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MACA and CSMA for DSR Routing Protocol in MANET Environment with Various Node Density

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Abstract: *Mobile Ad-Hoc Network is an autonomous group of mobile users that communicate using wireless links with no support from any pre-existing infrastructure network and used as a highly reliable end-to-end protocol for transporting applications. Due to the presence of Ad-Hoc Network in the MANETs, the interconnections between nodes or stations are likely to change on a continual basis, resulting frequent changes in network topology. The aim of this research is to compare the standardized MAC protocols on MANETs and thereby analyzing performance under varying node density of network with different MAC protocols. The routing protocols that are considered in the analysis is Dynamic Source Routing. In addition, from the transport layer's perspective, it is necessary to consider MAC protocols as well for MANETs because of its wide application, which enjoys the advantage of decisive data transmission on the Internet. Hence, it is of utmost important to identify the most suitable and efficient MAC protocols that can perform under these specific conditions. Therefore, this also makes an attempt to evaluate the performance of the two MAC protocols (CSMA and MACA) under a variety of network conditions and it is clear that the packet delivery ratio of CSMA increases 12.18% as compared to the previous work. The simulation results reveal that out of the three performance metrics, the CSMA protocol performs most robustly in different node density scenarios compare to MACA.*

Keywords: *MANET, MAC Protocols (CSMA and MACA), DSR, NS-2.*

1. INTRODUCTION

As wireless networks provide access computing and communication services on the move regardless of users location. The one type of wireless network is infrastructure less networks that is known as Mobile Ad-Hoc Networks (MANET) [1]. It is a self-configuring infrastructure fewer devices connected by wireless and equipped with networking capability. In these networks host movement is rapid. All nodes are capable to move and can be connected dynamically in arbitrary manner means topology change frequently. In wireless Ad-Hoc Networks, the nodes themselves from the network, and they do not need fixed infrastructure, therefore each node executes routing functionalities, such as forwarding network traffic. Before designing an Ad-Hoc wireless, we should consider different aspects, such as the use of the media access control protocol, routing protocol, transport layer protocol, quality of service, or support of security. To work properly the different protocols in wireless Ad-Hoc Networks must handle different issues, such as the noise of the network, routing information error, transmission ranges, etc.

2. BACKGROUND AND RELATED WORK

A Mobile Ad-Hoc Wireless Network (MANET) is a system of wireless mobile nodes that dynamically form a temporary network without any infrastructure [16]. Ad-Hoc Wireless Networks can be located in networks that use multi-hop radio relaying and may operate without any support of fixed infrastructure. As multi-hop, we refer to routes between nodes

that may contain multiple hops. In Mobile Ad-Hoc Networks, the system may operate in isolation, or may include gateways to interfaces with wired Networks, such as internet [17].

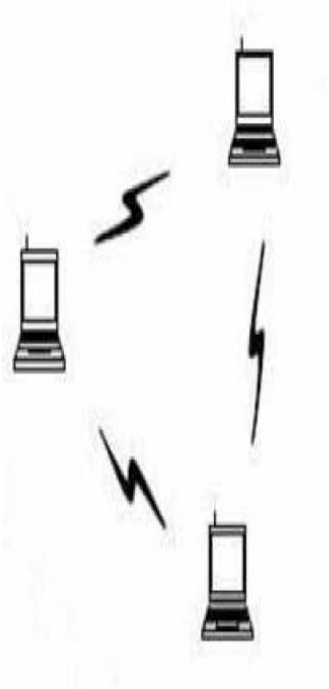

Figure 1: Wireless Ad-Hoc Network

3. MAC PROTOCOLS IN WIRELESS NETWORKS

A common radio channel is shared in Ad-Hoc Wireless Networks. Over this radio channel, access channel protocols used in wired networks become obsolete and new challenges must be managed, such as mobility of nodes, limited bandwidth availability, quality of service support, and hidden/exposed station problems.

4. ISSUES AND DESIGN GOALS

- **Bandwidth efficiency:** The radio spectrum where Ad-Hoc Wireless Networks operate is limited. Therefore, the MAC protocol must be designed in such a manner that all nodes receive a fair share from the bandwidth available. In addition, the MAC protocol should grant channel access to a node only when its transmission does not affect any ongoing other transmission.

- **Quality of service support:** It is quite complicated to provide quality of service in Ad-Hoc Wireless Networks since bandwidth reservation performed in a concrete instant of time may become invalid once the node moves towards out-range positions. In addition, the bandwidth reservation is hindered by the lack of a centralized station. The MAC protocol should be able to manage those constraints.

- **Synchronization:** Synchronization is crucial for bandwidth reservation, since time slots assigned to the nodes cannot be assigned in a randomize manner. In above chapter showed an example of synchronization and channel reservation in wireless environment, where the order in which node gets the channel is very important.

- **Mobility of nodes and no fixed infrastructure:** In cellular Networks, the base station coordinates the bandwidth reservation among the nodes. In Ad-Hoc Wireless Networks, there is no base station; therefore nodes must schedule access to the medium sharing more control information. The MAC protocol must minimize this overload.

5. SIMULATION ENVIRONMENT

In this work, we utilized five different scenarios, with the purpose of evaluating diverse behaviors of Mobile Ad-Hoc Networks. Firstly, we distinguish between CSMA and MACA protocol. Here dynamic scenarios used to analyze and to show communication in the network, due to mobility of nodes. A communication from the source node to a destination node can use intermediate nodes and alternative routes are not possible due to the separation between nodes. Therefore, in this scenario the packet delivery ratio is an important parameter. In this scenario, we used “Random way point” model where the speed and direction of nodes is randomly set. This thesis shows the creation of MANET scenario for NS-2 and then to analyze different MAC Protocol with the use of various performance metrics like Packet Delivery Ratio,

Routing overhead and Overall Throughput. In this thesis work created a scenario file for CSMA and MACA standard, which has to be used along with our TCL Script, these scripts consist routing protocol, we prefer a Dynamic Source Routing protocol for MANET scenario or topology with various node density 20, 40, 60, 80 and 100 dynamic nodes with a TCP variant which is NEW RENO for Two Ray Ground model.

In this section, five scenarios are described with two different MAC type which are CSMA and MACA, presented in tabular form.

Table 1: Simulation Parameters

Simulation Tool	**NS-2.35**
Simulation Area in (meter)	1500 x 1500 meter
Number of nodes	20, 40, 60, 80, 100 nodes
Propagation Model	Two-Ray Ground Propagation
MAC Type	CSMA, MACA
Routing Protocol	Dynamic Source Routing Protocol
Traffic Type	TCP
Queue type	CMU Priqueue
Channel	Wireless
Queue Limit	50 Packets
Speed of Nodes	10m/sec
Antenna	Omnidirectional antenna
Simulation Time	300 sec

Packet Delivery Ratio:- The packet delivery fraction is calculated by dividing the number of packets received by the destination through the number of packets originated from the source. This is the fraction of the data packets generated by the TCP sources to those delivered to the destination. This evaluates the capability of the protocol to discover routes. The better the delivery ratio, the most complete and correct the protocol.

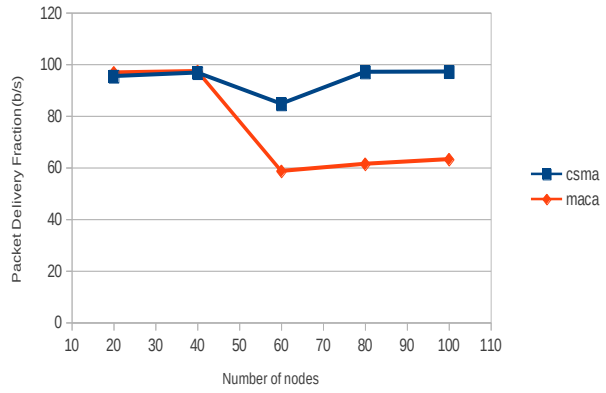

Figure 2: Packet delivery fraction verses Number of nodes

Routing Overhead:- This is the ratio of overhead bytes to the delivered data bytes. The transmission at each hop along the route is counted as one transmission in the calculation of this metric.

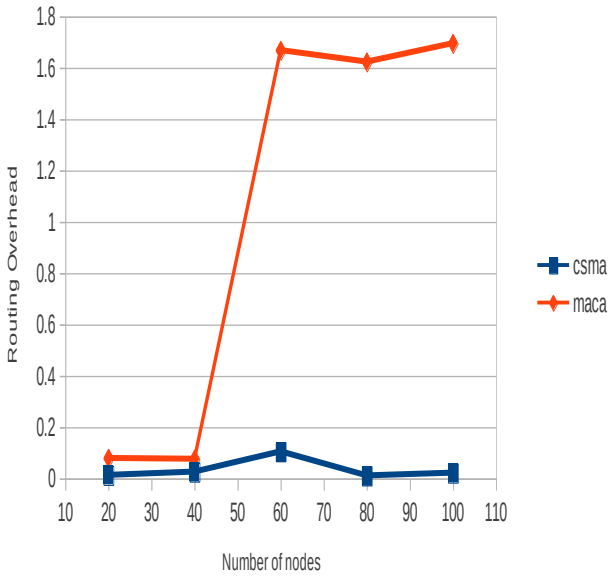

Figure 3: Routing Overhead verses number of nodes

Throughput:- It is defined as the number of packets flowing through the channel at a particular instant of time. This

performance metric signifies that the average rate at which the data packet is delivered successfully from source node to destination node over a communication network is known as throughput.

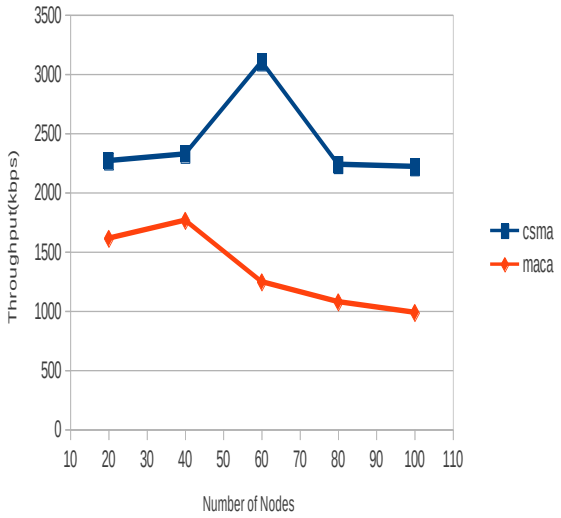

Figure 4: Throughput versus number of nodes.

6. CONCLUSION

The key issue treated in this master's thesis project has been the improvement of parameters in Mobile Ad-Hoc Networks using the Network Simulator, and it is concluded that for every received packet in the MACA layer, the signal strength of the node is stored. After attempting to send an RTS packet to a neighboring node without receiving a CTS packet, then communication is not possible. The last signal strength of the receiver node is compared to the transmission threshold. If the signal strength determines that the node is near enough, the MACA layer informs the routing protocol that it is not necessary to trigger a route maintenance process. At this moment, the routing protocol knows that the error was due to collisions in the MACA layer and the node is within the transmission threshold. The routing protocol does not interpret this link error at MACA layer as a broken link due to mobility and does not trigger a route error process because the route still exists, Work has been completed and it is clear from the simulation results Packet Delivery ratio and Throughput are high in CSMA as compare to the MACA with DSR routing protocol, Normalized Routing overhead for CSMA is low as compare to MACA network with DSR routing protocol, Throughput of CSMA is high as compare to the MACA network DSR routing protocol.

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