



## Review on MANET Including QoS: Characteristics, Challenges, Imperatives and Routing Protocols

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**Abstract**– Network security involves the authorization of access to data in a network, which is controlled the network administrator. The ad hoc wireless network is a special case of wireless network has not any fixed infrastructure. In this according to demand & requirement, it creates virtual network. It is a decentralized network. This feature of the wireless ad hoc networks makes it flexible and quickly deployable. Nevertheless, significant technological challenges are also posed by this property. There are several challenges incorporating issues of efficient routing, medium access, power management, security and quality of service (QoS). A lot of research has been done in this field and new techniques have been developed. This research paper provides an overview of these protocols by presenting their characteristics, functionality, benefits and limitations and then makes their comparative analysis so to analyze their performance. Challenges and advantage of MANET and QoS is described along with ECC algorithm cryptograph technique. The objective is to make observations about how the performance of these protocols can be improved.

**Keywords**– Mobile Ad Hoc Network, Quality of Service, Elliptic Curve Cryptography

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### I. INTRODUCTION TO MOBILE AD HOC NETWORK (MANET)

A mobile ad hoc network (MANET) is defined as an autonomous system of mobile nodes and associated hosts connected by wireless links. Every node operates not only as an end-system, but also as a node to forward the packets in appropriate direction. All the nodes are free to move and organize themselves into a network. The important use of mobile ad hoc network is in battlefield. MANETs do not require the support of wired access points or base stations for intercommunication. A mobile ad hoc network, unlike a static network, has no infrastructure. It is a collection of mobile nodes where communication is established in the absence of any fixed foundation. The only possible direct communication is between neighboring nodes. Therefore, communication between remote nodes is based on multiple-hop. These nodes are dynamically located in such a way that the interconnections between nodes are capable of changing on a continual basis. MANETs are self-configuring; there is no central management system with configuration responsibilities as show in fig 1. All the mobile nodes can communicate each other directly, if they are in other's wireless links radio range. Since MANETs allow ubiquitous service access, anywhere, anytime without any fixed infrastructure they can be widely used in military battlefields, crisis management services, classrooms and conference halls etc. MANETs ad-hoc fashion networking developments lead to development of multimedia applications such as video-on-demand, video conferencing etc. Routing protocols for this kind of wireless network should be able to maintain paths to other nodes and, in most cases, must be handle changes in paths due to mobility.

### II. CHARACTERISTICS OF MANET

- **Autonomous and infrastructure-less:** MANET does not rely on any established infrastructure or centralized administration. Each node operates in distributed peer-to-peer mode, acts as an independent router and generates independent data. Network management has to be distributed across different nodes, which brings difficulty in fault detection and management.
- **Multi-hop routing:** No default router available, every node acts as a router and forwards each other's packets to enable information sharing between mobile hosts.
- **Dynamic topologies:** In mobile ad hoc networks, because nodes can move arbitrarily, the network topology, which is typically multi-hop, can change frequently and unpredictably, resulting in route changes, frequent network partitions, and possibly packet losses.
- **Variation in link and node capabilities:** Each node may be equipped with one or more radio interfaces that have varying transmission/receiving capabilities and operate across different frequency bands. This heterogeneity in node radio capabilities can result in possibly asymmetric links. In addition, each mobile node might have a different software/hardware configuration, resulting in variability in processing capabilities. Designing network protocols and algorithms for this heterogeneous network can be complex, requiring dynamic adaptation to the changing conditions (power and channel conditions, traffic load/distribution variations, congestion, etc.). Energy constrained operation. Because batteries carried by each mobile node have limited power supply, processing power is limited, which in turn limits services and applications that can be supported

by each node. This becomes a bigger issue in mobile ad hoc networks because, as each node is acting as both an end system and a router at the same time, additional energy is required to forward packets from other nodes.

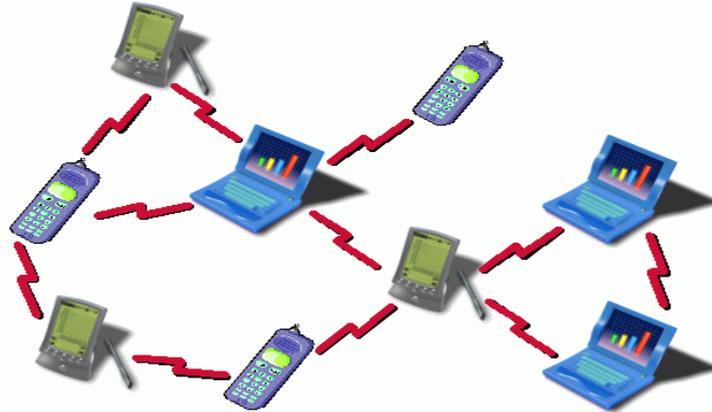


Fig 1: Mobile Ad hoc Network

- **Network scalability:** Currently, popular network management algorithms were mostly designed to work on fixed or relatively small wireless networks. Many mobile ad hoc network applications involve large networks with tens of thousands of nodes, as found for example, in sensor networks and tactical networks. Scalability is critical to the successful deployment of these networks. The steps toward a large network consisting of nodes with limited resources are not straightforward, and present many challenges that are still to be solved in areas such as: addressing, routing, location management, configuration management, interoperability, security, high capacity wireless technologies, etc.

### III. ADVANTAGES & APPLICATIONS OF MANET

The following are the advantages of MANET:

- They provide access to information and services regardless of geographic position.
- These networks can be set up at any place and time.
- Independence from central network administration. Self-configuring network, nodes are also act as routers. Less expensive as compared to wired network.
- Scalable—accommodates the addition of more nodes.
- Improved flexibility.
- They are robust due to decentralize administration.

Applications are described as below:

- **Military battlefield:** Ad-Hoc networking would allow the military to take advantage of commonplace network technology to maintain an information network between the soldiers, vehicles, and military information head quarter.
- **Collaborative work:** For some business environments, the need for collaborative computing might be more important outside office environments than inside and where people do need to have outside meetings to cooperate and exchange information on a given project.
- **Local level:** Ad-Hoc networks can autonomously link an instant and temporary multimedia network using notebook computers to spread and share information among participants e.g. conference or classroom. Another appropriate local level application might be in home networks where devices can communicate directly to exchange information.
- **Personal area network and Bluetooth:** A personal area network is a short range, localized network where nodes are usually associated with a given person. Short-range MANET such as Bluetooth can simplify the inter communication between various mobile devices such as a laptop, and a mobile phone.
- **Commercial Sector:** Ad hoc can be used in emergency/rescue operations for disaster relief efforts, e.g. in fire, flood, or earthquake. Emergency rescue operations must take place where non-existing or damaged communications infrastructure and rapid deployment of a communication network is needed.

### IV. CHALLENGES IN MANET

There are many problems in MANET network due to not fixed framework & infrastructure. It is very difficult to maintain routes for destination.

- Routing
- Quality of services
- Resources, maintenance route
- Security
- Multicasting
- Multiple routes

## V. QUALITY OF SERVICE (QoS)

QoS is the performance level of a service offered by the network to the user. Most of the multimedia applications have stringent QoS requirements that must be satisfied. The goal of QoS provisioning is to achieve a more deterministic network behavior, so that information carried by the network can be rightly delivered and network resources can be better utilized. However, there still remains a significant challenge to provide QoS solutions and maintain end-to-end QoS with user mobility. Most of the conventional routing protocols are designed either to minimize the data traffic in the network or to minimize the average hops for delivering a packet. Even some protocols such as Ad-hoc on demand Distance Vector (AODV), Dynamic Source Routing (DSR) and On-demand Multicast Routing Protocol (ODMRP) are designed without explicitly considering QoS. When QoS is considered, some protocols may be unsatisfactory or impractical due to the lack of resources and the excessive computation overhead. QoS routing usually involves two tasks: collecting and maintaining up-to-date state information about the network and finding feasible paths for a connection based on its QoS requirements. To support QoS, a service can be characterized by a set of measurable pre-specified service requirements such as minimum bandwidth, maximum delay and maximum packet loss rate.

## VI. CHALLENGES FOR QoS IN MANETS

A network is expected to guarantee a set of measurable pre-specified service attributes to the users in terms of end-to-end performance such as delay, bandwidth, probability of packet loss, delay variance (jitter), processing power, buffer space etc. The goal of QoS provisioning is to achieve a more deterministic network behavior so that information carried by the network can be better delivered and network resources can be better utilized. QoS provisioning in MANETs is very important in order to support real-time communications such as audio and video. But, provisioning of QoS over wireless networks is far more challenging than for wired networks because of variability of wireless links, node mobility, and lack of central coordination authority for QoS and channel assignment, limited battery power, multi hop communication and contention for accessing the wireless channel. Quality of service sometimes refers to the level of quality of service, i.e. the guaranteed service quality.

- Undependable channel
- Movement of nodes
- Limitation of energy supply
- No centralized approach
- Channel disarrangement
- Security

## VII. QoS MODEL AND MAIN REQUIREMENTS FOR A QoS MODEL

QoS model specifies an architecture in which some kind of services could be provided in MANETs. The model includes QoS resources reservation signaling, QoS routing and QoS Medium Access Control (MAC) as shown in Fig 2.

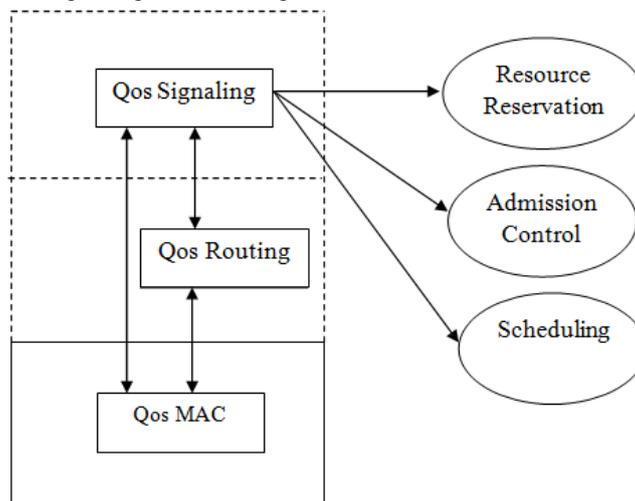


Fig. 2 QoS Model

The main requirements for a QoS Model for MANETs are as follows:-

- **Minimal overhead** –The wireless link capacity, battery and computational resources in a wireless multi-hop network are quite limited. Therefore a QoS model for wireless multi-hop networks should minimize the signaling overhead as well as the computational overhead entailed in provisioning of QoS.
- **Robustness** – QoS models should be capable of handling frequent route failures and dynamically changing network. The QoS model should have mechanisms to adapt to the changing topology without creating bottlenecks, in a fast and efficient manner.
- **Fairness** – The QoS resources should be shared in a fair manner among the wireless clients, and misbehaving nodes should not be allowed to make use of the network's resources without relaying packets for other nodes. A fundamental requirement of any QoS mechanism is a measurable performance metric. Typical QoS metrics include available bandwidth, packet loss rate, estimated delay, packet jitter, hop count and path reliability.

The existing QoS models can be classified into two types based on their fundamental operations – Integrated Service (IntServ) and Differentiated Services (DiffServ). IntServ is a fine grained approach which provides QoS to individual flows. It uses Resource Reservation Protocol (RSVP) to provide a circuit switched service in packet switched network. It aims to emulate a connection-oriented, virtual circuit connection for each flow admitted to the network. IntServ provides Admission control. One of the main responsibilities of admission control is that the interference caused by adding a new flow should not make QoS of old flows get poorer than required. The drawback of IntServ is the scalability problem caused by the need of storing every flow state in the routes. DiffServ provides QoS to large class of data or aggregated traffic. It is a coarse grained approach. It maps flows into a set of service levels. Under the DiffServ model, an application does not explicitly signal the network (i.e. the routers) before transmitting data. Instead, the network tries to deliver a particular kind of service based on the QoS specified by each packet. In DiffServ, routers are divided into two types: edge routers and core routers. Edge routers are at the boundary of the networks. Core routers forward packets based on the Type of Service field and they also need to follow the Per-Hop-Behavior (PHB) which takes charge of scheduling of packets. IntServ and DiffServ were proposed for static networks and thus cannot be applied directly to the mobile ad hoc environment. A QoS model designed for ad hoc networks must consider the unique features and challenges associated with mobile ad hoc networks. A Flexible QoS Model for MANETs (FQMM) considers the characteristics of MANETs and combines the high quality QoS of IntServ and service differentiation of DiffServ. The features of FQMM include: dynamic roles of nodes, hybrid provisioning and adaptive conditioning.

### VIII. TYPE OF QOS ROUTING PROTOCOLS

- **Network topology based protocols**
  1. **Flat protocols:** - mostly routing protocols implemented on physically flat network infrastructure with mobile users of same group. AQOR (ad hoc QOS on demand routing), QAODV (QOS AODV) etc.
  2. **Hierarchical protocols:** - for infrastructure based multicast routing protocols using physically hierarchical infrastructure for different type of mobile nodes. HQRMP(Hierarchical multicast routing protocol),SOM (self-organizing map)
  3. **Location aware (hybrid):**- connected through Bluetooth when required. LGF(location-based geo casting & forward) , SPBM(scalable position based multicast)
- **Route discovery with QOS approach**
- **Based on connection of Mac layer & network**
  1. **Dependent protocols:** - in this network layer is dependent upon the Mac layer. NSR (node state routing), CCBP (capacity- based routing) etc.
  2. **Independent protocols:** - in this network layer is not dependent upon the Mac layer. QOLSR (QOS optimized link state routing), DSARP (delay- sensitive adaptive routing protocol) etc.
- **QOS matrix base:-**
  1. **Single constrained:** - only using single parameter for improving QOS CACP (Content admission control routing protocols), CAAODV (Contention-Aware AODV) etc.
  2. **Multi constrained:** - [23]to find the multiple feasible path for communication GAMAN (genetic algorithm based routing), AAQR (application aware QOS routing protocol) etc.
- **QOS guarantee:-**
  1. **Soft QOS approach:** - guarantee of QOS in certain services only CLMCQR (Cross Layer Multi-Constraint QOS routing), AAQR (application aware routing protocols) etc.
  2. **Hard QOS approach:** - guarantee of QOS is compulsory NSR (Node State Routing), MRPC (Maximum Residual Packet Capacity routing) etc.

- **QRMR**

QRMR is a hybrid type routing protocol. Basically approach which is used in QRMR is similar to AOMDV routing protocol. Multiple routes are discovered during to path discovery process. In this new weight matrix is adding with every link between nodes which is depends upon end-to-end delivery, channel quality & link quality. These weight value next process routing and manage traffic through the network & enhanced the network capacity.

$$W = Lq + Cocc + Davg$$

In wireless network Qos is depend upon three factors end-to-end delivery, channel quality, link quality. Main propose of QOS is determined a route from source node to destination that fulfill the needs of users with QOS. Route is selected on the bases of QOS desire.

### IX. CRYPTOGRAPHY

The encryption-decryption procedures formulated for the wireless wired systems are not attainable to be connected specifically for the remote systems and specifically for remote sensor systems. WSNs comprise of minor sensors which truly experience the ill effects of the absence of preparing, memory furthermore, battery power. Applying any encryption plan requires transmission of additional bits, subsequently additional preparing, and memory and battery power which are vital assets for the sensors' life span.

Applying the security systems, for example, encryption could likewise build deferral, jitter and bundle misfortune in remote sensor systems. To accomplish ideal security in Remote Sensor Networks we should execute encryption decryption procedures. By utilizing Elliptical Curve Cryptography; an encryption-decoding strategy in Remote Sensor Networks we can accomplish system security.

RSA calculation is the most broadly utilized open key cryptography calculation for encryption and unscrambling by numerous sellers today. This is the original calculation that was utilized for giving information security. It can be utilized to scramble a message without the need to trade a mystery key independently. The RSA calculation can be utilized for both open key encryption and advanced marks. Its security is in view of the trouble of figuring huge whole numbers. Party A can send a scrambled message to gathering B with no earlier trade of mystery keys. An equitable uses B's open key to scramble the message and B decodes it utilizing the private key, which just he knows. RSA can likewise be utilized to sign a message, so A can sign a message utilizing their private key and B can check it utilizing as public key.

Points of interest of ECC over RSA:

1. Shorter keys are as solid as long key for RSA.
2. Low on CPU utilization.
3. Low on memory use.
4. Size of scrambled information is littler.

In today's world ECC calculation is utilized as a part of instance of key trades by declaration power (CA) to share people in general key declarations with end clients. Elliptic Curve Cryptography is a protected and more productive encryption calculation than RSA as it uses littler key sizes for same level of security when contrasted with RSA.

## **X. ELLIPTICAL CURVE CRYPTOGRAPHY (ECC) ALGORITHM**

Elliptical curve cryptography (ECC) is an open key encryption procedure in view of elliptic curve theory that can be utilized to make quicker, littler, and more productive cryptographic keys. ECC produces keys through the properties of the elliptic bend condition rather than the wireless strategy for era as the result of exceptionally huge prime numbers. Since ECC builds up equal security with lower registering power and battery asset utilization. RSA has been building up its own form of ECC. The properties and elements of elliptic bends have been concentrated on in arithmetic for a long time.

Their utilization inside cryptography was initially proposed in 1985, (independently) by Neal Koblitz from the University of Washington, and Victor Miller at IBM. An elliptic bend is not an (oval shape), but rather is spoken to as a circling line crossing two tomahawks (lines on a chart used to demonstrate the position of a point). ECC depends on properties of a specific kind of condition made from the scientific gathering (an arrangement of qualities for which operations can be performed on any two individuals from the gathering to produce a third part) got from focuses where the line converges the tomahawks. Increasing a point on the bend by a number will deliver another point on the bend, yet it is exceptionally hard to discover what number was utilized, regardless of the fact that you know the first point and the outcome. Conditions in view of elliptic bends have a trademark that is exceptionally profitable for cryptography purposes: they are generally simple to perform, and to a great degree hard to switch.

In spite of the fact that RSA open key cryptosystem is a safe hilter kilter key cryptosystem, its security accompanies a cost of bigger key sizes and computational force. Numerous specialists have searched for another option to this framework with a littler key size while keeping up the same level of security. The ECC framework depends on the ideas of Elliptic Curves. To examine the time taken by a calculation explores have presented polynomial time calculations also, exponential time calculations. Calculations with littler calculation can be assessed with polynomial time calculations and complex calculations can be assessed with exponential time calculations. The condition of an elliptic bend is given as,

$$y^2 = x^3 + ax + b$$

## **XI. CONCLUSION**

QoS is a wide area for research. Many protocols and techniques are developed in this field. QoS is provided in MANET is very important to make real time communication such as audio and video. There are many problems in the improving the QoS. Many factors are there which includes in the QoS like delivery ratio, overhead control, the average end-to-end delay. But QoS in MANET is very difficult and challenging as compared to the wired network. So there are many problems when we are discuss about is providing QoS in MANET. For example, which routing protocol discuss in introduction (QRMR) is advanced from AODV protocol, but there are many limitations in this so it has required further development in this. In ad hoc network many problems are there

- Dynamic topologies
- Bandwidth constrained
- Variable capacity links
- Energy constrained operation
- Limited physical security.

Selection of routing protocol in any ad hoc network is very challenging task. A design issue for an efficient and effective routing protocol is to achieve optimum values of performance parameters under network scenarios. Comparing the existing QRMR protocol with proposed routing protocol using ECC algorithm on the basis of these performance matrix:- Packet Delivery Ratio, End to end delay and Throughput.

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