QoS frameworks for Multimedia Traffic in Mobile Adhoc Networks: A Comparative Review

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***Abstract*—MANETs (Mobile Adhoc Networks) has gained an increased interest by the research community. Regular intelligent exchanges of multimedia will be typical in MANET, though the extended motivation on QoS (Quality of Service). However, various properties of the discussed QoS framework are provisioned for QoS as a challenging concern. Providing QoS provisioning is, to a great degree, challenging in MANETs in view of bouncing correspondences, center point movability and nonattendance of central coordination. Thus, most of the research has focused on giving QoS guarantees in MANETs coordinating traditions. Though huge numbers of QoS coordinating procedures have been proposed in composing, focusing on different QoS estimations yet none of the prescribed or discussed frameworks achieves a universal course of action. There exist several genuine necessary research areas of focus such as QoS metric assurance and cost limit layout, source level scheduling framework and QoS coordinating. In this paper, working and connecting of various QoS frameworks for MANETs is investigated throughout several veritable focus areas of research. After a comparative review, it is concluded that there is still a good scope of research for proposing a QoS framework for MANETs which could have cross-layer advantages, resource reservation, connection admission control, multi-constrained QoS parameters, hard QoS assurance, proactive routing advantages etc.**

Keywords-MANET; QoS; framework; OLSR; routing protocols; multimedia traffic; admission control; resource reservation

I. INTRODUCTION

The major focus area of research in the field of Mobile Adhoc Networks (MANETs) has been to solve the issues surrounding data exchanges. In recent times, extraordinary extension of two major areas namely MANET routing protocol and QoS have been thoroughly investigated. Various routing methodologies for remote systems, namely DSR (Dynamic Source Routing) and AODV (Adhoc On-demand Distance Vector) uses best effort routing. In this technique all the nodes under certain given degree compete for the common medium. No protections or figures can be given here on when a node is allowed to send, this is sufficient to simply find a course from a source to one or different goals of QoS routing, These routes furthermore need to satisfy at least one QoS impediments. To guarantee these restrictions after a course was found, resource reservations on the taking intrigue hubs are made. Initially, when MANET change started, QoS was not the first priority. That was the reason for best effort routing models became apparent. Gradually, with the development of huge numbers of time-sensitive applications, QoS has become more basic and then ever, prompting to a development of various research excitements from best effort routing to QoS based routing. Other than the quality parameter in MANET, it also assures a testing mechanism. This mechanism is a direct result of the dynamic topology, limited information exchange limit and essentialness basic. MANETs are of need of a gigantic change in the structure; the frameworks which are used for wired networks cannot be mapped completely to MANET framework. The way has to be found by the routing mechanism which satisfies the QoS parameter at the beginning of a session. And this parameter is required to act according to desired output. However, a universally accepted course of action is yet to be described. For comparisons sake, the best metric would be using cross-layer arranges, multi-restrictions routing metric whereas multicast routing based on QoS can be also explored for further future research directions. Though MANET has been making various multimedia exchanges, there exists a vast amount of QoS (Quality of Service) parameters to be considered. Regardless, various characteristics of MANET make QoS provisioning a troublesome issue. As compared to conventional wired networks giving QoS accreditations is incredibly troublesome and testing in MANET, because of multi-hop interchanges, dispute for channel access and several issues such as Node portability. In any case, in the latest several recent years, more research thought has focused on giving QoS guarantees in MANET directing traditions.

II. REVIEW OF QOS ROUTING PROPOSALS

Major and eminent routing algorithms e.g. OLSR (Optimized Link State Routing) [1] and AODV (Adhoc On-demand Distance Vector) protocols have been discussed for QoS provisioning in [4]. This protocol has chief advantages that it detects the accessible situation of the connection. Feasibility to extend the QoS data in protocol form in such a way that the each different hosts thinks about it ahead of time about the nature of the recommended route. Due to the reactive

nature of AODV, it lacks the functionality mentioned above. The OLSR protocol performs the best in high density traffic. Regardless, the best situation is the time when we have a significant number of hosts. Quality metric can be also extended in OLSR Protocol.

As stated in [5 – 7], Novel OLSR (Optimized Link State Routing) is outperformed by OLSR-MD (Minimum Delay) and OLSR-ETX (Estimated Transmission Time). OLSR-MD [5] and OLSR-ETX [5] can be used to overcome drawbacks connected to OLSR (Novel) namely low bandwidth and throughput. The above mentioned protocols have the advantages that they have extended packet size to go with minimum delay that perform better under any given scenario. Apart from default MPR (Multipoint Relay), many similar modifications can be made in OLSR [1]. QoS optimization can be introduced in OLSR routing protocols. Components like grouping might be converged with OLSR compared to preferring MPR. In [9], authors presented an adept metric than the hop distance which states OLSR (Optimized Link State Routing) in terms of QoS. There exist various measurements which are discussed for including QoS parameters in OLSR protocol [2] and exclusively considered metric for MANET, delay and bandwidth criteria as compared to hop distance count algorithm. In like manner, admission control is associated in each MPR. In [10], authors suggested the CAC (Connection Admission Control) – OLSR to ensure all action streams with necessities of QoS. This seems to work especially well for video and voice tjat are just yielded in the mesh system. It has shown that the affirmation control instrument for multi-hop remote work frameworks considering the endorsed standard and the OLSR coordinates tradition. Requirements of QoS which cannot be disregarded such already conceded activity streams. As part of future work, CAC-OLSR will be completed in work switches remembering the true objective to be evaluated in a bona fide framework. Also, adaptability ought to be explored in a circumstance with incalculable hubs and streams, and the segments direct with hub portability. The future work approach may include the channel occupancy metric and estimation criteria.

In [13], authors proposed a Cross-Layer Design (CLD) approach in OLSR protocol with a specific end goal. Proposed here is a strategy in perspective where a cross layer plan is implemented. This is done in order to revamp the whole execution of OLSR [8] by using BER (Bit Error Rate) which is a mix between the association accessibility and breaking point. In the proposed heuristic estimation, the technique is to find the propelled route similarly mostly vital subjective CI (Cumulative Index) and slightest BER with a particular true objective to upgrade working of MPR (Multipoint Relay) assurance count and course computation. A system which is given is directly inbound to OLSR protocol. Here it is not considering Reservation Signaling, Connection Admission Control, stream classifier considerations that are very basics of trade of essential information. Any current QoS structure can be used with the proposed architecture to give outstandingly strict QoS provisioning. In [14], authors presented the strategy which is suggested majorly reflects on upon significance of two differing need levels for development streams: Best Effort Level and other are being High Effort Level. The suggested framework in which a center point can isolate among action streams with different need levels by dispensing them assorted ways towards a similar goal. The approach which is presented, suggests a procedure works with two tables: DRT (Dedicated Routing Table) and SRT (Standard Routing Table) which will redirect the data movement streams. QOLSR (Quality Optimized Link State Routing) which means QoS development of OLSR protocol [2] is considered for alter as opposed to basic OLSR protocol. Proposed arrangement found simply constrained to the QOLSR convention, it's additionally not countering CAC (Connection Admission Control), Reservation Signaling, Stream classifier ideas that are extremely vital for the QoS information exchange. The observations are not contrasted.

In [15], authors found that a perfect way might not always be the shortest or quickest way and considering the system outline, diverse decisions, for instance, a highly dynamic path of huge data transmission might be prevalent intrigue. To get such decisions and upgrade the relative quality between ending customers, makers suggested to execute at each center point an evaluation of the transfer speed tender among each adjacent center point and tends to ensure the decision of a route with the help of each Multi Point Relays which give a greater transmission capacity en route. The transfer speed offer estimation on each association relies on upon the examination of dispute outlines to induce the course of action of maximal cadres. After transmission capacity estimated instead of choosing the congest among the given route, makers endeavor to find the way that ensures the most imperative transfer speed. The discussed arrangement concentrates on data transfer capacity estimation at every hub for discovering high transmission capacity ways, however defer limitation is not considered. Also Reservation Signaling, CAC (Connection Admission Control), Flow classifier which are really important in the given perspective. In [16], authors discussed about coordinating QoS using OLSR (Optimized Link State Routing) by enhancing the MPR (Multipoint Relay) decision criteria. Also QoS focused on end to end delay and effective transmission speed, another figuring has been proposed. Considering the QoS requirements, the proposed figuring picks the perfect route from source to goal. Not under any condition like selecting the MPR considering singular QoS estimations, the figuring considers both effective transmission capacity and ending points postpone through the technique to map them on lone estimations. Different criteria are used to make a lone estimation. The given course of action does not involve CAC (Connection Admission Control), stream separation and reservation signaling thoughts that are uncommonly fundamental for the QoS data trade. In [17], authors proposed QoS with Cross-Layering in terms of the CLQ-OLSR (Cross Layer Quality Optimized Link State Routing) which increases the profitably abusing multi-radio and multi-channel strategy by reinforcing sound correspondence mechanism and steady sight. Authors have arranged two game plans of coordinating segments: physically changed M-OLSR (Physical Modified Optimized Link State Routing) [17] and predictable controlling, to suit organize development.

None of the above recommendations oversee stipulation of advantages, channel resources and cross layering outline for

MANETs. So it is indeed requirement of QoS structure that can be effectively relevant to whichever convention and additionally gives QoS parts like cross layering, stream classifier, reservation signaling, and connection admission control and so on.

III. REVIEW OF QOS FRAMEWORK PROPOSALS

The versatility associated with MANET also increases the viabilities such as continually hinting at a topology level, stumpy medium nature. Contradictory to this, the target applications where MANETs are desired to acknowledge will have high relevance (e.g. military applications, emergency networks, several commercial applications, academics applications etc.). All of these have an incredibly strict need of quality media. It is this need and requirement which lets the QoS parameters and frameworks as the most desired in MANET. Complexities are truly subject to unremitting changes and assortments in order to oversee QoS as per following:

- In customary wired systems, wired connection limit is constant. While if there should arise an occurrence of MANET remote connection limit not at all steady among hubs. It is fluctuating along time in view of incessant alter in physical layer (e.g. because of versatility, updates in neighborhood situations). Presently as QoS related real world applications requires some amount of guaranteed data transfer capacity for transferring data (e.g. to get postpone or transfer speed imperatives), that can bring about brief administration interference for QoS applications.
- In MANETs, remote mobile nodes go after assets with their neighbor hubs. So multi-hop correspondence which is regularly utilized for broadcasting as a part of MANETs will expend a great deal more accessible system limit that in the customary wired system.
- In MANETs, the portability of nodes likewise includes and facilitate many-sided quality at the directing layer. Here alongside the issue of varieties in the accessible transmission capacity, there are different issues also like if there should arise an occurrence of connection breakages information ought to be rerouted through different ways. QoS applications running on the system is needed at a specific QoS level (e.g. distinct postponement or transfer speed imperatives), information ought to be rerouted in a very much coordinated way and additionally it ought to take after same transmission capacity prerequisites concurred at the beginning application time.

It is possible that QoS in MANETs needs data transfer capacity accessible at one moment, while a moment later it may be unrealistic for the system to offer the required measure of transmission capacity. Accordingly, congestion may happen effortlessly which can bring about additional bundle misfortune due to end to end delays. Any arrangement characterized will by one means or another requirement to think these challenges into the record.

In [18], authors proposed the INSIGNIA (In-band Signaling with Admission Control) framework which is an IP-based behavior of central structure which sponsorships adaptable administration ways in MANET have been talked about by creators which shown the blueprint, use, and evaluation of INSIGNIA [18]. A framework relies on upon an in-band hailing and sensitive state resource organization way which is suitable for supporting adaptability and ending point nature of organization in significantly active circumstances where a system topology, center point accessibility, and ending points QoS is time variant. Creators in like manner gave organize layer game plan which is free of the MAC (Medium Access Control) layer. The hailing information related to the QoS framework is typified in data groups, making this technique basic and "lightweight". In any case, the key drawback of suggestion is it's created explicitly for static adhoc networks with no flexibility and it is not oversee reservation of advantages. In [19], authors have suggested the instigated approach SWAN (Service Differentiation in Stateless Wireless Adhoc Networks) where a stateless system demonstrate that involves disseminated control computations to pass on organization division in flexible remote exceptionally selected systems in a direct, versatile and lively way. They have used rate regulation for TCP (Transmission Control Protocol) and UDP (User Datagram Protocol) best-effort movement, and source based confirmation control of UDP steady action. SWAN [19] uses unambiguous stop up the notice to dynamically coordinate surrendered continuous action despite system stream brought on by adaptability or development overweight conditions. A novel piece of SWAN is that it needn't bother with the assistance of a QoS-skilled MAC. Then again perhaps, sensitive steady organizations are built using obtainable best effort distant MAC development. SWAN uses cross layering arrangement that utilizes system and connection layers data and it depends on DiffServ thought of conventional wired systems. The fundamental issue of SWAN is that it is not managing reservation of assets that is really a pivotal part of QoS related steering.

In [20], authors proposed to keep QoS a logically developing in MANETs. As the huge amount of data is transferred and progressing through various applications during the transmission. A MANET is a connection-less system in which the parameters like limited amount of resources, flexibility which impacts QoS. As a reply, PRTMAC (Proactive Real Time Medium Access Control) was presented [20] tradition which somehow assures to provide QoS to the extent delay, throughput. It also does support QoS with benefit reservation instrument. Once the advantages are spared, center points get tip top access on the benefit. Proposed strategy concentrates on extremely specific MAC conventions. So it would require significant changes if there should be an occurrence of applying it on other directing conventions. In [11] another QoS structure was proposed named BRAWN (Bandwidth Reservation over Adhoc Network). The discussed idea is to permit end to end reservation of data transfer capacity in a specially appointed remote system. Reservation of resources is on demand, at any given point of time an end node begins an application with particular need of QoS, this application should team up with the reservation flagging module. Also the prescribed inward design of the given system known as BRAWN [11] has connections between the diverse

modules for setting up a QoS parameter. As seen with several applications QoS requests know about the operation of the convention and demand the assets through the Reservation Signaling module.

Basic Constraints faced in BRAWN (Bandwidth Reservation over Adhoc Network):

- Due to the primary nature of BRAWN design, it focuses only on Adhoc Networks. Mobility and versatility challenges are not covered. So portability should be tended to. But as we go along, "mobility" will present a few new difficulties for BRAWN that we should manage fittingly. It is because of the fact that the always showing signs of change system topology may bring about varieties of the accessible transfer speed or surprisingly more terrible there is the likelihood that a connection breaks influences at least one QoS routes.
- BRAWN works absolutely on the network layer, with the goal that we could not have the capacity to exploit the data from the lower layers. So cross-layer configuration could be proposed for in any event data trade between MAC (Medium Access Control) layer and Network layers.
- Up gradations of Internal working of Resource Reservation and Admission Control can be performed.
- Compared to MAC (Medium Access Control) using RTS (Request To Send) / CTS (Clear To Send), Pure CSMA (Carrier Sense Multiple Access) protocol is used which eases the various computations and bandwidth estimations.
- Also, in-band signaling protocol as an alternative can be used for the explicitly signal out-bands reservation.

IV. A COMPARATIVE REVIEW OF QOS FRAMEWORKS

Table I shows the most popular QoS design frameworks and their comparative review for QoS in MANETs. Table I shows the details, review points and scope of improvement for each respective QoS framework. From Table I, it is easy to understand that no particular QoS framework is capable of fully assuring today's real/non real time multimedia traffic flows in MANET. So as a future work, a QoS framework for MANET should be proposed by considering factors like cross-layer advantages, resource reservation, connection admission control (CAC), multi-constrained QoS parameters, hard QoS assurance and proactive routing advantages. The following observations are made after careful review of each framework. Authors also believe that following observations are important for further research to design a new QoS framework specifically for multimedia traffic in MANET.

- INSIGNIA can be extended for mobility issue in MANET. In order to tackle multimedia traffic handsomely some features e.g resource reservation, CAC could be added further in future work.
- SWAN is basically a cross layer design which can be extended further by incorporating it with proactive routing protocol (e.g. OLSR) to get maximum benefit of cross-layered information and to support multi-constrained QoS parameters. Also resource reservation, CAC could be added further.
- PRTMAC can be improved further by incorporating it with network layer. It can also been incorporated with proactive routing protocol.
- BRAWN can be worked on in future for dynamic mobile network (mobility) as it is just proposed and fitted for the static networks. There is no arrangement for checking delay estimation. It is single constraint architecture; not a multi-constraint one. It can be likewise improved for versatility perspective too. So there is a decent extent of research for amplifying its segments for offering almost hard QoS ensures in MANET where nodes are widespread or versatile.

TABLE I. A COMPARATIVE REVIEW OF QOS FRAMEWORKS

QoS Framework	Features	Review Points	Scope of Improvement
In-band signaling support for QoS in mobile ad-hoc networks (INSIGNIA) [18]	Network layer arrangement or Independent of the MAC layer with the QoS component is embodied in information parcels, making it easy, simple and also lightweight	1. Designed explicitly for Adhoc Wireless Networks 2. Reservation of resources or mobility issues are not considered	It can be extended for mobility and resource reservation
Stateless Wireless Ad Hoc Networks (SWAN) [19]	Cross-layer Solution (Network and Link Layers). It is based on the DiffServ idea	Reservation of resources is not considered	It can be extended for mobility and resource reservation
Proactive Real-time MAC (PRTMAC) [20]	Focused on very particular MAC protocols	Reservation of resources is not considered	It can be extended for any routing based (network layer) protocol
Bandwidth Reservation for Ad-Hoc Wireless Networks (BRAWN) [11]	Reservation Signaling Module/ Connection Admission Control/ End-to-end reservation of bandwidth/ CAC prevents congestion in the network	1. Best suited for multimedia traffic where QoS is very important criteria 2. Best suited for OLSR integration 3. It does not support multi-constraint QoS parameters	Mobility and Scalability can be also analyzed. Cross layering can be added further. It can be also extended for multi-constraint QoS parameters

V. CONCLUSION

The objective of this paper is to review the currently well-known QoS routing mechanisms/architectures and QoS

frameworks specifically for multimedia traffic in MANETs. Two broad categories of QoS solutions are reviewed. First the QoS solutions which are specifically depended on routing protocol in terms of new hop selection based on the QoS parameters. Then, QoS solutions provided by some specific design frameworks with integration of various modules and applicable on any routing protocol with minor changes. After a comparative review of various QoS frameworks, it is concluded that there is still a good scope of research for proposing a QoS framework for MANETs (specifically for multimedia traffic) which could have cross-layer advantages, resource reservation, connection admission control, multi-constrained QoS parameters, hard QoS assurance, proactive routing advantages etc. As a future work, one should focuse on designing a QoS framework for multimedia traffic in MANETs by exploiting cross-layering (network and data-link layer information exchange) and use of proactive routing protocol (e.g. OLSR) with resource reservation and connection admission as a separate modules. Along with this, flow classifier can be also added to classify non-multimedia and multimedia data from application layer itself.

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