.

Table 1: Simulation Parameters

Parameter	Value
Traffic Pattern	CBR
Simulation Time	600 seconds
Total Nodes	10, 20, 30, 40, 50
Node Placement	Random
Min. Speed of Node	0 m/s
Max. Speed of Node	10 m/s
Pause Time	50 sec.

The Table 1 below summarizes the simulation settings used in each of the experiments: In Glomosim [10], there is various mobility models available. Random mobility model was used in this research paper because it had been used in many prominent simulation studies of ad-hoc network protocol. In this mobility model, all nodes will be move at a model with minimum speeds of 0 m/sec and maximum speeds of 10 m/sec with a 50 sec pause time. Once the node reaches its destination, then it pauses for 50 sec and then continues onward. Simulation time of experiment is 600 sec.

Performance metrics:

In this dissertation the graphs are plotted between the following Performance Metrics. The performance metrics [6] such as Packet Delivery Ratio, Average End-to-End Delay and Throughput are being used to evaluate the network efficiency.

(i) Packet Delivery Ratio

The packet delivery ratio defined as the number of received data packets divided by the number of generated data packets.

$$\text{Packet Delivery Ratio} = \frac{\sum (\text{No. of Received Packets})}{\sum (\text{No. of Delivered Packets})}$$

(ii) Average End-to-End Delay

The average end-to-end delay is the average time needed to traverse from the source node to the destination node in a network. In other words we say that, the average time required for transmitting a data packet from source node IP layer to the destination IP layer, including transmission, propagation and queuing delay. The end-to-end delay is measured in second. The delay assesses the ability of the routing protocols in terms of use-efficiency of the network resources.

$$\text{Average End-to-End Delay} = \frac{\sum (\text{Time when Packets enters in the Queue})}{\sum (\text{Time when the Packets is received})}$$

(iii) Throughput

The average rate at which the data packet is delivered successfully from one node to another over a communication network is known as throughput. In other words we say that, throughput is the number of packet that is passing through the channel in a particular unit of time. This performance metric shows the total number of packets that have been successfully delivered from source node to destination node and it can be improved with increasing node density. The throughput is usually measured in bits per second (bits/sec). A throughput with a higher value is more often an absolute choice in every network.

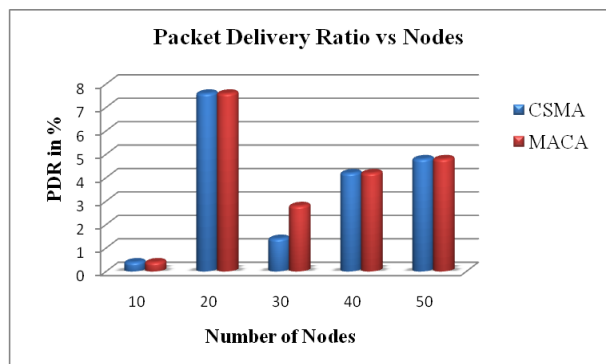


Figure 1: Packet Delivery Ratio with Varying Network Sizes of DSR Routing Protocol

3 RESULTS AND DISCUSSION

Results: Three performance metrics are used for measuring the performance of DSR Routing Protocols. The simulation results are shown in the form of graph that represents (i) Packet Delivery Ratio (ii) Average End-to-End Delay (iii) Throughput.

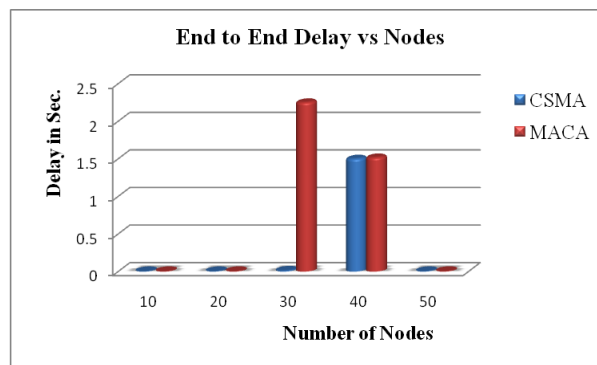


Figure 2 : Average End-to-End Delay with Varying Network Sizes of DSR Routing Protocol

4 CONCLUSIONS AND FUTURE SCOPE

In this dissertation we have simulated DSR routing protocols on Glomosim Simulator. The performances of the protocols were measured with respect to metrics like Packet Delivery Ratio, Average End-to-End Delay and Throughput. Simulations were carried out with identical networks and running different protocols on the mobile node. The simulation is done with CSMA and MACA over DSR. Here we conclude as:

1. Packet delivery ratio (PDR) of the network decreases as the nodes are increases. CSMA gives constant PDR with different nodes while MACA gives higher PDR with minimum number of nodes and lower PDR as we increase the number of nodes.
2. Average End-to-End delay increases as the number of nodes are increase but after certain number of nodes it's again decreases as the nodes increases. CSMA gives better (lower) delay in comparison to MACA.
3. Throughput are decreases as the nodes are increases in MACA, and in CSMA

throughput are increases as the number of nodes are decreases. MACA gives better throughput in comparison to CSMA.

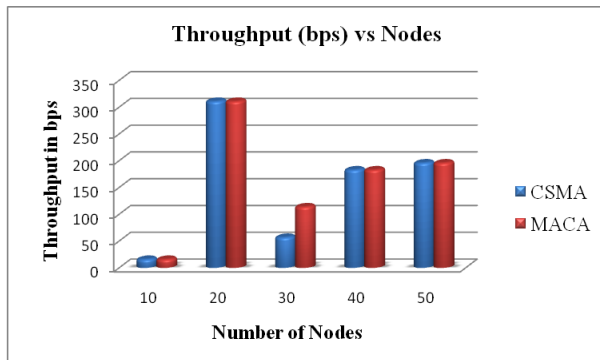


Figure 3 : Throughput with Varying Network Sizes of DSR Routing Protocol

Future Scope:

Future work may include same experiment for other routing protocols (DSDV, TORA, ZRP, OLSR etc), measuring the Throughput, Average End-to-End Delay, Packet Delivery Ratio, Packet Drop Ratio, and Routing Overhead, and the same experiments for different node mobility speed of the simulation and other mobility models. Another future work is to perform the experiments for various different node migration speeds. Future work may also include same experiments for other performance metrics like Upload Response Time, Download Response Time, and Retransmission attempts etc. This may affect the simulation results and perhaps will bring out the strength and weakness of different protocols unambiguously.

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