International Journal for Research in Engineering Application & Management (IJREAM)
ISSN : 2454-9150 Vol-04, Issue-12, Mar 2019

QoS management with multipath, preemption and priority queue in MANET

Sourabh Singh Verma, Assistant Professor, SET, Mody University of Science and Technology, Lachmangarh, India. ssverma80@gmail.com

Dr. R. B. Patel, Professor, Dept. of Computer Science & Engineering, National Institute of Technology, Uttarakhand, India. rbpatel@nituk.ac.in

Dr. A. K. Dahiya, HoD - IT & Professor – CSE, Faculty of Information Technology, DIT University, Dehradun, India. dahiyaanil@yahoo.com

Abstract **Quality of Service (QoS) is a challenging task to maintain in MANET. Due to frequent route breakup in MANET, there will be extra overhead to rediscover the paths. Such route breakup and limited bandwidth capacity of wireless links makes it typical to maintain QoS for some application. Multimedia applications required real flows which are currently on high demand and thus potentially required in Mobile Ad-hoc networks (MANET).**

As MANET uses mobile nodes, so topologies are not volatile and also it does not use any fixed infrastructure. In addition to this freedom of movements will introduce various challenges in itself. Providing QoS in MANET is a challenging task as MANET has its own properties of broadcasting and mobility. We can broadly categorized flows into two categories. One is the real-flow such as multimedia traffic and another one is best effort traffic. Best-effort flow does not have any reservation of resources, while on the other hand real-flow required some of the resources to be booked like bandwidth, buffer etc.

To maintain QoS we are proposing "QoS management with Multipath, Preemption and Priority queue (QMPP)". QMPP model incorporate multipath route maintenance with preemption and modified priority queue.

***Keywords* — QoS, MANET, buffer, dynamic queue, multipath, preemption**

I. INTRODUCTION

MANET is a network with no central server each node is supplied with the transmitter and receiver. Thus MANET is generally known as an infrastructure less network, each node is allowed to move in random direction. For communication between two nodes path required multi-hope configuration. With the growing demand of multimedia applications, there is requirement to maintain QoS of flows that are routing real traffic. Generally, a network's QoS can be measured in terms of the amount of successful data transfers from one node to another during a unit of time. Different applications have different QoS requirements for example popular applications like Streaming Video, Video conferencing, E-mail, and voice. All of them have required different delay tolerance and bandwidth. Handling of such QoS sensitive flows is a challenging task in MANET due to wireless and mobile nodes communication. Most of the basic routing protocol including AODV[1],ZRP[2],DSR[3] are not able to provide QoS support as they does not differentiate between the real-traffic and best-effort traffic. For real traffic communication a path must satisfy QoS requirements [4]. So it can be easily concluded that such basic routing protocols are not feasible for Real-Time communications.

A real application flow required to reserved bandwidth from source to destination. If bandwidth is not available than such flows need to starve or may be redirected from longer path, which may ultimately increase delay in communication. In our proposed protocol we believe that bandwidth reservation will not only solve the issue but we must add some more constraints such as preemption and advanced priority Queue with multipath route maintenance. We are proposing "QoS management with Multipath, Preemption and Priority queue (QMPP)". Which will ensures QoS management for high priority real flow.

Considering real flows and QoS requirement, QMPP is useful to provide a very responsive path discovery to high priority real flows. As Route Discovery packets RREQ (Route Request) of such flows are treated differently and with higher consideration. Additionally path of such flows are guaranteed to be provided with shortest path as we are also considering preemption of any less priority flows.

 DOI : 10.18231/2454-9150.2019.0166

Its advance priority Queue will take care to drop the real packets as least as possible even in the most complicated situation like buffer over flown.

QMPP will take care to maintain QoS for real flows by providing least packet drop and by providing least starvation for the flows. It also considers multiple path maintenance so that in route breakage a new path can be considered without delay.

Section 2 will give a brief literature survey and background for QMPP. Section 3 will be an explanation for QMPP. Section 4 will highlights the comparisons and result discussion of QMPP with QSMP[5](QoS sensitive Multi-Constraints protocol). Finally, concluding remarks in Section 5.

II. Literature Survey

Some flows in the network are required to be treated specially, as they required guaranteed delivery and needs a level of quality of Service. Real flows such as multimedia traffic requires reserving resources such as bandwidth, buffers etc. Since now many protocols has been proposed that maintains QoS in same specific way.

Let us start from some early models like as Integrated Services IntServ [6] and Differentiated Services (DS) [7]. Differentiated Services helps to map many flows into some service class, but it is not suitable for MANET as it requires boundary nodes to classify the traffic. Virtual paths are used to setup in IntServ by using primary signaling protocols known as Reservation Protocol RSVP[8] but it too can't be implemented with MANET as IntServe is not scalable because MANET don't have any fixed topology. A mix model of both is presented in [9]. It integrates the DS's traffic classes and with IntServe's granularity. Hence it is hybrid model. But this model lacks in providing QoS as it does not provide resource reservations.

Qos is analyzed with dynamic flows [10], also some extract a core in the network, which is a subset of some nodes in the network as in and CEDAR [11]. Such core extraction adds overhead to the network and thus requires resources and time. Each core nodes requires maintaining the local topology in its domain. If the network is large, than finding such core nodes become more crucial.

End-to-end paths estimation are done in CASMA [12] and EERV[13] for maintaining the performance for any flow. Similarly a queue management model such as RFDQ[14,] is proposed which modify priority queue to retain high priority to real packet and also it takes care to handle least possible dropping for real flow traffic, other queuing model as in [15],raise priority on application basis and Time To Live(TTL). Few works on urgency-centered Packet Scheduling as in [16] and monitored with real flows[17], Load distribution is done in[18] so that QoS required data can be transmitted in congestion free environment. But all these schemes do not reserve bandwidth to provide QoS for real traffic such as multimedia. Also QoS is greatly hampered due to various attacks from malicious attacks.[ict-springer,]

In [19] MMQARP to maintain the performance, it consider paths by considering reliable and energy efficient links. But it too does not provide any preemption and reservation of resources.

III. QoS Management with Multipath, Preemption and Priority Queue (QMPP)

Firstly we would like to give a brief about the schemes involves in QMPP to improve the performance of the network. QMPP will use MMQARP for finding the reliable core within the network. It will use AQR[20] for bandwidth estimation on each node to know availability of bandwidth, and then further to reserve it. It will apply preemption process as used in QSMP[5] to preempt any low priority flow. And then provide the route to higher priority real flows. It will improve priority queue by giving more importance to the packets that belongs to real-traffic. It also guarantees for the least packet dropping of such flows.

Considering all these we are proposing QMPP. QMPP steps can be described as:-

a) Source broadcast request packet RREQ for searching a path. We have added same fields in RREQ packet structure; these are required bandwidth, threshold delay, real flow indicator and maximum number of hopes. QMPP will try to use core nodes as much as possible to connect the source with the destination. Using core nodes will ensure less route breakup and better performance.

b) At each node required bandwidth is compared with available bandwidth (using AQR), if available than RREQ broadcasted as like in AODV. While on the other hand if bandwidth is not available than priority of requested flow is compared with already occupied flows. If newly requested flow's priority is higher than occupied flows than RREQ is forwarded further while a cache is maintained with the name of flow that will be preempted when first data packet is received.

c) Destination will send the route reply RREP packet back to the source. Source may receive multiple RREP as it is maintain multiple paths to the destination. It will select the path will least delay and with least preemptions.

d) On receiving data each node in the network checks that received packet is real packet or not. If it is real packet then it is placed at the top of the queue. After adding it at the top, it verifies the queue size. If queue size is larger than maximum size, then, it will look-up in the queue and drop any such packet that is not the part of any real flows, if no such packet found then last packet is dropped.

 DOI : 10.18231/2454-9150.2019.0166

ISSN : 2454-9150 Vol-04, Issue-12, Mar 2019

IV. ALGORITHM QMPP

a) Find if available Bandwidth (AB)>= required Bandwidth(RB) is then
 Update available bandwidth: AB=AB-RB
 else
 Find flow with lesser priority than requested flows.
 Record($flow_{preempted}$)
 If no such flow exists than drop RREQ else forward it

b) At source select the RREP with:
 i) Least delay
 ii) Shortest path
 iii) Least preemptions

c) On receiving a packet *Pi* each node will do:-

i) Verify received packet is a part of real packet or not

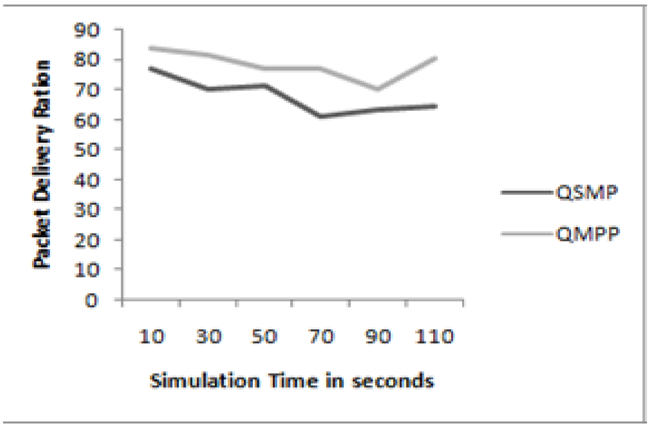
ii) It add data packet *Pi* at *queuehead* (*Pi*)
 If (*queue>maxsize*) than drop a packet P_{nr} which is not part of real traffic. *Drop*(P_{nr})

V. ASSESSING QMPP

For evaluating it we have used NS2 as a simulator, following parameter is set to evaluate it:

Packet size	512
Transport layer	UDP
Traffic	CBR
CBR rate	.10
Simulation time	variable
Routing protocol	QSMP (with AQR and MMQARP), QMPP
Queue Size	50

For evaluating QMPP end-to-end delay and packet delivery is considered. Here comparisons are done between QSMP and QMPP, as QSMP is added with modified priority queue its performance result is better than QSMP. The result in figure shows QMPP more promising in terms of packet delivery ratio as well as end to end delay.



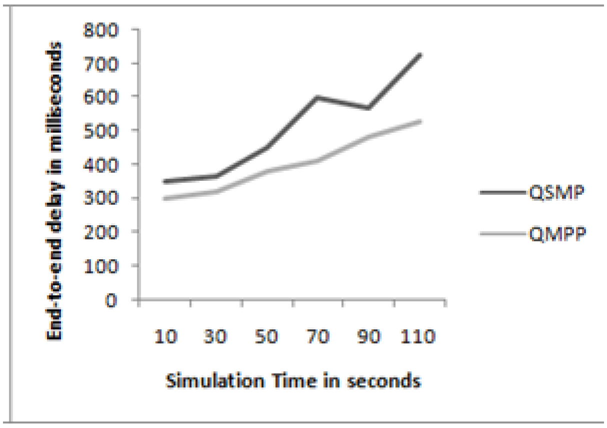


Figure1. Assessing QMPP using Packet Delivery ratio and end-to-end delivery as metrics.

VI. CONCLUSION

Real-time data is an important communication in the network. It needs strict QoS considerations otherwise data will be of no use. To achieve this we have proposed QMPP. QMPP is compared with QSMP that follows various constraints. Our experiment proves that QMPP is better in packet delivery fraction as well as it has lesser average delay. As it also modify the in-built priority queue of a network. It also considers the shortest path for high priority real flows and takes care to drop real packet in least possible situation.

REFERENCES

[1] C. Perkins and E.M. Royer, "ad hoc on demand distance vector (AODV) routing" (Internet draft), August 1998.

[2] Z. J. Haas,"A new routing protocol for the reconfigurable wireless networks", Universal Personal Communications Record, 1997. Conference Record., 1997 IEEE.

[3] David B. Johnson, David A. Maltz, v "The Dynamic Source Routing Protocol for Mobile Ad Hoc Networks (DSR)", draft-ietf-manet-dsr-09. txt, 2003.

[4] Wireless Networks", In IETF Internet Draft, march 2003. David Espes and Zoubir Mammeri, "Routing Algorithm to Increase Throughput in Ad hoc Networks", Proceedings of the International Conference on Networking IEEE ICNICONSMCL'06 2006.

[5] S.S.Verma, R.B.Patel, Anil Kumar, "QoS sensitive Multiple Constraints Protocol(QSMP)". (in print), Sylwan journal(ISSN: 0039-7660),vol160,issue3,2015

[6]. R. Braden, D. Clark, and S. Shenker. "Integrated services in the Internet architecture:an overview." Technical Report 1633, 1994.

[7]. D. Black. "Differentiated services", 2000. RFC2475.

[8]. Paul P. White. RSVP and integrated services: a tutorial. 1997.

 DOI : 10.18231/2454-9150.2019.0166

[9]Xiao, H.; Seah, W.G.; Lo, A. & Chua, K.C. (2000). A Flexible Quality of Service Model for Mobile Ad-hoc Networks (FQMM), Proceedings of IEEE Vehicular Technology Conference (VTC 2000-Spring), Vol. 1, No.4, ISBN: 0-7803-5718-3, Tokyo, May 2000.

[10] Sourabh Singh Verma, R.B.Patel, Anil Kumar "QoS Oriented Dynamic Flow Preemption (DFP) in MANET", accepted in Journal of Information and Optimization Sciences,Tayler and Francis, Volume 39, 2018 - Issue 1.

[11]R. P.Sinha and V.Bharghavan(1999).`Cedar: Core extraction distributed ad hoc routing', IEEE INFOCOM'99

[12] Ghalem Boudour ,Zoubir Mammeri ,CédricTeyssié (2010) 'End-to-end bandwidth allocation scheme for voice traffic support over MANETs', Springer science+Business Media, LLC.

[13] Sridhar K.N. and Mun Choon Chan, "Channel Aware Packet Scheduling for Manets (CaSMA)". IEEE, 2008

[14] Sourabh Singh Verma, R.B.Patel, S. k. Lenka " Analyzing varying rate flood attack on real flow in MANET and solution proposal "Real Flow Dynamic Queue (RFDQ)" International Journal of Information and Communication Technology, Inderscience(Scopus, ACM & Elsevier compundex). Vol. 10, No. 3, 2017, pp 276-286

[15] Sotirios-Angelos Lenas, Stylianos Dimitriou, FaniTsapeli, Vassilis Tsaoussidis(2011). 'Queue Management Architecture for Delay Tolerant Networking', Wired/Wireless InternetCommunications,Volume 6649, 2011, pp. 470-482.

[16] Hyunchul Joo, Ki Jin An, and Hwangjun Song(2011). Urgency-Based Packet Scheduling And Routing Algorithms For Video Transmission Over Manets, CCWMC.

[17] Sourabh Singh Verma, R.B.Patel, Anil Kumar "Analyzing Real Flows Performance in MANET using Dynamic Queue", accepted in Journal of Information and Optimization Sciences, Tayler and Francis, Volume 38, 2017 - Issue 6

[18] SivaKumar, P.; Duraiswamy, K. (2010).`A QoS routing protocol for mobile ad hoc networks based on the load distribution', IEEE International Conference on Computational Intelligence and Computing Research (ICCIC).

[19] Mamatha Balachandra, K. V. Prema(2014).`Multiconstrained and multipath QoS aware routing protocol for MANETs',Wireless Networks volume 20 issue8

[20] Q. Xue and A. Ganz(2003), `ad hoc qos on-demand routing (aqr) in mobile ad hoc etworks'.Journal of parallel and distributed computing.

 DOI : 10.18231/2454-9150.2019.0166