# Modify-QoS Based Multipath Routing in MANET: A Cross layer Approach

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***Abstract*—**A Mobile ad-hoc network is a collection of mobiles node that configure automatically and a temporary network. Only those nodes or devices can be communicate with each other comes under the radio range (wireless connection). It is a not depend upon the pre-existing or pre fixed network. Topology of the network also changes because mobility nature of the network and nodes are added or removed in a network. With the advancement of wireless technology, the necessity of Quality of Services (QOS) is increasing rapidly. Applications such as audio/video conferencing require very stiff or strict Quality of services (QoS) in data delivery. To provide the QoS in routing in MANET is a challenging issue because of the dynamic nature of nodes and limited node energy. In this paper, we proposed a Modify-QoS Based multipath routing protocol (M-QMR) to enhance the quality of services. M-QMR is based on cross layer design, because different layers are involved in communication, but the behavior of these layers is isolated with each other and overall network performance may effect from their operation. A cross layer approaches can extract the critical information from multiple layers which can be further utilized to enhance the overall network performance. The main purpose of QOS aware routing is to find an optimal (best) secure route from source to destination which satisfy requirement. The proposed protocols offers an increased life times of the nodes, better throughput ,low routing overhead and high packet delivery delivery ratio in different mobile environment. The MANET will be implemented in network simulator-2(NS-2) software environment for achieving highest quality of services.

**IndexTerms —**MANET, *Cross-layer, QoS, link stability ,Cedar*

## I INTRODUCTION

The mobile ad-hoc network is a collection of mobile nodes that configure automatically and a temporary network. Only those nodes or devices can be communicate with each other comes under the radio range (wireless connection). It is a not depend upon the pre-existing or pre fixed network infrastructures [1], [7]. The scenario of this network is based on the intermediate nodes or multi-hop network [4]. The meaning of the intermediates node is to pass or forward the packet node to node within the network. In this network the source node forward the packet directly destination node but location of the destination is long then data pass through the intermediate nodes. The MANET is decentralized types of the network, it mean does not depend on the centralized or pre-established network and it is peer to peer network. The Topology or structure of this network is also changes because mobility (movements) nature of network and any nodes are added or removed any time because it is perform distributed operation and it does not depends on other nodes. It is types of wireless ad hoc network (WANET) that usually purpose of network is to provide communication between the nodes or devices. The various simulations perform the routing using the protocols and their abilities, assuming moving degrees of mobility within an area. In mobile ad-hoc network main is:

- Node or Host movement frequent
- Topology change frequent
- Not depend upon the pre-established network and using the wireless links/connection.
- Packet pass via a multi-hop nodes

The data transaction/transmits in network is called routing. MANET routing is a bidirectional communication process. Every routing transaction divided into route discovery and route management phases. Routing is a main feature of MANET but the issue in route is change due to the rapidly change in the topology or structure of the nodes or devices in network [24]. Routing is a process of selecting the route/path in the network and also sending network traffic a selected path. And routing algorithm determines the specific choice of route that full fill the requirement. Every node in a network is independent of each other then it moves in any direction and frequently change it connection or we can say topology (structures of network). Every node in a network is router or host because it performs both task like connecting two different network and pass the information to other nodes. In this network mobiles node is also depend upon a battery if a battery is charged then communication is perform well other wised charge is down then connection break and another

think when a node move within range and out of the range in a network then topology change , due to mobility very effect on performance of the network

.

**TERMINOLOGY –**

1) **Nodes**: A set of the mobile devices with the wireless transmission capabilities are called nodes; they can join and leave the network at any time. Node -any device (router or host, mobiles) that implements using internet protocol (IP) address.
2) ***Mobility***: Mobility depends on the characteristics of the user as well as the environment because here each node travels independently in the environment.
3) ***Router:*** A router is a device that forwards the packet.
4) ***Host*:** Host is computer devices that communicate with other device using IP address.
5) ***Data traffic***: It is possible to generate data traffic in term of open session between a pair or a group of users.
6) ***Link*:** A communications facility at a layer below IP, over which nodes exchange IP packets directly without decrementing IP TTL (Hop Limit) Wi fi connection) .
7) ***Channel/network.*** This kind of network is couched in environment well defined by the physical characteristics of the node, which affect both the propagation and mobility the pattern of the radio signals.

The mobile ad-hoc network is infrastructure less with the nodes moving dynamically, and it has many issues for ensuring of quality of services parameters likes bandwidth, delay, throughput are challenging. These networks create by themselves dynamically in random and volatile or changing topologies. Advancement of wireless technology, the need of Quality of Services (QOS) is increasing fastly[16]. Development of QOS constraint routing protocol for MANET is very difficult task. Routing protocols are used to decide which path is able to fulfil the need of the desired Quality of services. MANET is constrained by limited resources and is vulnerable to many security issues which decrease the quality of services offered. The Quality of services can be measure the network performances to check the network transmission quality and services availability. The primary goal of the QoS is that a network certain guarantees to a data flow , such as high throughput, better packet delivery ratio, link stability and reliability ,dedicated as a bandwidth and improved loss characteristics. Achieving the quality of services is a challenging task due to the mobility, limited bandwidth and energy resources, and variables capacity of nodes, error-prone and insecure wireless network. In this paper we consider a multiples factor which can enhance the quality of services. The first parameter is Energy consumption by a node in network. It varies with node and is directly proportional to the traffic and node overhead. The second parameter is path or route signal strength it is varies due to nodes mobility-Mobility depends on the characteristics of the user as well as the environment because here each node travels independently in the environment. The third parameter emphases on node velocity, it is the rate at which node moves in an environment. The node velocity is directly proportional to instability in a network. Thus environment with high node velocity often have more link failure.
The Rest of the paper is organized as follows. Related work is introduced in Section II. Section III analyzes the QoS. Multipath routing protocol is discussed in detail in section IV. V explains the methodology with flow chart, Section VI describes results and discussion. Section VI concludes research work with future directions.

## II RELATED WORK

In this section, we focus on the more recent QoS Aware routing protocol for Mobile ad–hoc network that support real time multimedia applications and their QoS parameter selection, calculation and monitoring mechanisms. In Georgia's Parricides, Vincent Lenders [6] has proposed a connection availability based QOS-aware (LABQ) routing protocol. Node mobility has to find a links with more availability rather than directly finding mobile patterns of connection. There are various metric is used in routing metrics. The major disadvantage of this model is not including the rate of change which may affect the prediction.

Mukesh Kalla et al [29]**,** Quality of services aware bandwidth constrained precedence based routing protocol for ad hoc network (2016), this paper is based on the bandwidth parameter and packet is transferred from node to node. The development of QOS constraints routing protocol for MANET is still a challenging task. This paper is based on design of such kind of techniques that will calculate the available bandwidth throughout the path by assigning precedence. The QOS metrics packet delivery ratio, delay and throughput are taken into account for comparing the proposed QOS-RCBRP with Ad-hoc On-demand Distance Vector (AODV) routing protocol. From dense simulation results it has proved that the proposed protocol attains better performance in terms of reduced delay, increased throughput and packet delivery ratio.
In [7], Lal *et al.* proposed QARP which is a non-disjoint multipath routing protocol. The main aim of this paper is provides efficient services, to find bandwidth availability at each node, these routing protocol adapts cross layer communication and only one dis-ad vantages parameters i.e. bandwidth, for route discovery and not used node link-stability. This paper show the ant based multi-objective quality of services protocols in the network. To exchange the data between nodes using the routing, routing is main concepts. This routing protocol provides the Quality of services and routing both features. The routing mean find path suitable for communication in a network and second one is provides the quality of services meet requirement. The drawback of this protocol is used only one parameter i.e bandwidth for route discovery.

Raghupathy Sivakumar [12], this is provides multiple path algorithm for minimize the maximum utilization while supporting the same traffic demands. These routing protocol work when quickly change structure of the network.

Considering the advantages of load balancing, a multi-path routing for load balancing (MQRLB) is also avoids congestion within the network. So, Initially, Route Discovery is initiated when the source node attempts to discover disjoint routes to the destination. The balancing function and the forwarding function for each path is calculated, based on which the load unbalance condition is checked. In case of load unbalance, load distribution is done by adding redundant codes along with the data and transmitting through multiple paths. Thus QOS routing can be processed through multiple successful paths using load balancing. Some paper is based on the link availability –the nodes choose a link with higher availability rather than direct predicting. The major drawback of this model is not including the rate of change which may affect the prediction, proposed a new capacity-constrained QoSaware routing scheme referred as shortest multipath source (Q-SMS) routing. It forwards the data to other nodes according to the estimated residual energy. However, the major drawback of Q-SMS is the inability to predict route failure, which degrades performance in highly mobile environments

J. Chen et al proposed a cross layer based multipath routing protocol QoS-AOMDV, which focuses on the energy conservation and route balance. It constructs the weight route, based on metrics namely residual energy and queue length of the node. In this protocol data transmission is split among the available path after a specific time interval t. Drawback is not maintain the routing overhead.

[27] In this paper the proposed QMR takes into account QoS metric likes link stability, node energy and available bandwidth while selecting the optimal path. It considers the calculation of RSSI values to check if the nodes are moving closer to each other or not. Some of the above discussed protocol did not show the QoS parameter calculation; also some protocol relied on nodes being synchronized. The overhead of the maintaining synchronization is very high. Finally some protocol employed sending additional control message which increase traffic and consume the extra bandwidth & nodes energy.

### iii QoS Description

QUALITY OF SERVICES –The Quality of services can measure the network performances to check the network transmission quality and services availability [20]. The main goal of Quality of services is to make a network more deterministic. The number of packets transferred by the network should be more and reducing the routing overhead and number of packets drop in the network is less and the resources used in the network should be better utilized. The designing of that type of routing protocol which provides QoS is a challenging task[14]. The supporting Quality of services in MANETs, i.e., providing resources such as bandwidth and buffer space to real-time flows to satisfy their rate, delay, or jitter requirements, is a challenging problem. QoS can be implemented at different layers of a network and if it is implements in network layer then it is for finding the route with required quality. The QoS routing protocol should respond quickly in case of path breaks and re-compute the broken path or bypass the broken link without degrading the level of QoS. The components like varying topology and transfer speed has made enhancing QoS a demanding tasks. Today, a lot of research and effort have been put up to enhance QoS in Internet services and other wireless network architectures but that isn't enough for MANETs environment. The factors like time-varying route link capacity and dynamic network topology makes QoS a challenging task in MANETs.

- **QOS Parameters:** There are different applications available recently [24]. Each application has different parameters as per their levels of QOS. For example the bandwidth and delay are the quality of services key parameters of multimedia applications. MANET has four basic parameters such as packet delivery ratio, energy, bandwidth and delay etc.
- **QOS Aware routing:** The quality of service routing protocol uses QOS parameters for finding the path. The decision making considers the following parameters like network throughput, packet delivery ratio, reliability, delay, packet loss rate and path loss etc. The target is to find the feasible path between the source and destination which satisfies the quality of services requirements for each admitted connection and optimizes the use of the network resources[16].
- **QOS Framework:** A framework for quality of services is a finalized system to provide the services to user or application. It is a model that specify an architecture in which some kinds of services could be provided[15].

### iv Methodology

We proposed a Modify-QOS multipath routing protocol (M-QMR). It is based on the Quality of services aware weight based on demand multi path routing protocol (QMR). M-QMR is based on cross-layer design, which cooperates in sharing network-status information within different layers of protocol while maintaining the layers' separation to improve overall network performance. In M-QMR, the weight of the link is decided by multiple QOS factors like signal strength/relative mobility, and residual energy. The maximum aggregated weight decided by these factors helps to choose the most optimal route which is stable and energy efficient between source and destination. The proposed protocol offers an increased lifetime of nodes, better throughput, low packet delay and high packet delivery ratio in different mobile environments. The Modify quality of services multi-path routing is actually combination of reactive and mesh topology or network structures and this is called on demand multipath routing protocols. QOS multipath routing should provide QOS paths to all destinations. Guarantee or satisfies requirement to a data flow such as high throughput, controlled jitters and latency, better packet delivery ratio, link stability and reliability dedicated bandwidth are improved. We define Forward Nodes (FNs) as a

subset of the network topology that provides at least one path from each source to each destination in the multicast group. It provides the bandwidth QOS parameter services to the network [23]. The multipath routing scheme is proposed to find the more than one route is used to deliver the data appropriate destination in network. Mesh topology provides alternative paths to deal with dynamic topology changes in MANET, so we propose an on demand multicast routing protocol that uses forward nodes to apply multicast routing with QOS from source(s) to a group of destinations. In the MQMR protocol, we propose a flexible hybrid scheme that combines some features from the high quality. The objective of designing a multipath routing protocol is to provide enhanced robustness to the node or link failure.

**Modify-QOS AWARE WEIGHT BASED ON DEMAND MULTIPATH ROUTING PROTOCOL (M-QMR)**
In this section, we discuss the QoS constraint cross layer based on demand multipath routing protocol is M-QMR. The research is to create a Modify-QMR in MANET and to find all possible secure paths using QOS aware weight based on demand multiple route routing algorithms, in MANET: Using a CW Approach. We can propose a new efficient method of cross layer weight calculation. In the cross-layer technique, information sharing takes place between nonadjacent layers to optimize the overall performance of the network. By using the cross-layer interaction between layers many QoS parameters like energy, security, tree management cost and various controls overhead can be optimized for improved performance. In M-QMR, By assigning some value of connection based on multiple metrics like PDR energy & bandwidth. The high value of weight is selected a route/path for sending the data from source to destination [12]. This protocol provides the less number of packet dropping, better throughput and reducing routing overhead and high packet delivery ratio in different mobile environments.

A feature of proposed protocol:

1) Less connection failures and choose a feasible route.
2) Factors are packet delivery ratio, throughput to enhancing the reliability and network lifetime.
3) Provides the efficient transmission of Secure data accessibility
4) Reliable data delivery and it provides sufficient resource to meet the common QOS requirement.

The modify multipath routing protocol is

1. It is QOS aware routing protocol and multicast protocols (types of cast)
2. Multi channels (communication model only one shared media is used)
3. An effort to reduce the control traffic using multiple paths.
4. M-QMR combines the support for QOS and routing. Subset of node is selected dynamically and distributed which maintains local topological information and route computation task.
5. The advantage of using M-QMR is that route discovery and maintenance tasks are limited to subset of nodes which are easy to handle and low overhead is created.

**M-QMR ADVANTAGES:--→**

1) The M-QMR is based on the Quality of services matrix based routing protocols.
2) It Performs both routing and QOS path computation very efficiently and it adapts very quickly to dynamic in the topology.
3) Utilization of bandwidth and reduces traffic overhead. It used broadcasts provide a reliable mechanism for establishing paths with QOS support.
4) Route discovery/maintenance duties limited to a small number of nodes.
5) Link state propagation a function of link stability/quality.
6) It can provide good routes in dynamic ad-hoc network and reduce the control overhead.
7) The goal is to provide that are highly likely to satisfy the bandwidth requirement of route.
8) Finally bandwidth is the QOS parameters, it find short stable route that can satisfy the bandwidth requirement of the connection.

To achieve this goal, M-QMR protocol works in three phases: (i) QoS Route Discovery Phase, (ii) QoS Route Reply and (iii)Route Maintenance Phase.

***1. QoS Route discovery:*** The proposed M-QMR is a modified version of the QMR [13] protocol with additional mechanisms to find a QoS enhanced optimal route. It uses already available route to transmit data between source and destination. If the route isn't available it initiates route discovery. The route discovery begins with broadcasting route request packets (RREQ) to neighbors. The RREQ packets carry normal information like in QMR and also current route link stability, bandwidth availability (BW) and route remaining energy (RRE) which are calculated as the calculation of $C_w$ value. The modified formula considers the packet delivery ratio of the links.

- Modified $C_w$ = a*PDR + b*Residual Energy + c*Bandwidth

.After an intermediate node receives the RREQ, it checks the packet's signal strength and comparing it with threshold values it assigns a link signal strength value to it and multiplies it with current link mobility in the RREQ packet. Similarly, every node in the route keeps updating PDR, RRE and BW values in the RREQ packet and forwards it to its neighbors.. On reaching the destination, the current value of signal strength is again checked by the destination node. The

RREQ is discarded if signal strength is below lower threshold. The destination node waits for some time known as twait to collect all the RREQs. After twait it sends RREP packets to source via respective routes. The source node on receiving multiple RREPs calculates C w value for each route and selects a route with the maximum Cw value and initiates the data transfer.

***2 .Route Reply:***

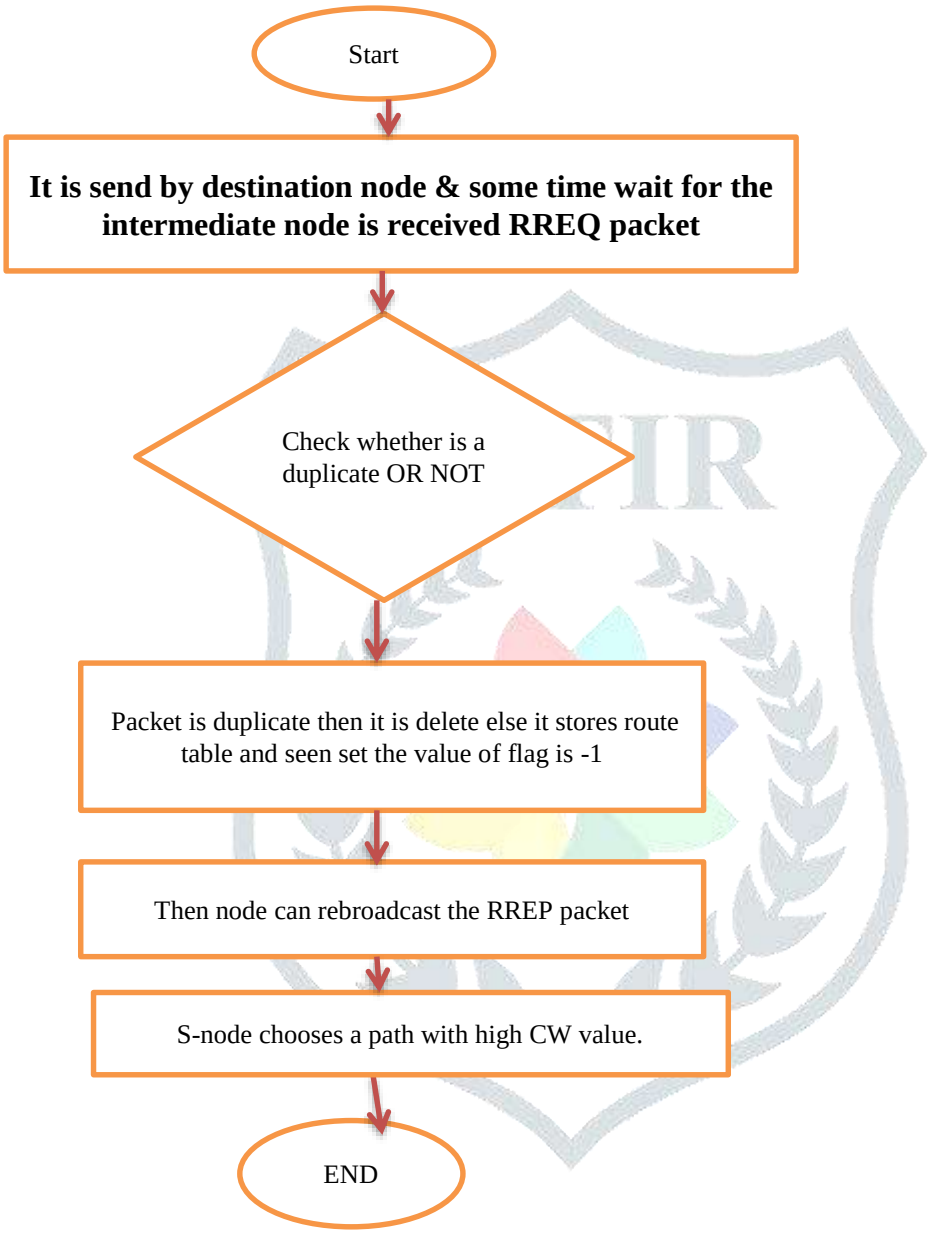


Figure1: flow chart of the route reply

***3. Route maintenance****:* The route maintenance is final phase of them-QMR protocol**.** The connection failure is frequently or rapidly in the mobile ad-hoc network cause of movement & less power of devices. The purpose of this phase is to maintain path or route that is recently deleted. When any node or source node is select a path if not exist then check it cache is available then choose and transfer data. If the route is available, then the source can immediately initiate data transfer. If no routes are available, then source needs to start the route discovery process again.

## V RESULTS AND DISCUSSION

We have simulate the M-QMR routing protocol in network simulators tool NS 2.35. A network consists of the 50 nodes and the mobiles-node move about within an area that boundary is 1000m*1000m. This is a telling the value of x-axis distance and y-axis distance and the radio range is 150 meter. The maximum node speed is 5m/s. The parameters simulations are below in a table:

Table 1: SIMULATION PARAMETERS

| Parameters | Values |
|---|---|
| Area | 1000m*1000m |
| Number of nodes | 50 |
| Radio–propagation model | Two ray ground |
| Radio range | 150m |
| Mobility velocity | 4-20m/s |
| Antenna type | Antenna/Omni-antenna |
| Energy fb | 30 joule |
| Packet size | 512 bytes |
| Mobility model | Random waypoint |
| Queue length | 50 |
| Th-high ,th-low | 1.5*Rth,1.2*Rth |
| Eth | 10%efb |

This is a Main.tcl file first we define node configuration parameters. After that we create simulator object, in simulator object set ns [new simulator] i.e generates an NS simulator object instance, and assigns it to variable ns. The set ns [new simulator] is a tcl script code in set node_(0) [$ns_node], set node_(1) [$ns_node].The "Simulator" object has member functions that do the following:

1. Create compound objects such as nodes and link
2. Connect network component objects created
3. Set network component parameters
4. Create connections between agents
5. Specify NAM display options.

And create NAM FILE it is network animator. The main function of the Nam file is to shown the whole communication between the nodes in wireless networks. In which name of the file is co-operate.Nam, which contain whole animation information regarding the network what is throughput and bandwidth etc. The cooperate nam framework consist of various button likes paly, stop, fast forward and rewind backward etc. Next create trace file in which open a cooperate.tr file and also nam trace-file –trace all the information's include it. In which comparisons with my proposed M-QMR routing protocol and previous is QMR routing protocol. The below figure depicts the variation of the packet delivery ration as a function of node s velocity. It is the rate at which node moves in an environment. The node velocity is directly proportional to instability in the network. Thus environment with high node velocity often have more link failures. It means high mobility then connection break is more, that why I am chosen relative mobility value is less. **The Packet delivery ratio (PDR)** is ratio of the data packet delivered to destination to those transmitted by the source node. With the increase in node s velocity/ mobility, the probability of link failure increase, which results in packet loss more.

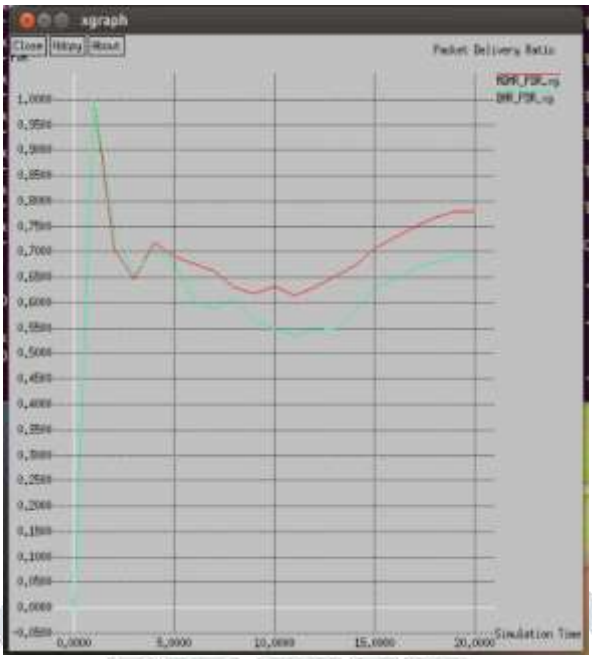


***Figure 2:*** *Packet delivery ratio against node mobility.*

Since in our proposed M-QMR the node with a higher cross layer weight value and lesser relative mobility selecting by intermediate node between source and destination and it avoid the those packet who goes longer place in network. The proposed M-QMR, PDR is 80% of packet to the specified destination whereas in QMR the PDR is 70%. The x-axis represents the simulation time and y-axis show the number of packets Of PDR. The red line in a graph show PDR of the M-QMR and another is QMR protocols. Figure 3 represents the **Number of Packet drop**; it is defined as the number of packets lost/down per unit time. From the graph we can depict that the proposed M-QMR is no. of packet drop is less as compare of QMR protocol because avoid the high relative mobility. If less packet is lost or down the obvious performance of network increase. Only those packet is drop in the network –relative mobility is more. The number of packet dropped in QMR is more as modified QMR protocol. Showing in the graph:

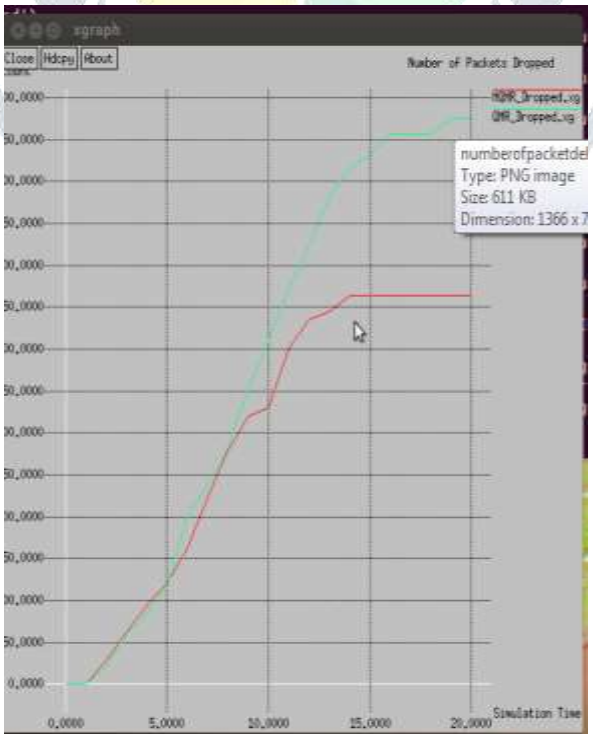


***Figure 5.2:*** *Numbers of packet drop*

The next graph is the **routing overhead** –it means network congested or not. If any nodes received more number of packet then network is congested because those nodes cannot handles its. Then more overhead is create in network but our proposed M-QMR routing protocol reduce these overhead. And M-QMR show less overhead as compare to the QMR routing protocols. When overhead is then performance is high.

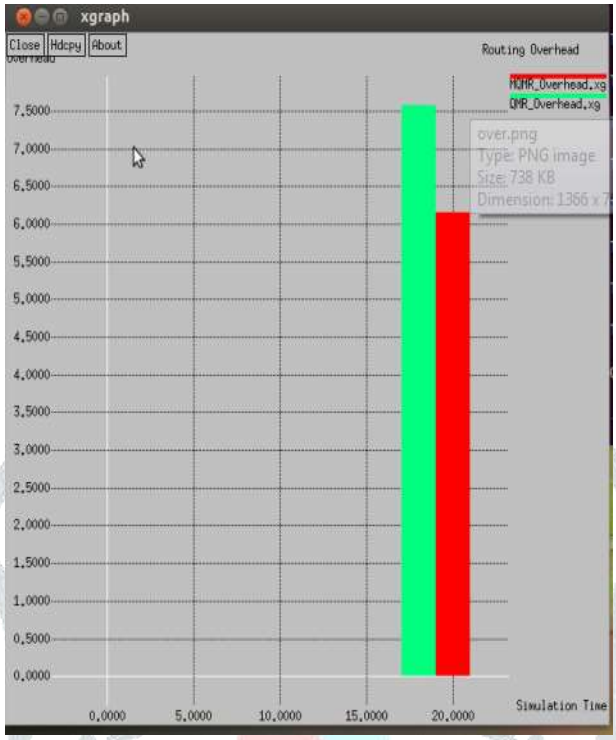


Figure 3: Routing overhead

Figure 5.4 describes the T**hroughput** against the node mobility. Throughput is defined as the amount of data transmitted successfully from source to destination in given time of period. Our proposed scheme M-QMR has greater throughput when compared to the existing scheme QMR. Throughput is considered as the important parameter in determining the performance of the network. As long as there is improved throughput the system can perform in an efficient manner. The efficiency thus plays an important role in the communication network. Because the threshold for the PDR is less than not forward the packet, link break is reduces. In which various paths but I am choose only those one who is optimal or feasible in a network. And relative mobility is less and cross layer weight value is high, below showing the throughput of network. The red line show more throughput as compare to second routing protocols:

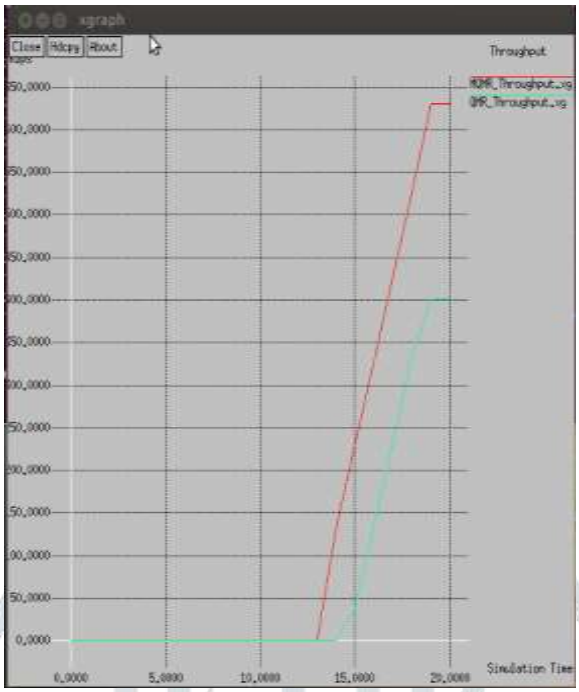


***Figure 5.4: Throughput against node mobility***

The simulation and comparison results of the proposed M-QMR show the performances improvement in the QOS on MANET under different criteria.

**COMPARTIVE ANALYSIS WITH EXISTING TECHNIQUE*:*** The comparison Modify-QMR and QMR routing protocol to improvement the quality of services of the network. It is depends upon different QOS parameters: packet delivery ratio, routing overhead, number of packet drop and throughput.

Table 5.2: comparison Modify-QMR and QMR routing protocol

| **Parameters** | **QMR** | **M-QMR** |
|---|---|---|
| **Packet delivery ratio** | **0.70** | **0.80** |
| **Number of packet drop** | **675** | **500** |
| **Routing overhead** | **7.7** | **6** |
| **Throughput** | **400**kbps | **650**kbps |

## VI CONCLUSION AND FUTURE SCOPE

The proposed work aims at maintaining links between two nodes for longer duration of time possible. Packet delivery ratio is one such parameter, which shows the impact of link breakage in the network. If the links gets broken between the two connecting nodes, then the packets from one node cannot reach the connecting node. This results in loss of packets and reduction on value of packet delivery ratio. For this, in the proposed scheme, the source node selects the path considering relative mobility of the nodes. The existing scheme, however, use the RSSI value to determine if the nodes are moving away from each other or moving closer to each other. The inclusion of packet delivery ratio in the calculation of cross layer weight has proved better for the network, as the parameters namely, PDR, throughput, number of packet drops and routing overhead, has shown improvement as equated to the existing scheme. The nodes having least relative mobility are preferred in the network (as per the proposed scheme). This leads to lesser link breakage and better packet delivery ratio of the network. The value for PDR is 0.80 in case of proposed scheme, and 0.70 in case of existing scheme. In the proposed scheme the nodes having value of PDR lesser than 0.75 do not take part in forwarding the RREQ packets. Thus, the bad links are avoided in formation of the route from source to destination node. With the improvement of PDR, the value of throughput also increases and number of packet drops decreases in the network. The throughput for Modified-QMR is 650

Kbps and for QMR is 400 Kbps. The numbers of packet drops are lesser for the Modified-QMR; this is because links with lesser packet delivery ratio are avoided. The improvement of network parameters satisfactorily helps to conclude that Modified-QMR is better than QMR. This work is done by considering single scenario for a network (i.e. network with fixed number of nodes).

***FUTURE SCOPE*:** The proposed protocols of this research work can be extended in the following ways: The proposed stability based routing protocols can be extended to meet the QOS requirements of multimedia communications In future, researchers can analyse the impact of scalability of the network over Modified-QMR. One can also test the network's performance under varying mobility of the nodes. In addition, the energy consumption of the network can be analysed to check the network lifetime under Modified-QMR In the proposed scheme, we have focused on maintaining link reliability. We use relative mobility of the nodes to achieve the same purpose. Therefore, source node forwards its value of mobility along with RREQ packet to the neighboring node. According to the proposed scheme, if for any node the value of PDR is less than 75 percent, then the node does not forwards RREQ packets in the network.

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