

# An Improved Quality of Service using M-DSR Protocol in MANETs

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**Abstract**—Mobile Ad hoc Networks (MANETs) is a type of wireless ad-hoc network which is a self-arranging network of mobile nodes connected by wireless route links which creates an discretionary topology. The mobile nodes are free to move randomly and to arrange themselves in a random manner. Thus, the wireless ad hoc network topology may expand rapidly and unpredictably. In mobile adhoc networks, the routing protocol plays an important role for improving Quality of Service(QoS). There are many different types of routing protocols such as reactive, proactive and hybrid. The Dynamic Source Routing (DSR) is a reactive routing protocol which establishes routes on-demand, as they are needed. In this paper, we proposed a new routing protocol Modified Dynamic Source Routing (M-DSR) which is based on route caching strategy and a better route caching method can decrease routing overheads with the help of the existing route information more competently which intern gives good performance than the existing DSR routing protocol with respect to set of performance metric such as packet delivery ratio, throughput, packet loss and overhead, under different pause time. We design proposed M-DSR routing protocol and implemented with certain simulation parameters using Network Simulator (NS-2) tool. The performance analysis of routing protocol designed for wireless networks has been very challenging. Hence, simulations are always utilized to obtain the desired performance results.

**Index Terms**— MANETs, DSR, M-DSR, QoS, NS-2.

## I. INTRODUCTION

We have latest multimedia applications such as digital television, video telephony, videoconferencing and web games, etc. and real-time interactive audio and video streaming requires high throughput and less delays which are the most fundamental quality of service parameters. Providing good quality of service for mobile adhoc networks is still being the topic of good research in order to determine best solutions for high performance, not only considering in particular stage but even at different stages of network architecture that is by different network layers such as application, session, physical, network, etc. The routing method plays an a important role for a network in general and specially for wireless adhoc networks. Routing protocols in wireless adhoc networks has been a major subject of researches; several concepts have been discussed, and

many different routing protocols have been developed. In this paper we proposed new routing protocol M-DSR which has different technique compared to other on-demand routing protocols on wireless ad-hoc networks. In M-DSR routing protocol, route caching strategy place an important role in identify the route path between source and destination node in infrastructure less wireless network. we particularly focused on different performance metrics such as throughput, packet loss, normalized overhead and packet delivery ratio etc.

The flow of this paper is as followed as: In section 2, we present a complete review of QoS in MANETs. In section 3, we discuss the operation of the DSR routing protocol. In section 4, we discuss about motivation of problem occurred in on-demand routing protocol. In section 5, we define proposed new routing protocol and the changes made in it. We formulate later in section 6, 7 & 8, the performance of DSR and M-DSR routing protocol performed with respective to certain performance parameters by simulation using NS-2, Considering several steps. We end with conclusion and future work of our researches.

## II. QUALITY OF SERVICE IN MANETS

A MANETs can be seen as an independent system or a multi-hop route wireless extension to the Internet. As an independent system, it has its own network management mechanisms and network routing protocols. As a multi-hop route wireless extension, it should provide a flexible and consistent access to the Internet service. Recently, because of the rising popularity of multimedia applications and potential commercial usage of MANETs, QoS support in MANETs has become an inevitable task. Due to the bandwidth and varying topology of MANETs, improving the QoS in MANETs is a very challenging task. A lot more of research has been done on improving QoS in the Internet services and other type of network architectures, but most of them are usually not suitable in the MANETs environment area [1].

The QoS model defines the network architecture in which some services could be provided in the wireless network. The challenge of MANETs is the first main criteria that should be considered in QoS model. For example, time-varying route link capacity and dynamic network topology. Along with the network potential commercial applications of MANETs require the consistent connection to the Internet network. Thus the QoS model for MANETs should also consider the present QoS network architectures in the Internet services[2].

## III. DSR ROUTING PROTOCOL

DSR is relies upon the standards of source routing. In DSR routing protocol there will be no occasional routing advertisements. Rather, when a node needs a route to another node, it dynamically determines which is depend upon cached information or on the base of a route discovery method. Source routing is a routing technique in which the packet from source determines the complete information about the sequence of the communicating nodes through which to forward the data packet to destination. The sender unequivocally records this route in the packet's header, identifying each forwarding "hop" by the specific route address of the next neighbouring node to which it transmit the data packet by the way to destination node. The fundamental point of interest of DSR routing protocol is the intermediate route hops not necessary to store the routing packet information keeping in the mind to route the packet they receive node, while the routing packets themselves as of now contain all the necessary routing information. Not like all conventional routing protocols, the DSR protocol utilizes no intermittent routing advertisement messages, thereby reducing overall network bandwidth overhead, especially at the time when less or no important host movement is taking place. Generally source routing protocol contains of two main techniques they are: Route Discovery and Route Maintenance method. At the point when a mobile node wants to send a data packet to destination node, it initially searches its route cache to figure out if it as of now has route to the destination node. In the event that it has one, which is not lapsed, it will utilize this route to send the routing packet. Else if the node does not have any such route then it will start route discovery by flooding a route request control packet. This route request control packet contains the location of the source and the destination node, and a unique sequence number of packet that is request id, which is set by the source node. Every node in the simulation network contains a list of source and destination address, number of route hops, request id pair in the routing table which it has newly received from its nearest node in order to fine duplicate route requests received. On receiving a route request control packet, if a node has already received of source and destination address, number of route hops, request id pair or it searches its own address already recorded in the request, it discards the multiple copy and does not handle it further. Else, it adds its own address to the route record in the route

request control packet and re-floods the inquiry to its neighbour's nodes. When the route request control packet reaches the destination through intermediate nodes, the destination node in turn sends a route reply control packet to the source node with a copy of the route. If a node can complete the query from its route cache, it may send a route reply control packet to the source without propagating the inquiry packet. Besides, any node taking part in route discovery can take in routes from sending data packets and accumulate this routing information into its route cache. Fig. 1 is a case of the making of a route record in DSR routing protocol [2].

Whenever transmitting or sending an a packet to a destination, If there is change in network topology Route Maintenance is utilized to distinguish such that the route utilized by this packet is broken. Each node along the route, when transmitting the data packet to the subsequent route hop is responsible for detecting if its connection to the next hop has broken. We have wireless Medium Access Control protocols, for example, IEEE 802.11, retransmit every data packet until and unless a routing link-layer acknowledgement is got, or we can say as until a more number of retransmission attempts is been done. Secondly, Dynamic source routing will make utilization of a passive data acknowledgement [4].

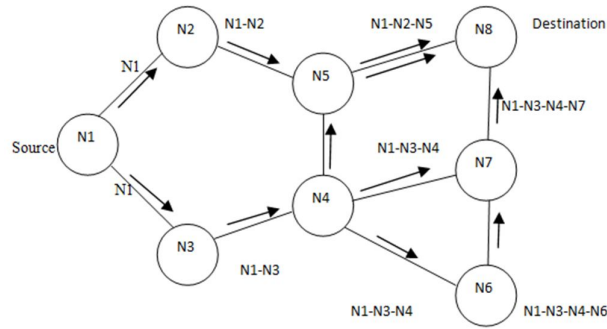


Fig. 1:(a) Building the Route Record during Route Discovery

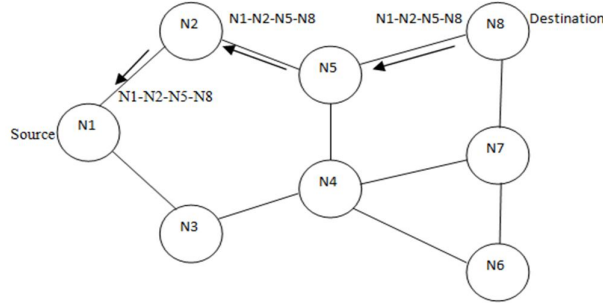


Fig. 1:(b) Propagation of the route reply with the route information

The DSR protocol is intended for networks in which the mobile nodes move at a moderate speed with respect to packet transmission latency [5]. An advantage of DSR over some on-demand protocols is that DSR does not use periodic routing advertisements, thereby saving bandwidth and reducing power consumption. On the other hand, as the network becomes larger, control packets and data packets also become larger because they need to carry addresses for every node in the path. Also, aggressive use of included with each packet. This difference results in a reduction of routing protocol overhead. Because the RREP is forwarded along the path established by the RREQ, AODV requires symmetric links.

#### IV. PROPOSED M-DSR ROUTING PROTOCOL

DSR is an on-demand routing protocol that is based on the concept of source routing. The protocol is composed of two major mechanisms, i.e. *Route Discovery* and *Route Maintenance*, and three types of route control messages, i.e. *Route Request*, *Route Reply*, and *Route Error*. When a source node in the ad hoc

network attempts to send a packet to a destination but it does not already have a route to that destination in its route cache, it initiates a route discovery process by broadcasting a route request packet. This route request packet contains the source node address, the destination node address, a unique sequence number, and an empty route record. Each intermediate node, upon receiving a route request for the first time, will check in its own route cache. If it has no route to the destination, the intermediate node will add its own address to the route record and rebroadcast the route request. If it has a route to the destination in its route cache, the intermediate node will append the cached route to the route record and initiates a route reply back to the source node. The route reply contains the complete route record from the source to the destination. The intermediate node ignores the latecomers of the same route request by examining the sequence number. If the node receiving the route request is the destination node, it will copy the route record contained in the route request and send a route reply back to the source. In most simulation implementations, the destination node will reply to all the route requests received as DSR is capable of caching multiple paths to a certain destination and the replies from the destination most accurately reflect the up-to-date network topology. Due to the node movement, the routes discovered may no longer be valid over time. The route maintenance mechanism is accomplished by sending route error packets. When a link is found broken, a route error packet is sent back from the node that detects the link failure back to the source node. Each node, upon receiving the route error message, removes from its cache all the routes that contain the broken link [5]. Some ad hoc routing protocols, such as WRP [6] and AODV [1], use the periodic local broadcasts of the *hello* messages to ensure the local connectivity. Nodes learn of the existence of a neighbor from receiving or overhearing the packets transmitted by that node. When a node is not sending anything, it must send a *hello* message within a specified time period. Otherwise, failure to hear from a neighbor indicates a broken link between the two. DSR does not incorporate such local connectivity maintenance mechanism. In DSR, each node transmitting the packet is responsible for confirming that the packet has been received by the next hop along the source route. This can be done by either a link layer acknowledgement (as in IEEE 802.11), or a “passive acknowledgement” (in which the first transmitting node confirms the receipt at the second node by overhearing the second node transmitting the packet to the third node), or a DSR-specific software acknowledgement returned by the next hop. Thus, once a route enters the cache, the failure of the route can only be detected when it is actually used to transmit a packet but fails to confirm the receipt by the next hop. Besides the aforementioned basic functions, more optimization mechanisms are proposed and added to DSR protocol. These optimizations include gratuitous route replies, salvaging, gratuitous route errors, snooping, tapping, etc. [6]. Most of the optimizations are included in our simulation implementation.

In DSR, the route returned to the source is a complete path leading to the destination. By caching each of these paths separately, a “path cache” organization can be formed. A pathcache is very simple to implement. When a route is needed, the path cache data structure can be efficiently searched for any path leading to that destination.

In this paper, we study the effect of route caching strategy on the performance of on-demand routing protocol in an ad hoc network. A path cache is one in which each cache entry is a node list representing an entire path leading to a certain destination. Due the mobility, links are broken. On such condition, cache is checked for any route availability. Even if the route is available, if it is expired it will create packet loss. Hence in M-DSR, on link breakage condition, packets are buffered and new route is identified and buffered packets are delivered via the new route. Hence the performance of M-DSR is improved than DSR.

## V. PERFORMANCE PARAMETERS

In order to calculate the performance of routing protocol such as modified M-DSR and existing DSR, we compare them with set of execution measurements for example, Throughput, Packet Delivery Ratio (PDR), Normalised Overhead Load and Energy Consumption.

### *Packet Delivery Ratio (PDR)*

It is a proportion of packets received to packets sent during certain simulation period, it is given by

$$PDR = PR * 100\% / PS$$

Where, PR is Sum of packet received by destination node, PS is Sum of packet sent by source node.

### *Throughput*

It is defined as average transform rate or bandwidth of route, it is given by

$$TP = PR * SZ / SE$$

Where, SZ is Packet Size, SE is Simulation End Time.

#### Normalized Overhead Load

It is described as sum of number of routing packets sent per data packet during communication.

### VI. SIMULATION RESULT & ANALYSIS

The performance analysis of DSR and M-DSR routing protocol in MANETs is performed in a simulated environment. NS 2.35 [7] simulator is used under Linux (ubuntu 11.10) or windows platform for simulation. The performance analyses are performed by following simulation parameters for both protocols. Tab. 1 shows the main simulation parameters used for scenarios.

Fig. 2 shows packet loss during varying pause time, The number of packet loss is more while routing the packets through DSR than M-DSR routing protocol. Higher the loss of packets lower the performance of the wireless network.

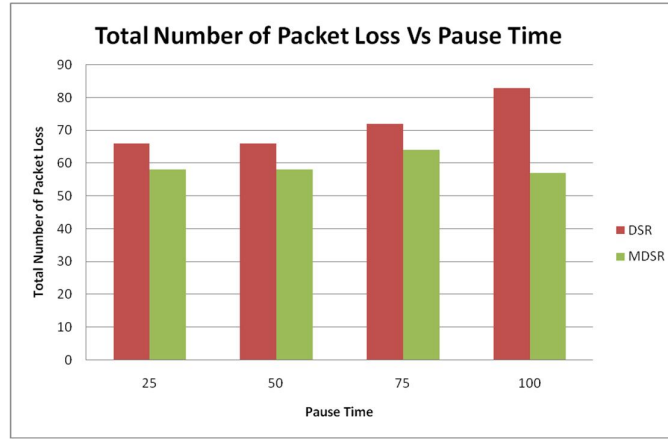


Fig. 2: Total number of packet loss, when the number of pause time varies

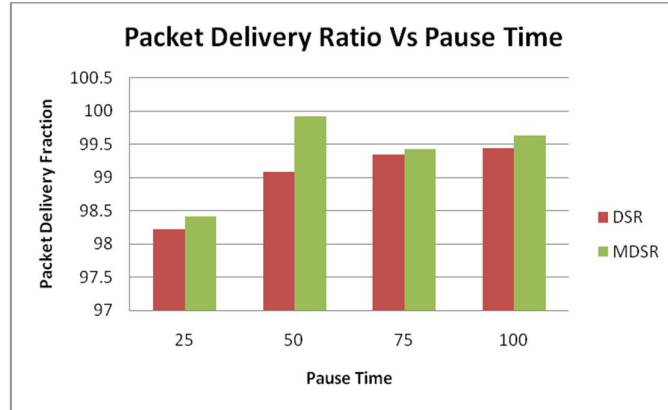


Fig. 3: Packet Delivery Ratio, when the number of pause time varies

Fig. 3 shows packet delivery ratio of each routing protocols on varying pause time. It is seen that M-DSR has higher packet delivery ratio than DSR routing protocol. Higher the packet delivery ratio more the packets received with respect to packets sent. M-DSR routing protocol shows better performance in packet delivery ratio.

Fig. 5 shows the normalized control packet overhead required by the transportation of the routing packets. M-DSR has less control packet overhead. The reason is good route caching strategy can reduce routing overheads by making use of the available route information more efficiently.

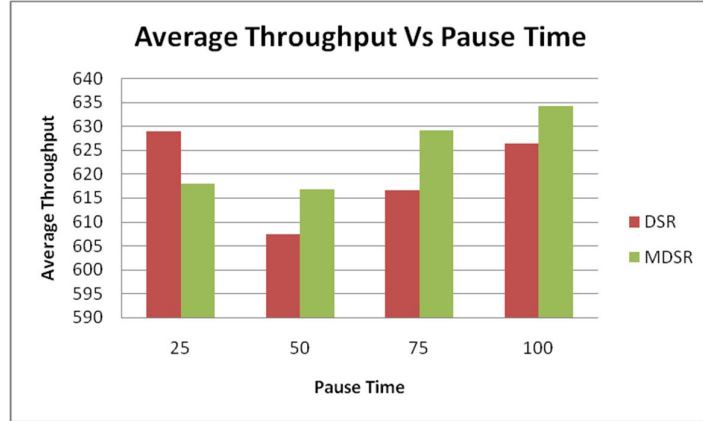


Fig. 4: Average Throughput, when the number of pause time varies

TABLE I. SIMULATION ENVIRONMENT

Simulator	NS-2.35
Protocol	DSR, M-DSR
Pause Time	25, 50, 75, 100 Sec
Simulation area	600m x 600m
Number of nodes	25 nodes
Movement model	Random Waypoint
MAC Layer Protocol	IEEE 802.11
Queue size	50
Transmission range	250
Interference range	550
Packet Size	1500 bytes/packet
Application Type	CBR
Agent Type	TCP

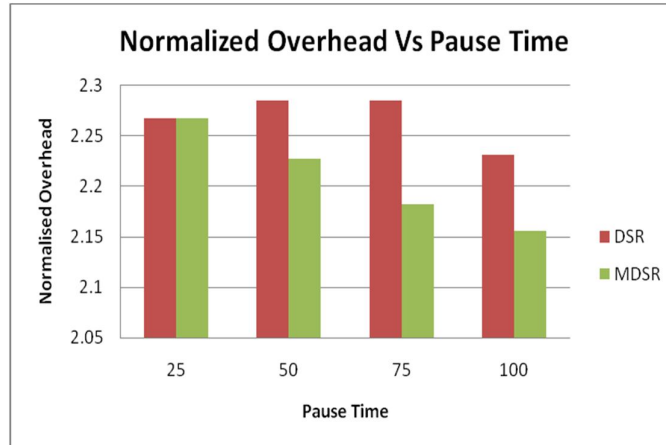


Fig. 5: Normalized Overhead, when the number of pause time varies

## VII. CONCLUSION

In this proposed work, we study the effects of the route cache schemes on the performance of on-demand routing protocols in ad hoc networks. We base our simulation on DSR, the well-evaluated on-demand routing protocol in ad hoc networks. We first study the “path cache” performance with varying lifetime assignments. We conducted extensive simulation study to analysis the performance of proposed route cache for M-DSR and compared it with that of existing DSR routing protocol using NS-2 simulator. The simulation results show that M-DSR improves the performance of DSR routing protocol in most of the metrics, such as the packet loss, packet delivery ratio, throughput and Normalized overhead. Our future work will focus on table driven routing protocols and improve its performance for large scale ad-hoc networks.

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