ISSN: 2277-9655
Impact Factor: 1.852

IJESRT

INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY

A Survey on Quality of Service in Mobile Ad Hoc Networks (MANET)

M.Mohanraj[*1], Dr.M.Punithavalli[2]

[*1]Research Scholar / Assistant Professor, Dr.SNS Rajalakshmi College of Arts and Science, Coimbatore, Tamilnadu, India

[2]Director - MCA, Sri Ramakrishna Engineering College, Coimbatore, Tamilnadu, India

mohanrajsns@gmail.com

Abstract

An ad-hoc network is a collection of wireless mobile hosts forming a temporary network without the aid of any stand-alone infrastructure or centralized administration. Mobile Ad- hoc networks [MANET] are self-organizing and self-configuring multi-hop wireless networks where the structure of the network changes dynamically. To support multimedia applications, it is desirable that an ad hoc network has a provision of Quality of Service (QoS). However, the provision of QoS in a mobile ad hoc network is a challenging task. In this paper, we present a review of the current research related to the provision of QoS in an ad hoc environment. We examine issues and challenges involved in providing QoS in an ad hoc network. We discuss methods of QoS provisioning at different levels including those at the levels of routing, Medium Access Control (MAC), and cross layer. Also, we discuss schemes for admission control and scheduling that are proposed in the literature for the provision of QoS. We compare salient features of various solutions and approaches and point out directions for future work.

Keywords: ad hoc networks; QoS; quality of service; methodologies; admission control; scheduling; fairness.

Introduction

A mobile ad hoc network (MANET) is a self-configuring less infrastructure network of mobile devices connected by wireless links. Ad hoc is Latin and means "for this purpose". Each device in a MANET is free to move independently in any direction, and will therefore change its links to other devices frequently. Each must forward traffic unrelated to its own use, and therefore be a router. The primary challenge in building a MANET is equipping each device to continuously maintain the information required to properly route traffic. Such networks may operate by themselves or may be connected to the larger Internet.

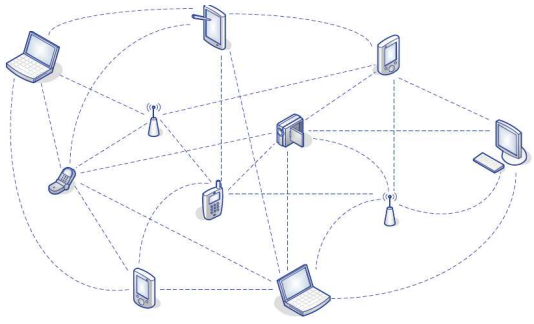


Fig. 1. A Mobile Ad-hoc Network (MANET)

Quality of Service (QoS) means that the network should provide some kind of guarantee or assurance about the level or grade of service provided to an application. The actual form of QoS and the QoS parameter to be considered depends upon specific requirements of an application. For example, an application that is delay sensitive may require the QoS in terms of delay guarantees. Some applications may require that the packets should flow at certain minimum bandwidth. In that case, the bandwidth will be a QoS parameter. Certain application may require a guarantee that the packets are delivered from a given source to destination reliably, then, reliability will be a parameter for QoS. As more and more applications are added on top of an ad hoc network, it is desirable that the network should provide QoS in some form or the other. However, the characteristics of an ad hoc network pose several challenges in the provision of QoS. Some of these challenges are as follows.

- The topology of the network varies dynamically.

Therefore, it is difficult to design a scheme or a protocol that is able to provide hard guarantees about the QoS desired by an application.

- The resources of the devices used are limited,

ISSN: 2277-9655
Impact Factor: 1.852

Therefore, any such scheme or a protocol should be a light-weight scheme. In other words, the protocol should not consume a significant amount of energy or should not incur a large amount of computational or communication overheads.

Challenges of QoS Routing in Ad Hoc Networks

Mobile ad hoc networks differ from the traditional wired networks. They have certain unique characteristics which cause difficulties for providing QoS in such networks. The unique characteristics are dynamically varying network topology, lack of precise state information, shared radio channel, limited resource availability, hidden terminal problem and insecure medium. These characteristics and their effects on ad hoc networks will be discussed in this part one by one.

Dynamically varying network topology

In mobile ad hoc networks, nodes are mobile and network topology is changing dynamically. Consequently, the route which is already set up with required QoS could not satisfy QoS anymore if one of the nodes on this established route moves. For example, a node could move to an area with more interference to it. The node whose data rate has been overused should take some actions. The information about loss of QoS should be sent by this node to all sources whose transmission is going through the overloaded node. Sources who receive this message have to find another possible route by using QoS aware routing protocol again. This procedure will cause delay which may not be acceptable.

Lack of precise state information

Due to the dynamic characteristic, information of nodes transmitted to other nodes may change right after this information is transmitted to its neighbors. The information here can be the data rate available at the neighboring node, since available data rate of nodes is affected by the data rate of its neighbors.

Shared radio channel

Data transmitted on the radio channel can be received by stations which are in the carrier sensing range of the transmitter. This broadcast characteristic will cause interference to other stations when traffic is transmitted over the air interface. Thus, stations have to share channel with neighbors in their carrier sensing range. This is very different from the wired channel which will not cause that much interference between each other because of proper construction of lines that attenuates crosstalk interference significantly.

Limited Resource Availability

The resources such as data rate, battery life, and storage space are all very limited in ad hoc networks. The battery life in a sensor network is a very good example. In a sensor network, each sensor has very limited battery life, so routing based on power consumption is widely considered.

The data rate is very limited for wireless links if we compared it with the data rate available in wired network. In addition, the basic characteristics of the wireless channel e g. fading, noise, and shared data rate between neighbor nodes (neighbor nodes have to keep silent when it senses some node is transmitting) will also degrade the wireless data rate.

QoS-Aware Routing Protocols

The primary goal of the QoS-aware routing protocols is to determine a path from a source to the destination that satisfies the needs of the desired QoS. The QoS-aware path is determined within the constraints of bandwidth, minimal search, distance, and traffic conditions. Since path selection is based on the desired QoS, the routing protocol can be termed QoS-aware. In the literature, numerous routing protocols have been proposed for finding QoS paths. In the following sections some of these QoS routing protocols are described.

1. QAMNet - Quality of service for Multicast in MANETs
2. CQMRP - Cluster-based QoS Multicast Routing Protocol
3. QMRPCAH - QoS Multicast Routing Protocol for Clustering Mobile Ad Hoc Network
4. HVDB - Hypercube-based Virtual Dynamic Backbone
5. QoS-ODMRP - QoS On-Demand Multicast Routing Protocol
6. E-QMR - Cross-layer QoS Multicast Routing Protocol (This protocol is an extenson of protocol QMR
7. Hu* - This protocol was not named by the authors. The first author's name is used instead
8. QMRP -] QoS aware Multicast Routing Protocol
9. QoS-AODV - QoS Ad Hoc On-Demand Distance Vector Routing
10. HQMRP - Hybrid QoS Multicast Routing Protocol
11. QoS-MEM - QoS-aware Minimum Energy Multicast
12. LTM* - Lantern-Tree-based QoS Multicast (This protocol was not named by the authors. We call it LTM)
13. MPT* - Multiple paths/trees (This protocol was not named by the authors. We call it MPT)
14. EQMGA - Entropy-based Genetic Algorithm to support QoS Multicast Routing

ISSN: 2277-9655
Impact Factor: 1.852

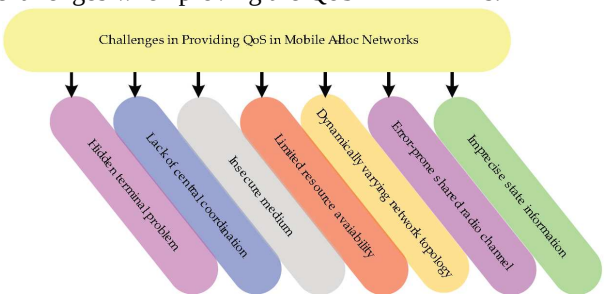
15. QMOST - QoS-aware Multicast Overlay Spanning Tree
16. LACMQR - Location-based multicast routing for mobile ad hoc networks
17. AQM - Ad Hoc QoS Multicasting
18. M-CAMP - Call-Admission Multicast Protocol for MANETs
19. MCEDAR - Multicast Core-Extraction Distributed Ad Hoc Routing
20. QoS-MAODV - QoS–Multicast Ad Hoc On-Demand Distance Vector Routing
21. HQMGA - Hierarchical QoS Multicast routing using GA in MANET
22. QMR - QoS Multicast Routing Protocol
23. EGA - A Genetic Algorithm for Energy-Efficient Based Multicast Routing on MANETs
24. SEQMRAN - Secure Efficient QoS Multicast Route Discovery for MANETs
25. FQM - Framework for QoS Multicast
26. ODQMM - On-Demand QoS Multicast for MANETs
27. MACO - Ant Colony Algorithm Based on Orientation Factor for QoS Multicast
28. AMOMQ - Ad-hoc Mesh-based On-demand Multicast Routing Protocol with Quality of Service Support QoS-MAODV- 2Lqos QoS Constrained Multicast Routing For Mobile Ad Hoc Networks HTQ* - Hexagonal-tree TDMA-based QoS multicast protocol (This protocol was not named by the authors. We call it HTQ)
29. QMMRP - QoS Multilayered Multicast Routing Protocol

Identifying Problems and Solutions

In general, the application of MANETs was first proposed for military battlefield and disaster recovery. However, as a result of evolution in multimedia technology and the commercial interest of companies, quality of service in mobile ad-hoc networks has become an area of interest. Because of various requirements of different applications, the services required and the QoS parameters will change for each application. Therefore, quality of service is identified as a set of measurable pre-specified service requirements such as delay, bandwidth, probability of packet loss, and delay variance (jitter) which a network needs to make them available for the end users while transporting a packet stream from a source to its destination.

Real time applications need mechanisms that guarantee restricted delay and delay jitter. For instance, the most important delays that affect the end to end delay in packet delivery from one node to another node are: the queuing delay at the source and intermediate nodes, the processing time at the intermediate nodes, the transmission delay, and the propagation duration over multiple hops from the source node to the destination node.

Generally in wired networks, QoS parameters are characterized by the requirements of multimedia traffic. But in ad-hoc networks QoS requires new constraints due to highly dynamic network topology and traffic load conditions, time-variant QoS parameters like throughput, latency, low communication bandwidth, limited processing and power capacity than wire-based network. Moreover, QoS in ad-hoc networks relates not only to the available resources in the network but also to the mobility speed of these resources. This is because mobility of nodes in ad-hoc networks may cause link failures and broken paths. In order to continue a communication therefore, it requires finding a new path. However, delay will occur for establishing a new path, also some of the packets may get lost depicts some challenges when proving the QoS in MANTEs.



Error-prone shared radio channel is another issue for providing QoS as the radio channel in a broadcast medium, thus, during propagation through the wireless environment the radio waves go through several impairments (e.g. attenuation, multipath propagation, and interference) from other wireless devices working in the surrounding area.

In mobile ad-hoc networks, mobile computation devices are usually battery powered. A limited energy budget constraints the computation and communication capacity of each device. Energy resources and computation workloads have different distributions within the network. The main reasons for energy management in ad-hoc networks are limited energy reserve, difficulties in replacing the batteries, lack of central coordination, constrains on the battery source, and selection of optimal transmission power.

The battery Life, bandwidth, and buffer space are the important resources in each network.Usually, the transmitter power consumes the most energy in the node and it is essential to conserve the available energy in MANETs either by low-power design of hardware or special power control mechanisms.The hidden terminal problem is inherent mobile ad-hoc networks . This may

ISSN: 2277-9655
Impact Factor: 1.852

happen when packets originating from two or more sender nodes which are not within the direct transmission range of each other crash at a general receiver node. Thus,it requires the retransmission of the packets that may not be adequate for flows.Security issue is an important factor in providing QoS in mobile ad-hoc networks.

Communications in wireless environment are not secure due to the broadcasting behavior of this type of network. Generally, MANETs have fewer resources than fixed networks and they are more influenced by the resource constraints of the nodes.Therefore, it is hard for these networks to support different applications with appropriate

QoS requirements The other important problems in MANETs when providing QoS are routing, maintenance and variable resource problems.

1. Routing problem: It explains how to find a loop-free from the source to the destination in the network that can be able to support a requested level of QoS. Route selection strategies can be based on the power aware, level of the signal strength, link stability,and the shortest path.
2. Maintenance problem: It describes how to make sure that, when network topology changes, new routes that can support existing QoS obligations are available, or can be quickly found.
3. Variable resource problem: It addresses how to react to changes in available resources,either as the result of a route change, or as the result of changes in link characteristics within a given route.

As we mentioned earlier a mobile ad-hoc network (MANET) may include a group of mobile nodes with a wireless communications device and a controller, in which they operate in accordance with a multi-layer protocol hierarchy. The QoS solutions can be classified based on the QoS approaches or based on the layer at which they operate in the network protocol stack. Generally, the QoS approaches can be classified based on the interaction between the routing protocol and the QoS provisioning mechanism, and the interaction between the network and the Medium Access Control (MAC) layers, or based on the routing information update mechanism

Conclusions

Multi-hop mobile radio network, also called mobile ad-hoc network is created by a set of mobile nodes on a shared wireless channel. This network is adaptable to the highly dynamic topology resulted from the mobility of network nodes and changing propagation conditions. MANETs are expected to have a significant place in the development of wireless communication systems. Such networks are attractive because they can be rapidly deployed anywhere and anytime without the existence of fixed base stations and system administrators. Hence, mobile ad-hoc networks must be able to provide the required quality of service for the delivery of real-time communications such as audio and video that poses a number of different technical challenges and new definitions.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.

References

[1] Agarwal, S.; Katz, R.H.; Krishnamurthy, S.V. & Dao, S.K. (2001). Distributed power control in ad-hoc wireless networks, *Proceedings of 12th IEEE International*

[2] *Symposium on Personal, Indoor and Mobile Radio Communications (PIMRC)*, October 2001, pp. F-59-F-66 Vol. 2, San Diego, CA , USA, ISBN: 0-7803-7244-1.

[3] S.H.Shah, K. Nahrstedt, “Predictive location-based QoS routing in mobile ad-hoc networks”, in: Proceeding of IEEE ICC 2002, vol.2, pp.1022-1027, 2002.

[4] A.R.Bashandy, E.K.P.Chong and A.Ghafoor, “Generalized quality-of-service routing with resource allocation” IEEE J.Select.Areas Commun., vol.23, pp.450-463, 2005.

[5] Carvalho, M. (2008). Security in Mobile Ad Hoc Networks, *IEEE Security and Privacy Magazine*, Vol. 6, No. 2, pp. 72-75, April 2008, ISSN: 1540-7993.

[6] Junhai, L.; Danxia, Y.; Liu, X.; Mingyu, F. A survey of multicast routing protocols for mobile Ad-Hoc networks. *IEEE Commun. Surv. Tutor.* 2009, *11*, 78–91.

[7] Hashim, A.A.; Qabajeh, M.M.; Khalifa, O.; Qabajeh, L. Review of multicast QoS routing protocols for mobile ad hoc networks. *IJCSNS* 2008, *8*, 108–117.

[8] Masoudifar, M. A review and performance comparison of QoS multicast routing protocols for MANETs. *Ad Hoc Netw.* 2009, *7*, 1150–1155.

[9] Nargunam, A.S.; Sebastian, M.P. QoS-aware multicast routing for mobile ad hoc networks. *Int. J.Bus. Data Commun. Netw.* 2008, *4*, 1–21.

ISSN: 2277-9655
Impact Factor: 1.852

*[10]*Darehshoorzadeh, A.; Dehghan, M.; Motlagh, M.R.J. Quality of service support for ODMRP multicast routing in ad hoc networks. *Lect. Note. Comput. Sci.* 2007, *4686*, 237–247.

*[11]*Saghir, M.; Wan, T.; Budiarto, R. A new cross-layer framework for QoS multicast applications in mobile ad hoc networks. *IJCSNS* 2006, *6*, 142–151.

*[12]*Latha, P.; Ramachandran, R. QoS Constrained Multicast Routing for Mobile Ad Hoc Networks.*IJCSNS* 2009, *9*, *66–70*.

*[13]*Chen, L.; Heinzelman, W.B. QoS-aware routing based on bandwidth estimation for mobile ad hoc networks. *IEEE J. Sel. Area. Commun.* 2005, *23*, 561–572.

*[14]*T.B.Reddy I.Karthigeyan, B.Manoj and C.S.R.Murthy, "Quality of service provisioning in ad hoc wireless networks: a survey of issures and solutions." Vol.4, pp.83-124, 2006.

*[15]*Shahram Jamali, Bita Safarzadeh, Hammed Alimohammadi. A stable QOS-aware reliable on-demand distance vector routing protocol for mobile ad-hoc networks. Scientific Research and essays (2011), pp.3015-3026.

*[16]*Sharma N, Nandi S, Route Stability Based QoS Routing in Mobile ad hoc networks. *Journal of Wireless PressCommunication (*2010), Vol.54, pp.203-224, DOI: 10.1007/s11277-009-9718.