# QUALITY OF SERVICE SUPPORT MOBILE AD-HOC NETWORKS (MANETS): ITS CHALLENGES AND ASSOCIATED ISSUES

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**ABSTRACT**

*A MANET Mobile AD-Hoc Network is a collection of self-configured wireless mobile nodes that form a wireless network independently of any centralized network. MANET are emerging as a very popular technology for future generation of wireless mobile infrastructure. Quality of Service (QoS) is much more difficult and challenging task in MANET. The real time applications like as Multimedia, Video conferencing, disaster recovery etc. can be easily support if Quality of Service can be providing for Mobile Ad-Hoc Network. Quality of Service is usually defined as a set of service requirements that needs to be met by the network while transporting a packet stream from a source to its destination. The provision of QoS in wireless access networks is very challenging because of the movement of the hosts and the characteristics and unpredictable nature of wireless links.*

*In this paper we focuses on challenges and issues in providing QoS support to MANETs. There are many challenges in Quality of Service provisioning for MANETs like automatically changing in topology, wireless capacity limitations, limited battery power, and Network Configuration, Limited physical security. Several important research issues and open questions need to be addressed to facilitate QoS support in MANETs. In this paper we are going to outline the future issues and challenges related to QoS provisioning in MANETs.*

***Keywords: MANET, Quality of Service, Wireless Network.***

## I. INTRODUCTION

There are many types of researches in different fields such as Science, Medicine, Computer science and Information technology. In no other field has these developments been more clear than in field of wireless network technology. Basically, there are two basic types of wireless technologies that are of interest; the cellular network concept and the Ad-hoc network concept. The cellular network concept is basically the same as is used in mobile phone technology (GSM), and is a highly researched area. In 1970s, Ad-hoc network concept has received attention in research. A Ad-Hoc is a Latin word that means "For this purpose". A Mobile Ad-Hoc network is a self-configured, less-infrastructure network of mobile devices connected without the wires[1]. In other words, A MANET is a collection of self-configured wireless mobile nodes that form a wireless network independently of any centralized network. Every node operates as an end system and a router for all other nodes in the network. Nodes in mobile ad-hoc network are free to move and organize themselves in an arbitrary fashion[2]. Each user is free to roam about while communication with others. The path between each pair of the users may have multiple links and the radio between them can be heterogeneous. This allows an association of various links to be a part of the same network.

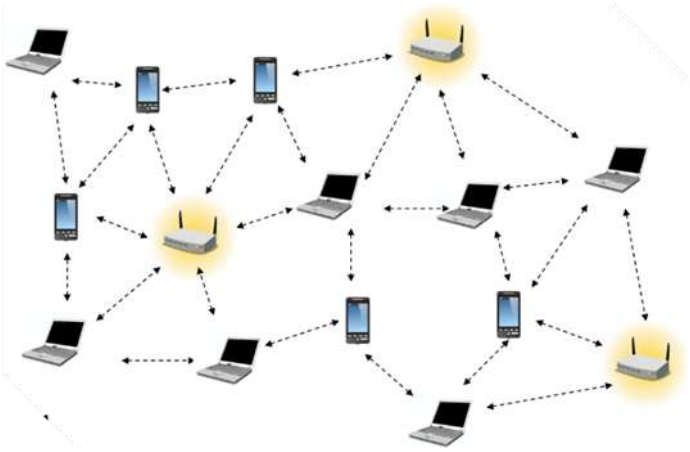


**Fig. 1. Mobile Ad-Hoc Network**

A Set of services requirements to be met by the network while transporting a packet stream to its destination from its source is known as Quality of Service (QoS). The actual form of QoS and its parameter depends upon the requirement of the specific application. The main goals of QoS are:-

- More Determined network behavior is to be achieved
- Better initialization of the resources of network
- Better network for delivery of information
- Maintenance of end-to-end QoS with user mobility etc.

QoS metrics is also introduced which includes packet loss rate, bandwidth, estimated delay, packet jitter, path reliability and hop count.QoS framework is a structural collections of concept and its relationship between related topics of QoS supportive system which have common disciplines. In this way quantified and identified system of QoS is used for originate the following application process of the services[2].

## II. REVIEW OF LITERATURE

Due to the need or requirement of the quality services in internet as well as in traditional wireless network, there is need to conduct number of researchers but even though results are not appropriate in current scenario and quality of services for MANET's are still an open challenge/problem. A number of different terminal challenges are faced in providing suitable QoS for delivery of real-time communication like Video/audio. In this section, regarding the proposed area, several QoS frameworks for MANETs are reviewed.

Essential Services to each users or application are offered by the complete system called framework of QoS. In (Xiao et al., 2000), on the basis of intserv and diffserv model, FQMM presents a hybrid service model for flexible QoS model for mobile Ad-Hoc networks. Combination of the high priority traffic of the reservation procedure with the service of low-priority traffic is done by FQMM. To overcome the problem of scalability or classifying the low-priority traffic into service classes, FQMM provides the ideal QoS for per flow.

The basic problem appeared by QoS framework is addressed by this protocol (Murthy &Manoj, 2004). But other problem cannot be solve by it like:-

- Decision Regarding the classification of traffic
- Allotment of traffic per flow or aggregate services to given flow
- How much amount of traffic belongs to the given flow
- Forwarding or scheduling the traffic by the intermediate rates.

For providing in Multi-hop wireless network, packet of scheduling approach is described [luo., 2004]. To achieve fair and maximum allocation of the shared wireless channel bandwidth is seeked by scheduled disciplines besides the minimum through put and delay bound for each flow, by the introduction of scare and dynamic network resources, the problem is get solved regarding the co-ordination of the adaptation between the order of the different layers of the network, described in [Bharghavan., 1998]

The Concept of QoS ranges, Its adaptively and other mechanisms which helps in providing QoS in wireless environment has been investigated by Mobiware efforts [Angin., 1998]. For providing the QoS in mobile Ad-Hoc network an approach called INSIGNIA protocol is adopted which combines the idea of QoS ranges with light weight signaling carried in the data packet headers [Mirhahhak., 2000]. Highly responsive and lightweight network is designed by using If based QoS framework. Base quality of service is required only a minimum quantitative QoS guarantee (minimum bandwidth) that can also support adaptive services [Lee., 2000]. INSIGNIA integrated with an Ad-Hoc routing protocol is an in-band signaling protocol.

An in-band signaling system supports:

- Reservation andRestoration
- On the basis of Inherent flexibility end to end adaption
- Robustness and scalability which is found in IP networks.

Resources are quickly released at the time of path reconfiguration, this guarantee is given by the soft state reservation scheme which is used in this framework. To support high layer and soft quality of services, a network feedback had made which is based on the link and acceptable throughput measurements.

However this scheme does not considers:-

- Inherent characteristics of MANETs
- Drawback of differentiated and integrated services
- Changing network topology
- Limited resources availability
- Error-prone shared radio channel.

Therefore, an accurate model has to be designed to investigate its applicability for supporting a combination of non-real-time services (data or FTP) and a real time Video/Audio with in the MANETs.

## III. CHALLENGES IN MANETs

### 3.1 Challenges in Mobility Schemes

The mobility management schemes can be divided into personal, and global and local host mobility. With the Session Initiation Protocol (SIP), the location of a user can be tracked and sessions initiated to the current host of the user. With Mobile IP, the location of a host can be tracked on a global scale. The local mobility management schemes can help support host mobility within an administrative domain more efficiently. All these mobility mechanisms can be seen as complementing each other to offer a wide spectrum of mobility support[3].

Mobile IP allows the mobile node to inform other nodes of its current location in the Internet. Because an IP address defines the physical location of a node to the routing infrastructure, a mobile node must, in the common case, change its IP address every time it changes locations. When the IP address changes during a communication session, the new address must be securely indicated to the communicating partner. When the IP address changes, all protocols that keep state information based on the IP address, RSVP, for example, must re-

initiate the states[1]. The more often the IP address changes, the more refreshing of states is needed, usually all the way between the communicating partners.

### 3.2 Challenges in QoS Architectures

QoS can be provided at different levels of a network node. Figure below presents QoS mechanisms found on different protocol layers. Starting from the lower layers, ATM can be used to provide additional support to any of these QoS mechanisms. When ATM is not used as the link layer technology, Multi-Protocol Label Switching can still be used to support the IntServ and DiffServ architectures, and RTP can be used over these two architectures.

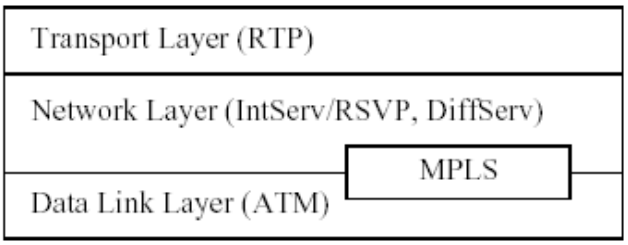



**Fig. 2. Classification of Different QoS Mechanisms**

Because the QoS mechanisms drive for the same generic goal, it can be argued that once one QoS mechanism, or at most two, is used to provide quality for a packet stream, additional QoS mechanisms only give little gain in the QoS. For example, if an application reserves resources from the network using RSVP (Resource Reservation Protocol), and then sends an RTP-based stream, the flow adaptation mechanisms of RTP would introduce an overhead and consume a portion of the bandwidth with little benefit[4].

The benefits and problems of the two main QoS architectures, the Integrated Services model and RSVP keep the state of the reservations per flow; they can provide a greater level of accuracy and a finer level of granularity on the part of the network to respond to service requests. The service requests of each application are used to generate a reservation state within the network. This state-based model is intended to be exclusionary, where other traffic, for example best-effort traffic, is dropped in order to meet the promised service targets[1]. The architecture also poses some challenges to the queuing mechanisms as there is the requirement to allocate absolute levels of egress bandwidth to individual flows while still supporting an unmanaged low priority best effort traffic class. Moreover, keeping accurate information of reservation states may be quite challenging in a dynamic mobile environment. Some people claim that, due to these issues, RSVP is not able to scale with the traffic, and, thus, RSVP would not be a proper solution in current networks.

One issue that does create problems with RSVP is mobility. RSVP uses the destination IP address of a flow as the session identifier. If the destination addresses changes, the whole reservation must be re-initialized. Thus, when a mobile node is receiving a flow, moves, and its IP address changes, the whole reservation must be requested again. For the upstream, it is possible to request a shared reservation, where all upstream senders share a single reservation, the size of which is the largest of the requested reservations[5]. After a handover, where the IP address of the mobile node changed, the mobile node can send a Path message to update the reservation path.

### 3.3 Challenges While Interacting Qos with Manet

There are many types of handover conditions between different entities can be identified. It can be ensure within the same access router (AR) including a change of the access point serving the mobile node. This is called an

*Intra-AR* handover. Handovers in between access routers and access network gateways (ANG) are called *Inter-AR* and *Inter-ANG*, respectively[6].

Figure –Elucidate the possible handovers while a mobile network node moves within and in between two administrative domains. The different levels of handovers create a variable load of signaling in the access network. The higher the handover is propagated in the access network topology the more time it will take to set routing and QoS allocations in place.

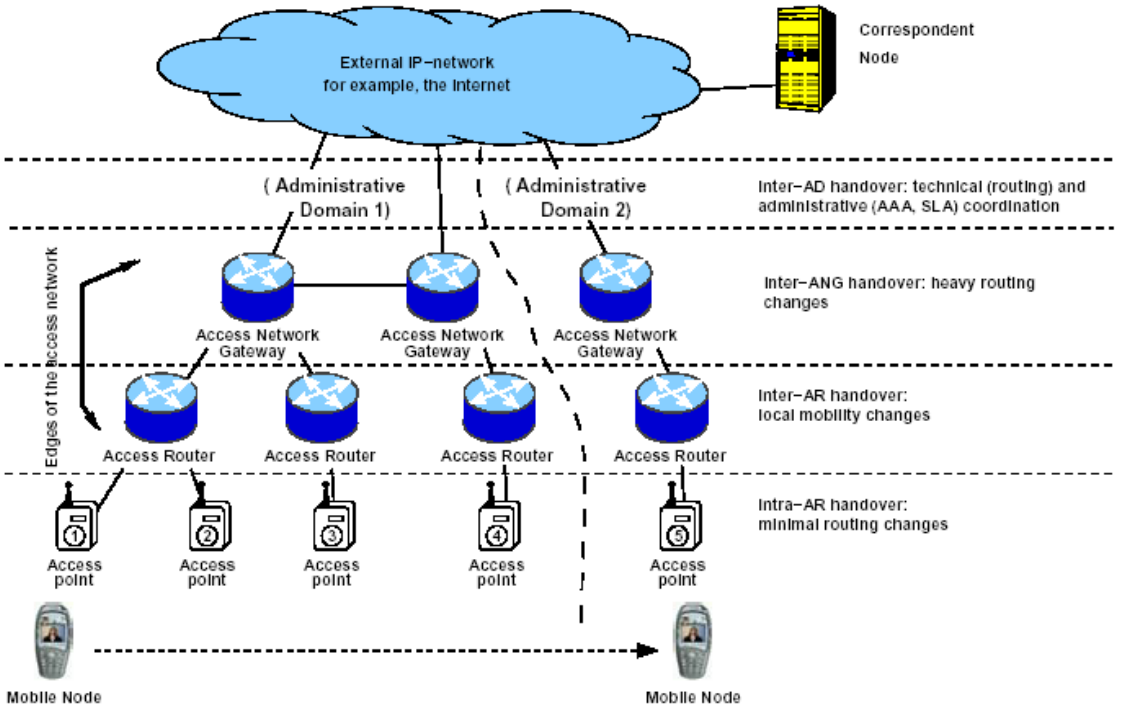
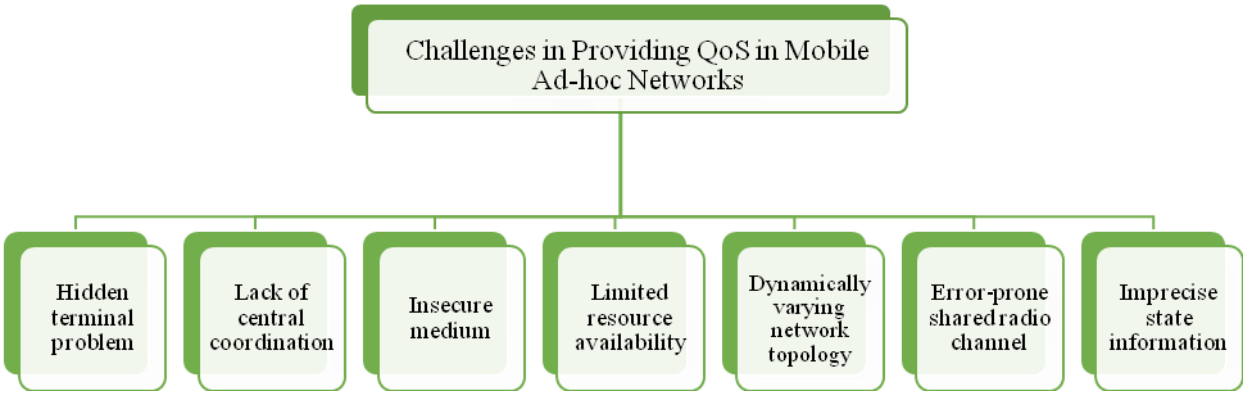



**Fig. 3. Example Network Topology Illustrating Different Handover Situations**

In this figure, Intra-AR handover would be in between access points 1 and 2. Inter-AR handover would be between access point 2 and 3, and Inter-ANG handover is in between access point 3 and 4. In addition, an Inter-AD handover would be between access point 4 and 5 that would change the whole access point network process. In handover situations RSVP has problems guaranteeing the reservations because updating the reservation, routing and data transmission are independent. RSVP-aware nodes need to send periodic Path and messages for each flow to refresh the end-to-end reservations. When a network route changes, than data packets will receive only best-effort service until the reservation state has been updated on the new path. When there is no any reservation, the refresh messages should be sent instantly after a handover[7]. This process update the location of the mobile node at the intermediate RSVP network Routers. Also, it would be possible to initiate the QoS negotiation with the new access router before the handover with a Context Transfer protocol or if the mobile node can communicate simultaneous over the wireless link with the old and new access router. In an Intra-AR handover, the handover control and handle only radio resources networkif the flows of data will use the same routing paths in between the access router and the access network gateway. This handover is also called a layer 2 handover. If the interface to the mobile devices does not change then the IP layer is transparent. Otherwise, the handover triggers change internal to the AR. After the changing of interface, the AR will be reallocate on the new interface, if the AR will e changed but ANG still on same interface. At this stage the routing path is similar and the availability of radio resources and resources in the active network is affected. The new AR interface

need to carry full authorization and control procedure at the synchronization time based. When the mobile node moves with in huge network or does handover to active network to another network, then the active network gateway is changed. In this situation, A new IP address is allotted to the active mobile nodes.

Overall, the further away the movement of the mobile node is noticed, the more adverse the effect on the QoS provision may be. The frequency of the different handovers depends on the mobility of the node and on the access network structure. For example, it is possible to build quite a large access network supporting thousands of mobile nodes with only one gateway router and a few access routers. Within such a network, no change of gateways would happen, and changing access routers could only happen a few times per Mobile node. Still, with standard RSVP, there is no way to predict before a hand over whether the new access router or gateway can support the service requested by mobile node[8].




## VI. ISSUES IN MANETs

An Active research area is providing QoS support in MANET.

### 4.1 Routing

the issue of routing packets between any pair of nodes becomes a challenging task because of constantly changing in the networks of the topology. Maintenance of the both state information i.e. flow specific and line specific is made possible by the nodes in Ad Hoc wireless network. The link specific state information includes:-

- Delay
- Bandwidth
- Error rate
- Loss rate
- Delay jitter
- Cost
- Stability

And distance value for each link. The flow-specific state information includes:-

- Source address
- Session ID
- Destination address
- QoS requirements of the flow like

a. Minimum bandwidth requirement
b. Maximum bandwidth requirement
c. Maximum delay litter
d. Maximum delay

Due to dynamic changes in network topology and channel characteristics, state information is inherently imprecise. Hence inaccurate route decision results in some of the real-time packets missing their deadlines.

### 4.2 Security and Reliability

Communication through a wireless channel is highly insecure due to the broadcast nature of the wireless medium. Hence, Security is the main issue in AWNs especially. For the tactical and military applications. Susceptible reason to attack is AWNs such as:-

- Spoofing
- Eavesdropping
- Message distortion
- Denial of service
- Impersonation

It is difficult to provide secure communication guarantees without any sophisticated security mechanisms.

### 4.3 Quality of Service (QoS)

In constantly changing environment, providing different quality of service levels will be a great challenge. MANET is an inherent stochastic feature of communication quality but to offer fixed guarantee on the service offered by the device is very difficult issue. So, over the traditional resource reservation, an adaptive QoS is to be implemented to support the multimedia services.

### 4.4 Limited Resource Availability

Limited area of MANETs include:-

- Battery Life
- Band width
- Storage Capacity/Space
- Capability of Processing

Out of the above, very critical resources are namely bandwidth and battery life and availability of these resources significantly affects the performance of provisioning mechanism of QoS. Hence, for the optimum utilization of the scare resources, efficient management system is required.

### 4.5 Internetworking

Internetworking between MANET and fixed in many cases in addition to the communication with in an Ad-Hoc networking. Harmonious mobility management is a challenge for those mobile devices which have co-existence of routing protocols. The issue of routing packets between any pair of nodes becomes a challenging task because of constantly changing in the networks of the topology. Maintenance of the both state information i.e. flow specific and line specific is made possible by the nodes in Ad Hoc wireless network[9].

### 4.6 Power Consumption

For the lean power consumption for the light-weight mobile terminals, the communication related function should be optimized. Power aware routing and conservation of power must be taken into consideration.


**Fig. 4. Some Major issues in MANETs**

## V. CONCLUSIONS

Mobile Ad-Hoc Network is created by a set of mobile devices nodes on a wireless shared network channel, it is also called Multi-hop mobile radio network. This wireless channel is adjustable in highly dynamic topology that are developed from the changing communication channels and the mobility of network nodes. MANETs play a significant role for the development of wireless communication network. Many networks are attractive because of the rapidly growth of such network are active anywhere and anytime without the presence of base station and system administrators. So, MANETs is able to provide QoS for delivery of real time communications (Audio/Video) to each and every mobility nodes.

Many ideas regarding QoS inherited from the wire-based networks can be used for MANETs if we consider various constraints due to the dynamic nature, bandwidth restriction, the limited processing, and capabilities of mobile nodes. Thus, for providing efficient quality of service in mobile ad-hoc networks, there is a solid need to create new architectures and services for routine network controls.

## VI. FUTURE WORKS

The development growth of mobile ad-hoc networks gives great chances in various fields including academic, Science, Military, disaster recovery, industrial sectors, and social environment. However, there are many problems that require to be addressed properly. These problems and issues needs to develop systematic routing procedures, mechanisms for reducing power consumption and extending the battery life, mechanisms for systematic use of limited bandwidth and communication capacity, new algorithms for network security, and making smaller but more high-powered mobile devices.

## VII. ONGOING RESEARCH IN SECURING MANETS

### 7.1 Securing Routing in MANETs

An extension compatible with a variety of existing reactive routing protocols, SRP is designed.For guaranteed acquisition of correct topological information and for combating the attacks that disrupt the route discovery process SRP is introduced.

#### 7.1.1 Ariadne

(on the Basis of DSR- a secure routing protocol) The initiator can be authenticated by the discovery of the target node of route. An intern the initiator authenticate the each intermediate node on the path toward the destination present in the RREP message. From the node list in the AREQ or RREA message, no intermediate node can remove a previous one[10].

#### 7.1.2 Aran

It is known as Securing routing protocol (Conceived as an on-demand routing protocol) that helps in protection and detection of malicious actions. Which are carried out by peers or the third party in the AD-Hoc environment. Following are introduced as a part of the minimal security policy for the Ad-Hoc environment:-

a. Message integrity
b. Authentication
c. Non-repudiation

It Consists of:-

a. Preliminary Certification Process
b. End-to end authentication stage which is mandatory
c. An Optimal second stage which helps to provide secured shortest paths.

### 7.2 Dealing with selfish and Malicious Nodes

KeyFor detecting malicious nodes by means of combined and monitoring and establishment routes reporting by avoiding nodes which are misbehaving by the introduction of confident [cooperation of Nodes, Fairness In Dynamic Ad-Hoc Networks]. DSR is designed as an extension to a routing protocol, to hold a token in order to participate in the network operation another approach is required which is taken based cooperation enforcement scheme for each node of the Ad-Hoc network. On the basis of the monitoring of the node's contribution to packet forwarding and routing operations, a granted scheme is required called token which work collaboratively with nodes of network[11]. Through a token renewal exchange with its neighbor, each node can be renewed upon expiration of it.

### 7.3 Key Management and Node Authentication

A Self organized Public-Key management scheme is introduced which is based upon the PGP is introduced for supporting security system of the Ad-Hoc networking routing protocols users issue certificates for each other based on their personal acquaintances. Public key certificate of each node is cooperatively generated by a set of neighbor based on the behavior of the node as monitored by the neighbors is authenticated by polynomial secret sharing.

The Secret digital signature is key used to generate public key certificates is distributes among several nodes by using a group signature mechanism which is based on polynomial secret sharing.

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