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A Survey on Quality of Service Routing Protocols for Mobile Ad hoc Networks

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Abstract:Due to the emergence of communication through wireless mode, infrastructure less transmission of data received greater importance. Mobile ad hoc network (MANET) is one such kind of infrastructure less means of communication. Ensuring Quality of Service (QoS) is one of the major research dimensions in the field of MANETs. This paper surveys the review of literature on QoS routing protocols for MANETs. From the review it is evident that on-demand routing is comparatively better than table – driven routing protocols for ensuring QoS. Also it is noteworthy that on-demand routing protocols have more futuristic research dimensions for carrying out further exploration and invention of routing protocols for MANETs.

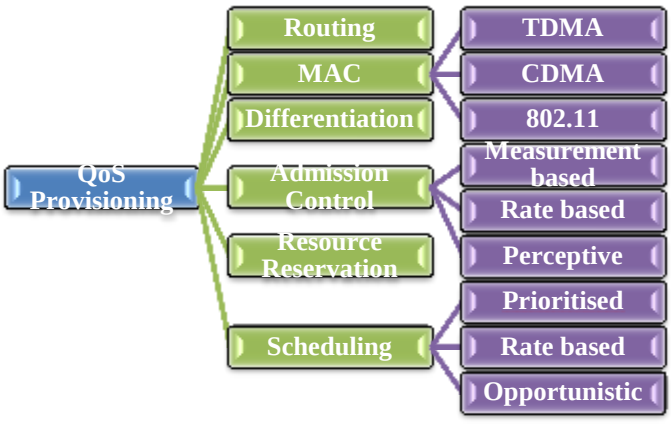
Keywords: wireless, communication, infrastructure – less, QoS, MANET, on –demand routing, reactive routing, table – driven routing, proactive routing, algorithms, congestion control, reliability.

1. Introduction

As innovation is developing quickly, it requires many hand-held devices like laptop, palmtop, mobile phones and so forth. Which are progressed by expanding CPU time, disk space, power consumption and memory size. MANET [15, 16], opens the entryway for these devices. MANET is self-mending, multihop, infrastructure less system allowed to move starting with one place then onto the next place. There are a few uses of MANET like sound, video, multimedia and so on, which requires great correspondence and QoS [17, 18]. Essentially different remote system CDMA, GSM and Wi-Fi, MANET can't give solid QoS [19]. Thusly, selecting fitting protocol is critical and testing assignment, because of number of protocols displayed in the writing, vary from each other and required certification of stringent QoS [20]. The principle point of QoS routing [21] is to discover pertinent path, that must fulfill QoS constraint prerequisites, for example, packet loss, bandwidth, delay, jitter, energy consumption which are transmission qualities of topology. QoS routing additionally fulfills constraint like link, path and tree constraint [22]. Where, bandwidth, jitter-delay and end-to-end delay are principle, link and path constraint individually [23]. Along these lines, to fulfill the above constraints with different goals, there is need of possibly new approach or method for understanding the QoS routing. Along these lines, confusion in the issue is considered, and open arrangement is given utilizing metaheuristic calculation as opposed to different strategies. To comprehend QoS routing, past analysts utilized different metaheuristic calculations [24, 25]. Be that as it may, there is need of upgrading routing protocols in MANETS, to give stringent QoS improvement [26].

2. Background

For any communication framework there are a few parameters to be accomplished productively to demonstrate the execution of the framework. These parameters are packet loss, power consumption, bandwidth, delay and so forth. The point of the QoS change is to improve the system execution and better use of the assets. For continuous application MANET is vital for media transmission however it confronts a few difficulties when goes to the execution components. 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. The Fig.1 portrays various dimensions of QoS provisioning in MANETs.



3. QoS Routing in MANETs

Most routing protocols for mobile ad hoc networks, such as AODV [1], DSR [2], and TORA [3], are designed without explicitly considering quality-of-service of the routes they generate. QoS routing in ad hoc networks has been studied only recently [4], [5], [6], [7], [8], [9], [10], [11], [12], [13]. QoS routing requires not only finding a route from a source to a destination, but a route that satisfies the end-to-end QoS requirement, often given in terms of bandwidth or delay. Quality of service is more difficult to guarantee in ad hoc networks than in most other type of networks, because the wireless bandwidth is shared among adjacent nodes and the network topology changes as the nodes move. This requires extensive collaboration between the nodes, both to establish the route and to secure the resources necessary to provide the QoS. The ability to provide QoS is heavily dependent on how well the resources are managed at the MAC layer. Among the QoS routing protocols proposed so far, some use generic QoS measures and are not tuned to a particular MAC layer [8], [9], [12]. Some use CDMA to eliminate the interference between different transmissions [4], [5], [10], [13]. Different MAC layers have different requirements for successful transmissions, and a QoS routing protocol developed for one type of MAC layer does not generalize to others easily. So far no work (to our knowledge) has been done on QoS routing in a flat-architecture, TDMA based ad hoc network, although much work has been done in the MAC area [14]. In this paper we develop a QoS routing protocol for ad hoc networks using TDMA. The object is to establish bandwidth guaranteed QoS routes in small networks whose topologies change at low to medium rate. The protocol is based on AODV, and builds QoS routes only as needed.

4. Review of Literature

In [27] the authors proposed R-AODV routing protocol. The authors mentioned that overall successful delivery of route reply (RREP) control messages plays a significant role in reactive routing protocols when compared to proactive routing protocols. Though, the loss of RREPs control messages leads to non-pairing towards the routing performance which is due to the cost of a RREP control message. When the RREP message is lost, a large amount of route discovery process will get wasted. On the other hand, the source node need to startup with next turn of route discovery for enabling a route towards the destination. The authors proposed the reverse AODV technique that tries to send henceforth of reverse RREQ control message. The authors also simulated their R-AODV protocol and claimed that it is better than that of AODV routing protocol.

Niranjan Kumar and Satyanarayana [28] proposed a Multipath QoS Routing protocol for traffic splitting in MANET. In their proposed work, they adapted a technique by which the network prefers to transmit the data packets through the path that is capable enough to satisfy the routing conditions like bandwidth, delay and stability of the link in the network. When the path is not capable enough to meet the routing constraints, then the traffic is distributed along the multiple disjoint paths, using the Traffic Splitting algorithm. The authors calimed in their simulation results, that their proposed protocol reduces the packet drop and delay with improved throughput for real-time and non real-time traffic.

The authors Biradar and Kulkarni [29] aim in enhancing the quality of service using M-AODV protocol in MANETs and named their protocol as M-AODV. M-AODV routing protocol obtains more than one paths between source node and destination node. It is claimed by the authors that by making use of time constrained route selection and measuring the quality of the link, M-AODV routing protocol can attain more performance improvement than that of conventional AODV routing protocol.

Jayabarathan et al [30] have proposed a reactive routing protocol named Priority Aware Adhoc On Demand Multipath Distance Vector (PA-AOMDV) protocol towards improving QoS for MANET. With their priority aware mechanism, PA-AOMDV protocol is capable enough to offer precise admission control. The authors claimed that PA-AOMDV achieved better throughput and packet delivery ratio than that of AOMDV routing protocol. It is noteworthy their proposed protocol performs better where network size is small and under less mobility speed.

Hwang et al [31] analyzed the performance of AODV and DSR routing protocols for the quality assurance metrics. An effort has been made by the autors to study the performance analysis of two prominent on demand routing protocols i.e. DSR and AODV. Their performance analysis and evaluation is done on the basis of scales applied on Packet Delivery Ratio (PDR), in several scenarios such as varying pause time, differing speed and number of nodes. From their performance analysis the authors stated that in case of reliability, AODV performs better at denser medium, while DSR is good for sparse medium. The authors concluded that AODV performs than that of DSR protocol.

In [32] the authors Hansika and Anuradha proposed a protocol which altered conventional AODV routing mechanism by incorporating less energy consumption. Their protocol adapted an idea which determined the best path based on the cumulative residual energy available. From their simulation results the authors claimed that their proposed routing protocol achieves better packet delivery ratio and throughput. The authors also claimed that their proposed protocol consumes less energy than that of the AODV protocol.

In [33] the authors Pariselvam et al proposed probe packet based congestion free service discovery architecture for MANET. In their proposed protocol, the authors took advantage of the probing mechanism when the source node does not have any idea about the status of the destination node. The authors claimed that their proposed protocol attains better packet delivery ratio and lesser overhead with less number of packets drop.

Upadhyay et al [34] proposed a novel approach for transmission of large packet size message in MANET. Their approach claimed with an advantage by considering the left over battery power of nodes and selecting only those nodes whose battery power is more than required threshold for transmission of large message and hence achieves QoS routing. The authors claimed that their proposed work attains better in terms of energy required for transmission and receiving of packets.

In [35], the authors Rao and Singh proposed an AODV nthBR protocol (an improved version of AODV protocol). AODV nthBR protocol has been simulated for the QoS parameters throughput, end to end delay and lifetime of devices. The results obtained by the authors compared with other reactive routing protocols like AODV, DSR and AODV BR. The results obtained with AODV nthBR were found to much better than other protocols for the same simulation set up.

The authors [36] Hay et al proposed a new direction focusing on two Quality of Service metrics, Packet Delivery Ratio (PDR) and latency, in conjunction with Network Coding protocols in Mobile Ad-Hoc Networks (MANETs). The network coding makes use of new forwarding paradigm by which the intermediate nodes performed a store, code and forward operation for incoming packets. From their results the authors claimed that their proposed protocol attained better PDR and lesser latency.

In [37] the authors Rigazzi et al proposed a protocol named secure routing protocol for BeeAdHoc based on fuzzy logic in MANETs (BeeAdHoc) is investigated. In their protocol a malicious node is capable enough to launch a number of attacks and disrupt normal behavior of the protocol. Then, a secure framework for BeeAdHoc is proposed by the authors which is designed based on fuzzy set theory and digital signatures. The authors implemented FBeeAdHoc in MATLAB platform. The authors claimed that their experimental results showed that FBeeAdHoc was able to counter the attacks launched by a malicious node. Also it is claimed by the authors that the network performance of proposed secure framework, FBeeAdHoc, is approximately the same as compared to non-secure BeeAdHoc and better than AODV.

5. Findings and Conclusions

This research work presents the review of literature for the problem of QoS routing in MANETs. Several research works are reviewed and the findings are listed below.

(i) Among the proactive routing and reactive routing strategies, reactive routing is more suitable for QoS provisioning in MANETs.

(ii) Performance metrics such as packet delivery ratio, throughput, packets drop, delay, latency and energy consumption are the metrics for ensuring QoS in MANETs.

(iii) Congestion control and congestion aware routing protocols are one of the mechanisms for ensuring QoS.

(iv) There is a huge scope of further research by making use of swarm intelligence and machine learning techniques.

Reliable routing, congestion control are the two stringent and thrust research areas for ensuring QoS in MANETs. From this review it is evident that when reliable routing and congestion control are deploying hand – by – hand then QoS is assured in MANETs.

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