# Performance Validation of MQoSM and Resource Reservation Polices for MANETS over Long Area and Heavy Load

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**Summary**
It is very common issue that on any network especially MANET, when number of node/users increase with increase in distance of service area then QoS of network is automatically degraded. In this regard authors have presented MQoSM with its supporting Preempted resource reservation polices those works effectively with excellent results of QoS parameters as Jitter, Delay, Packet Drop and most important Throughput, even on heavy load of user nodes and large area of service. The verification experiments were performed and tested in simulation scenario by using OPNET MODULATOR 14.0

***Key words:***
*MQoSM, Preempted Policies, Heavy Load, VHPT*

## 1. Introduction

4G network development is done by focusing on the delivery of multimedia contents to the user during node movement [1]. It is obvious that in this technology development the demand increases as the capacity increases. Due to absence of fixed network infrastructure the nodes directly communicate with each other. Limitations of power capacity and transmission range are imposed on nodes because of node mobility [2]. Therefore, in multi hop ad-hoc networks efficient and effective routing is the biggest challenge need to be resolved [3].

In ad-hoc networks the active research area is providing QoS support to the network development. When providing QoS several difficulties are pose due to some unique characteristics of ad-hoc networks like hidden terminal problem, dynamic change in network topology, availability of limited resources, shared radio communication channel, central control problem, unsecure multimedia message transmission and many more [5]. For QoS provision in networks several similar issues are already addressed by many different researchers which deal with common issues including bandwidth limitation, limited power and mobility. Due to host node movement, the established route may break and may face unavailability of reserved resources again [6].

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## 2. Literature Review

### 2.1 QoS Attributes

When we talk to provide QoS in MANETS, then with many other attributes, mainly it include QoS Frame work and QoS Recourse Reservation Mechanisms with support of routing protocols.

#### 2.1.1QoS framework

It is a complete system for user or application that provides required services with quality. To provide promised services to user/application all components of this system work in coordination with each other. The QoS service model is the key component for any framework that fulfills the user requirements [8].
The key design issue here is whether to provide service to users on a per session basis or on a per class basis. The aggregation of users in each class is represented on some criteria basis [9]. In this framework routing with QoS is another key component for finding few or all feasible routes within network that satisfy user needs with packet scheduling schemes, call admission control, QoS medium access control and QoS signaling for resource reservation schemes. At the change of network state (change in topology) and flow state (change in the delivery service from end-to-end view), the QoS module, named as resource management scheme, signaling protocol and routing protocol should react promptly [10].
In last decay, many researchers has performed lots of work on QoS models to satisfy the requirements of network. Each discussed model possess few benefits and some deficiencies. All proposed models by other researchers are given is tabular form having their functions, drawbacks and purposes.
In this regard an extensive literature review was conducted by authors through [11, 12, 13, 14, and 15] about the frameworks represented by different researchers. The brief about those Models is given here in Table No. 1

2.1.2 QoS Resource Reservations and supporting Routing Protocol

After finding path with required QoS, in next step required resources are needed to be reserved along that path. This process is done by resource reservation signaling protocol [7]. For example, when minimum bandwidth reservation and finding is required for any application, the signaling protocol is responsible for achieving communication with medium access control subsystem to find required bandwidth. The previous reserved resources are released on the termination of a session.

Authors gave entirely a new approach for path finding and resource reservations on paths for transmission of information between nodes. The approach is "advance Resource Reservation" [18].

A very much detailed review was conducted and was presented in [19].The authors select a Proactive approach for routing protocol on which paths are found in advance and select AODV to serve this idea.

## 3. Accounts of Events

With reference to the above review authors worked on both issues i.e. QoS Model or Framework and QoS Policies.

3.1 MQoSM

To optimize QoS in MANETs we have given a QoS Mode termed as "Memon Quality of Service Model (MQoSM)". MQoSM model was designed and develop to enhance QoS for several type of traffic in network depending upon their priorities [20]. The service will be provided on priorities basis in shape of contract with user. Network user has to pay for the traffic type for their transmission over network. The features of this model for its services are delay control, control of policy, model shaping, classification and admission control. To achieve the mentioned aim of this model some additional features are added those are contract enforcement, control of traffic, feedback control and scheduling.

3.2 Preempted Resource Reservation

First time in MANETs, an idea of Resource Reservation scheme is designed for the different paths on the basis of MQoSM. In [21] a complete mechanism of advance resource reservation is given to serve the mentioned purpose and an implementation of a feasible algorithm is also given in [20].

A complete review of a Routing protocol is also given [22] that match the policies to support, and a proactive routing protocol was proposed to match mentioned policies with or without some modifications in it. Table No. 2 shows summary.

## 4. Verification of MQoSM and Policies

4.1 Simulator assumptions

To verify the proposed model and its resource reservation policies the virtual environment was created by using OPNET MODULATOR 14. To clear idea of names given to types of traffics on network with the names given in OPNET, following assumptions are made with respect of compression:

a. Reserved Service (OPNET Name) to VHPT name given by authors

b. Excellent Service (OPNET Name) to HPT name given by authors

c. Standard Service (OPNET Name) to MPT name given by authors

d. Best Effort Service (OPNET Name) to LPT name given by authors

4.2 Simulation Parameters

Simulation was performed on Voice transmission Service with following parameters given in Table No. 3.

**4**.3 Simulation Environment

Fig No.1 represent the simulation scenario where verification is performed on 40 nodes by implementing QoS Policies.

## 5. Verification of Performance

Performance was verified by on very common and popular QoS parameters those are: Delay, Jitter, and Packet Drop and above the all Throughput of network. Delay, Jitter, Packet Drop and Throughput are explained in [23]

a. Delay: Authors explained delay in [23] when small networks were verified with low load in small range and here we can observe that delay packets those are indicated by Blue Color for VHPT are maximum up to 7-8%, on other side other traffics goes to 18%.

b. Jitter: Same way Jitter indicated in Blue Packets for VHPT is about 0.04% and for other it goes up to 1+%.

c. Packet Drop: Packet Drop of VHPT indicated in Blue dots is about 0% and on other hand for rest of categories it goes to 0.6%.

d. Though put: Throughput for VHPT is surprisingly high up to 98% and others are in range of half to that maximally.

## 6. Conclusion

The authors have concluded their piece of work by giving verification of proposed MQoSM mode for optimized QoS in ad-hoc networks. Advance resource reservation on paths

is implemented in this model. The simulations are performed using OPNET Modulator version 14.0 and validation of this designed model is checked by running simulation on specific scenarios. From the excellent simulation results it is proved that for different priorities of network for which users pay according to their contract the proposed policies work well. The results are observed by focusing on the parameters throughput, end to end delay, packet drop and jitter for large scale networks having nodes 40 and 600 sqr/m distance. Simulation experiments performed on voice applications using OPNET simulator results that proposed policies work well and give excellent results.

Table 1: Popular Frameworks

| Name of Framework | Given By | Attributes |
|---|---|---|
| FQMM [1st QoS architectural ] | Xiao et al (2000) | • It provide services on IntSer and DiffServ Classes.<br>• Three types of nodes: Source, Intermediate relay node and Destination<br>• Provide QoS on class basis. |
| LQoS | Christian Bonnet et al (2001) | • Supports real time data transmission.<br>• It includes QoS TL,QoS Routing and QoS Queue Management.<br>• It reduces Packet delay. |
| INORA | S. B. Lee et al (2002) | • Used for Adaptive QoS requirements.<br>• Give Minimum Quantitative QoS guarantee called BaseQoS.<br>• Used for Real Time Services. |
| SWAN | G. Ahn et al (2002) | • It is Distributed Model that assumes Best Effort mechanism.<br>• Use Feedback based control mechanism.<br>• Topology changes are not effected on network. |
| PRTMAC | T. Sandeep et al (2004) | • It is a cross layer QoS model .<br>• It require Bandwidth reservation and BW availability for application.<br>• Used in High mobility networks. |

Table 2: Performance and Simulation Parameters of Routing Protocols

| Performance Parameters | Simulation Parameters |
|---|---|
| (1) No of hops per rout<br>(2) Traffic received and sent<br>(3) Route discovery time<br>(4) Total route requests sent<br>(5) Total route replies sent<br>(6) Control traffic sent and received<br>(7) Data traffic sent and received<br>(8) Retransmission Attempt<br>(9) Average power,<br>(10) Throughput<br>(11) Utilization | (1) Network size<br>(2) Network density<br>(3) No. of nodes<br>(4) Transmission range of nodes<br>(5) Movement speed<br>(6) Pause time<br>(7) Traffic type<br>(8) Sources<br>(9) Packet size<br>(10) Transmission rate<br>(11) No. of scenarios<br>(12) Simulation time<br>(13) Roaming area<br>(14) Speed<br>(15) Radius coverage[ |

Table 3: Simulation Parameters and their values

| PARAMETERS | VALUES |
|---|---|
| Simulation Time | 180 sec |
| Mobility Model | Random way point |
| MAC protocol | 802.11g |
| Routing Protocol | AODV |
| Network Scenario | 40 nodes and 600 $m^2$ |
| Propagation Model | Two Ray Ground |
| Time between Retransmitted | *500 ms |
| Timeout for non-Propagation | *30 ms |
| Traffic Rate | 11Mbps |
| Node Transmission Range | 500 – 600 $m^2$ |
| Transmit Power | 0.0058 W |
| Terrain Area | 600 $m^2$ |
| No of Nodes | 40 |
| Pause Time | 10 sec |
| Node Placement | Random |
| Maximum Queue Size | Infinity |
| Traffic Type | CBR |
| Node Placement | Uniform |
| Bit Rate | 11mbps |
| Wireless Propagation Model | Free Space |
| Antenna Type | Omni directional |
| Minimum Node Speed | 0 |
| PHY Layer Protocol | 802.11e |
| DATA Link Layer Protocol | MAC 802.11e |
| Queuing Policy | Priority Basis |
| Bandwidth | 11Mbps |

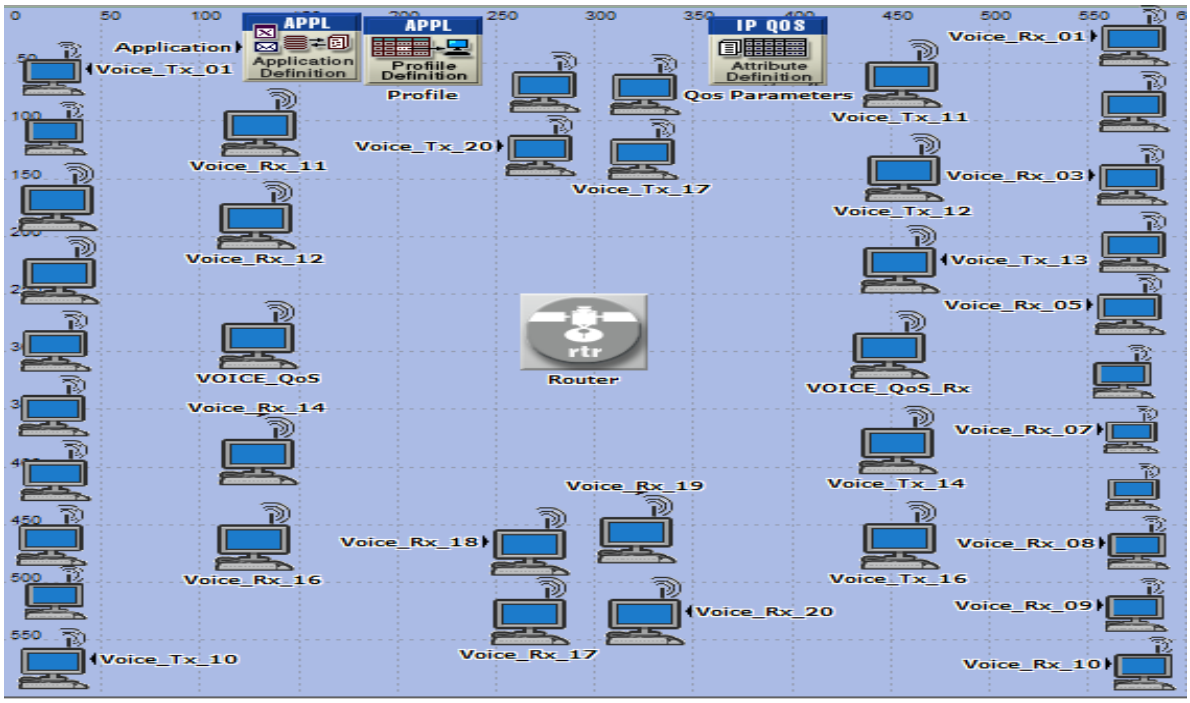


Fig. 1. Scenario: Sulleman-Project- MANET-Network with QoS Parameters

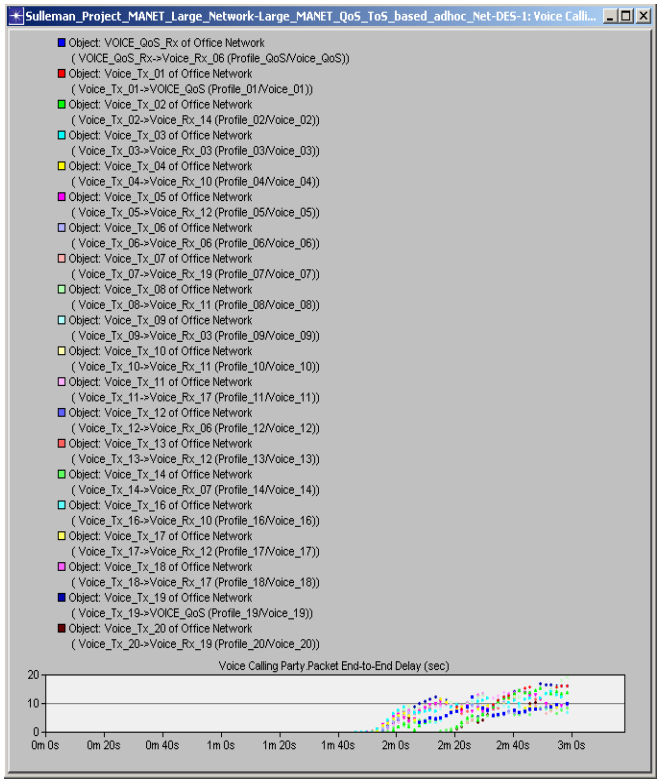


Fig.2. End to End Delay for all traffics with QoS Policies

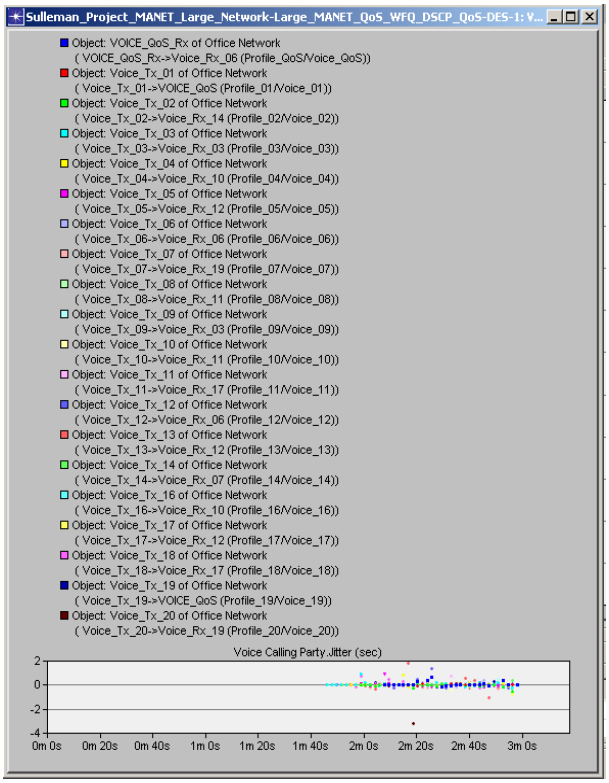


Fig.3. Jitter for all delays for all traffics with QoS

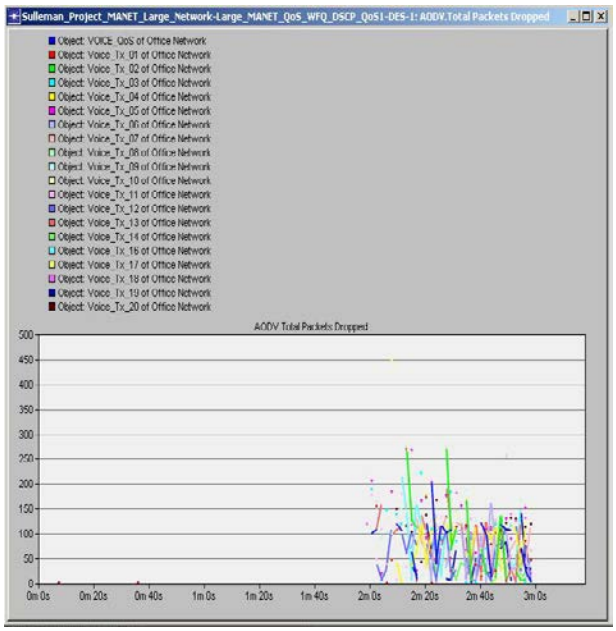


Fig.4.Packet Drop for all traffics with QoS Policies

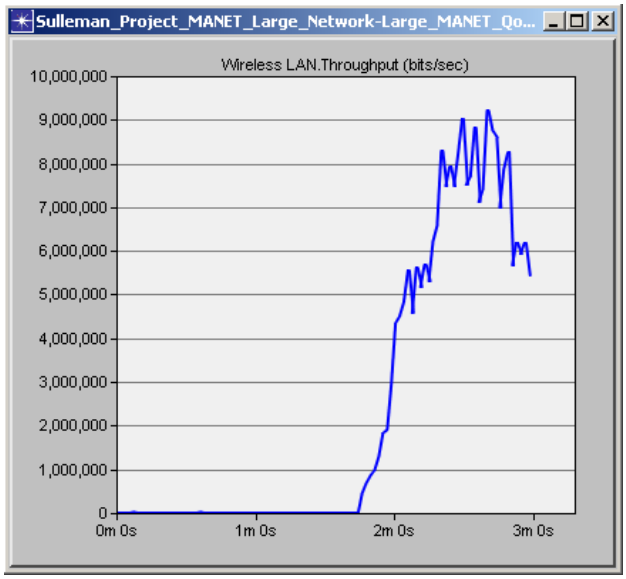


Fig.5.Throughput for Large Networks with QoS Policies

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