IOSR Journal of Engineering (IOSRJEN) **www.iosrjen.org**
ISSN (e): 2250-3021, ISSN (p): 2278-8719
Vol. 08, Issue 11 (November. 2018), ||V (III) || PP 67-71

Improvement in Quality of Service (QoS) within VANETs: A Survey

Mr Amol S. Dudhe[1], Dr Salim Y. Amdani[2]
[1]Department of Information Technology BabasahebNaik College of Engineering Pusad, India
[2]Department of Computer Science &Engg BabasahebNaik College of Engineering Pusad, India

Abstract: VANETs have gained great focus among the researchers since last few decades. The areas of great interest are the types of routing, and quality of service (Qos). The main challenge is to find the ways to counter the continuously changing VANETs topologies and its high speed nature, and then determining which routing protocols are best suited for a particular transmission type; and which ones provide more consistent and stable routing performances. Due to special characteristics of VANETs, QoS (Quality of Service) provisioning in these networks is a challenging task. QoS is the capability of a network for providing superior service to a selected network traffic over various heterogeneous technologies. In this paper we present an overview of Vehicular Networks,QoS Concepts, QoS challenges in VANETs and approaches which aim to enhance the Quality of Service in Vehicular Networks.

Index Terms: VANET, Vehicular Networks, Quality of Service (QoS), Delay, Packet loss, Throughput

I. INTRODUCTION

Traffic safety is a major challenge recognized by the major players in the automotive industry and by many governments. According to which each year thousands of road accidents are reported in any country. Traffic accidents are most of the times a result of the driver's failure to access quickly and correctly the driving conditions. Normally drivers have imperfect information about road situations, speed and position of vehicles around them and usually are compelled to make decisions like breaking and lane changing without the benefit of whole data. "The need for communication when the deployment of any fixed infrastructure is impossible and the advancement of computer and wireless communication technologies, led to the development of Mobile Ad-hoc Networks (MANETs)" [7]. MANETs are kinds of wireless networks which are self-configuring and infrastructure-less. Nodes are connected together without any fixed topology and each device in MANET is free to move independently in any direction, and will therefore change its links to other devices repeatedly. All nodes that take part in such a networks must forward the traffic unrelated to its own use, and play the role of a router. During the last years, researchersawarded a great interest to the deployment of MANETs to improve road safety, then, and as a result, Vehicular Ad-hoc Networks emerged [7]. Vehicular Ad-hoc Networks as a subset of Mobile Ad-hoc Networks which provide data exchange via Vehicle-to-Vehicle (V2V), Vehicle to Roadsides (V2R) and Vehicle to Infrastructure (V2I) communications and a car which takes part in such a network is equipped with a WLAN and cellular communication device [9]. VANETs is also defined as a wireless communication technology which is also able to enhance driving safety and velocity by exchanging real-time transportation information, and "it should upon implementation, collect and distribute safetyinformation to massively reduce the number of accidents by warning drivers about the dangerbefore they actually face it" [8]. In addition, VANETs are also able to minimize incidents andimprove traffic conditions by providing vehicles, drivers and passengers with information aboutthe road condition. VANET has its own unique characteristics when compared with other typesof MANETs, the unique characteristics of VANET include: predictable mobility, lack of powers constraints, variable network density, Rapid changes in network topology, High computational ability and large scale networking [11].

Safety services information such as traffic accidents androad congestion which are sensitive to reliable and real-timecommunication should be broadcasted immediately. Datatransmission in such environment is critical and has to bedistributed in multiple paths to improve the end-to-end delay.Some stale routes are generated in the routing table which leadsto unnecessary routing overhead causing frequent link failures aswell as route discoveries. Therefore the discovered routebetween couple of vehicles should be as stable as possible tosatisfy QoS requirements.[1]A critical component in providing QoS support in VANETSis the routing algorithm [7]. The chosen routing algorithm mustdiscover and reserve routes that meet certain constraints betweensource vehicles and destination vehicle. In addition, such routesmust be as stable and reliable as possible in order to satisfy thestringent requirements of QoS and real-time safety applicationsin VANET. The actual QoS constraints that ought to be met aredelay, bit error rate, bandwidth, route duration etc, in addition toVANET specific requirements like route stability and routereliability. Providing end-to-end QoS support guarantee for realtimetraffic data in VANET is even more challenging [7, 8],because in a high speed mobility context. Thus, multiple nodescontend for a common channel which make many data packetsto be lost and the failure notifications together with the overheaddue to route repairs increase significantly. In an effort to reducethe number of re-transmission of packets, several research worksthat were initially designed for mobile ad-hoc networks(MANET) are modified to suit VANET. However, VANETperform in different approach which dominate the MANETresearch because of the high speeds, driver behavior as well asmobility constraints. These features make the existing clusteringalgorithms for MANET unsuitable and stable for vehicularnetworks. The intermittent nature and short-live of thesealgorithms, make the created clusters to provide scalability withlower communication overhead.[1]

II. QUALITY OF SERVICE

Quality of Service (QoS) is the abilityof a network to provide improved serviceto selected network traffic over variousunderlying technologies, including framerelay, ATM, Ethernet, SONET, and IP-routednetworks and offers flexibility, scalability,efficiency, adaptability, software reusability, andmaintainability. "QoS is also defined as a set ofservice requirements that needs to be met bythe network while transporting a packet streamfrom a source to its destination" [4], in fact itis the measure of how satisfying a service is aspresented to the end-user. QoS provisioning often needs negotiation between host and network, call admission control, resource reservation, and priority scheduling of packets [13]. QoS can be rendered in network thorough several ways: per flow, per link, or per node. In particular, QoS features provide improved and more predictablenetwork service by supporting dedicated bandwidth, improving loss characteristics, avoiding and managing network congestion, network traffic shaping, and Setting traffic priorities across the network [14].

As it is mentioned, QoS is quantitatively defined in terms of guarantees or bounds on certain network performance parameters. The most important performance parameters are the bandwidth, delay, jitter, and packet loss. The term bandwidth describes the size of the pipe that an application program needs in order to communicate over the network. The channel bandwidth determines the channel capacity, which is the maximum information rate that can be transmitted [15]. The delay of a network specifies how long it takes for a bit of data to travel across the network from source to destination. It is typically calculated in multiples or fractions of seconds. Jitter is defined as a variation in delay of received packets. The sending side transmits packets in continues stream and spaces them evenly apart. "Because of network congestion,improper queuing, or configuration errors, the delay between packets can vary instead of remaining constant" [16]. Packet loss is one of the other important QoS parameters. Actually there are some applications which may not function perfectly, or may not work at all, when the packet loss rate is high. For instance, when streaming video frames, after certain number of lost frames, the video streaming may become useless, this number may be zero in certain cases, therefore, certain guarantees on the number of rate of lost packets may be required by certain applications for QoS to be considered. Packet loss can occur because of packet drops at congestion points when the number of packets arriving significantlyexceeds the size of the queue. Corrupt packets on the transmission wire can also cause packet loss[15]. Providing QoS support in ad-hoc networks is a dynamic research area. VANETs have certain unique characteristics that facade several intricacy in QoS provisioning. The characteristics that affect QoS provisioning in these kinds of networks are: dynamic varying network topology, inaccurate state information, lack of central coordination, error prone shared radio channel, hidden terminal problem, limited resource availability and insecure medium [13]. Thereare several approaches in literature speciallydesigned for providing QoS in MANETs butcould not be used in VANETs, because they do not

consider the high mobility constraints, large scalenode population and large scale networking inurban areas [17]. QoS parameters such as packetloss, throughput, jitter and latency are the mainrequirements in vehicular communications. Each application in VANETs has its own requirements,for example; safety warning applications should have minimum End to End (E2E) delay, becauseif a warning message receives at destination with high delay, that message could not be helpful forpreventing an accident. Accordingly, packet loss and throughput are two other factors that are veryimportant in active safety applications [12].

A. Improving QoS in VANET Using MPLS

Authors in [12] investigated Multiprotocol Label Switching (MPLS) in a roadside network to improve overall QoS ofVANET. This approach is useful for sound andvideo transportation in VANETs, which willbe the most important applications of VANETsin near future. MPLS is a forwarding methodwhich can assign packets to different forwardingequivalent class (FEC) for receiving the requiredservice from the network to support QoS. MPLSis considered as layer 2.5 protocol [18] and itis compatible with any layer 2 technology, likeEthernet and ATM. Moreover, MPLS directsdata from one network node to the next, basedon short path labels rather than long networkaddresses, avoiding complex lookups in a routingtable. Using MPLS in communication networksprovides many advantages such as faster routing, providing better QoSand traffic engineering. However, MPLS is asuitable technology for communication networkswith fixed nodes and infrastructure, thereforeMPLS has its overhead for the wireless nodesin VANETs that move with fast speed more than100 Km/h. Utilizing MPLS in wireless nodes thatare vehicles in VANET for V2V communicationmay not have positive effect on QoS parameterslike E2E delay, because negative effects of MPLSoverhead on QoS may be more than MPLSbenefits for it.Therefore, in [12] vehicular communicationsare divided into two categories; Vehicular Ad-hocNetworks which includes V2V communicationsand a Roadside Network which consists of Roadside Access Network (RAN) and Roadside Backbone Network (RBN). RAN enables the V2I communications and RBN represents thebackbone network of RSUs, in which RSUs communicate with each other [18]. In this paper it is assumed that each vehicle is covered by a base station, which has its own domain of service, and base stations are connected with a wired network named RBN and MPLS is enabled in the wired backbone network (Fig. 3. shows the proposed architecture in [12]. As we mentioned, there are two types of communications in this work: V2V and cell-based communications. V2V ad-hoc communications is done by usingAODV routing protocol internally in VANET [18] and the cell-based communications which transmits packets to other base stations and vehicles by using the MPLS enabled RBN. The hypothesis is that, if vehicles send their data through the base stations (the wired infrastructure- RBN), it is possible to gain higher QoS than V2V ad-hoc communication. Finally authors used SUMO [12] to design Manhattan mobility model and then they exported the output of SUMO to NS2.34 for the main test. Results show that in comparison to AODV (for V2V ad-hoc communications), the MPLS enabled road side backbone network provides better QoS in terms of E2E delay, packet loss and throughput.

B.Improving QoS in VANET Using TDMA-based routing scenario

Researchers in [1]considermoving vehicles in a city area connected via highway to showthe impact on the performance of the routing algorithm. The gridarea of the city differs from each other with the number ofmoving with an average speed. Vehicles rely on multi-hop ad-hoc fashion to deliver the data packages especially when they arenot in proximity with each other. In their proposed scenario, theexchange of information is among the vehicle as there are noroad side units (RSU). The density of the network is an importantfactor in communication in VANETs. In order to perform multihopcommunication in timely fashion, the network of vehicleshould have a certain amount of density. The minimum level ofdensity required for communication is dependent on the wirelesscommunication range, and varies in different environments. Theyconcentrate on the problem of transmission of realtimetraffic information for V2V communications in a denseenvironment without deploying roadside infrastructure.flooding of the packets in the network. The clustering approachconsiders mobility aspect of vehicle to increases the routestability, and reduces the amount of routing control overhead.This could be feasible because vehicles moving in the samedirection shall express the same speeds and moving patternswhich relatively leads to stable network topology [2].

Researchers in [1] have analyzed that the percentage of the packets loss increases as the traffic load increases, as a result of high packetcollisions particularly when density gets higher. This indicatesthat in a high dense traffic, the normal scenario receives noguaranteed QoS because of the high loss rate. In TDMA only onepair of sender and receiver is active, thus collisions are alwaysavoided. The vehicle head move faster than the behind ones inorder to find an alternative route when the link to the secondvehicle breaks, especially in a high speeds. The proposed DMAscheme obtained relatively low packet loss when the time slotsare sufficient as compared to the normal scenario whichexperiences a sudden increase in packet loss. This is becauseincrease in traffic load results in increase in the contention forchannel access and more collisions are likely to occur. Thisindicates that the TDMA-based scenario performs better with asmuch as 75% decrease compared to the normal scenario.

C. Utilizing Mobile IP and MPLS to ImproveQoS in VANET

Mobile IP is the running standard for supporting IP mobility of mobile nodes in the wireless networks with infrastructure. Moreover, Mobile IP enables the mobile node to access internet and changes its access point without losing the connection [13]. Mobile node (MN), Home Agent (HA), Foreign Agent (FA) and Care-of-Address (CoA) are the main components of Mobile IP. When the MN moves away from HA to the foreign network, a CoA is assigned to it in order to inform the HA of its current location.This operation enables MN to send and receive at any location without going through HA. In the last section we discussed about using MPLS in a wired backbone network and the results showed that an MPLS based roadside backbone network improves QoS. In order to connect movingvehicles to the infrastructure, which can be an Internet router, packets must have address that is valid for both wired network and also Ad hoc network of vehicles. When a vehicle moves far from the coverage area of itsaccess point or base station, to be able to send and receive packets of Internet server to/from it, packets should be addressed dynamically. The mobile node in VANET which is a vehicle should be in the coverage range of Mobile IP base station and must be connected to it directly. Therefore authors in [14] integrate VANET with QoS support using MPLS for forwarding (which is proposed in [12] and Mobile IP for continuous connection between vehicles and base stations. Simulating the proposed idea, 3 methods are compared in terms of throughput, packet loss and delay. In the first method, packets are sent by source nodes to the destination vehicles or base stations in a completely wireless mode throughbase stations and vehicles by using AODV routing protocol. The second method, which is proposedin [12], base stations are connected through an MPLS enabled wired backbone network and in the third method, the wired backbone network is used with MPLS, and Mobile IP is enabled on each node to have stable connection for mobile nodes. Although using Mobile IP instead of static addressing imposes overhead for network, but packet loss and throughput of network is improved. The achieved results show that in comparison to MPLS enabled scenario in [12], using Mobile IP doesn't have positive effect on delay but improvement is seen in packet loss rate and throughput.

D. Improvement of QoS in VANET with Different Mobility Patterns

In [3] ,Authorsconcentrate on the different routingprotocols i.e. AODV, AOMDV, DSR, and DSDV. Ad-hoc On-Demand Distance Vector (AODV) is a reactiveprotocol that discovers routes on an as needed basis usinga route discovery mechanism. It uses traditional routingtables with one entry per destination. Without usingsource routing, AODV relies on its routing table entries topropagate an RREP (Route Reply) back to the source andalso to route data packets to the destination. AODV usessequence numbers maintained at each destination to determine freshness of routing information and to preventrouting loops. All routing packets carry these sequencenumbers. Ad-hoc On-demand Multipath Distance VectorRouting (AOMDV) protocol is an extension to the AODVprotocol for computing multiple loop-free and linkdisjoint paths. The routing entries for each destinationcontain a list of the next-hops along with thecorresponding hop counts. All the next hops have thesame sequence number. This helps in keeping track of aroute. For each destination, a node maintains theadvertised hop count, which is defined as the maximumhop count for all the paths, which is used for sendingroute advertisements of the destination [4, 5]. DynamicSource Routing (DSR) is a routing protocol for wirelessmesh networks. It is similar to AODV in that it forms aroute on-demand when a transmitting computer requestsone. However, it uses source routing instead of relying onthe routing table at each intermediate device. Destination-Sequenced Distance-Vector Routing (DSDV) is a table drivenrouting scheme for ad hoc mobile networks basedon the Bellman-Ford algorithm. The main contribution of the algorithm was to solve the routing loop problem. Eachentry in the routing table contains a sequence number, thesequence numbers are generally even if a link is present;else, an odd number is used. The number is generated bythe destination, and the emitter needs to send out the nextupdate with this number. Routing information isdistributed between nodes by sending full dumpsinfrequently and smaller incremental updates morefrequently [6].The authors have considered three different scenario's i.e. high speed highway environment, variablespeed vehicles environment and city environment. In eachnetwork base station is mounted in the centre. Thecoverage area of the base station antenna is more thanexisting VANET. In all three different environments,they communicate vehicles with base station,base station with vehicles and vehicle to vehicle. They have change themodulation technique according to thechannel condition by using AMC technique. Also they havetransmit and receive the data by MIMO technique.

III. CONCLUSION

Vehicular ad-hoc networks are radio communication networksin that traffic message is dispersed as of lots of originatorsto numerous destinations. In this paper we surveyed, someof the routing protocol and QoS parameters associated withthe vehicular networks. Efficiency of VANET communicationis increased using these QoS parameters. QoS fulfils theVANET services such as multimedia information, safetyrelatedmessages without any delay. Efficient routing is possibleusing the Vehicular ad-hoc Network by satisfying theQuality of Service. QoS parameters and metrics by a considerableamount increase VANET proper communication. Researchon Quality of Service in VANET is still going on so alot of development need in this area.

REFERENCES

[1]. AbubakarAminuMu'azu and Sallam Osman.Fageeri , "Enhanced Bandwidth Reservation Guaranteesfor QoS Routing in Vehicular Network"in 2017 International Conference on Communication, Control, Computing and Electronics Engineering (ICCCCEE), KhartoumSudan,PP 12-17,2017.

[2]. T. K. Mak, K. P. Laberteaux, R. Sengupta and M. Ergen, "MultichannelMedium Access Control for Dedicated Short-range Communications," in Vehicular Technology, IEEE Transactions on, vol. 58, pp. 349-366, 2009.

[3]. Prabhakar D. Dorge , Sanjay S. Dorle, Megha B. Chakole and Dhiraj K. Thote “Improvement of QoS in VANET with Different Mobility Patterns,”in 2012 International Conference on Radar, Communication and Computing (ICRCC), Tiruvannamalai,TN., India., pp.206-209,Dec 2012.
[4]. B.Sreedevi, Y.Venkatramani, and T.R.Sivaramakrishnan,“Performance Comparison using AODV and AOMDVProtocols in Heterogeneous Hybrid Cluster Routing usingPartial Authority Nodes in Mobile Ad hoc Networks,”European Journal of Scientific Research, ISSN 1450-216XVol.58 No.4 (2011), pp.542-549, EuroJournals Publishing,Inc. 2011.
[5]. S. R. Biradar, KoushikMajumder, Subir Kumar Sarkar,andPuttamadappa C, “Performance Evaluation andComparison of AODV and AOMDV,”S.R.Biradar et al. in (IJCSE) International Journal on Computer Science andEngineering Vol. 02, No. 02, 373-377, 2010.
[6]. Khalid Abdel Hafeez, Lian Zhao, Zaiyi Liao, and BobbyNgok-Wah Ma, “Impact of Mobility on VANETs’ SafetyApplications,”in IEEE Globecom, pp 26-31,2010.
[7]. Khairi. D, Berqia. A,”Survey on QoSand Security in Vehicular Ad-hoc Networks.”inInternationalJournal of Advanced Research in Computer Science andSoftware Engineering, vol. 5, no.5, pp. 42-52,May 2015
[8]. Adibi. S, Erfani. S,”Mobile Ad-hocNetworks with QoS and RSVP Provisioning,”inCCECE,Saskatoon, Canada, May 2015.
[9]. Shrivistava. P, Ashai. S, Jaroli. A, Gohil,” Vehicle to Road-Side-Unit Communication UsingWimax,”in International Journal of Engineering Research andApplications, vol.2, no.4, (pp. 1653-1655).Aug,2012.
[10]. Zheng. K, Zheng. Q, Xiang. W, Zhou. Y”Heterogeneous Vehicular Networking: A Survey onArchitecture, Challenges, and Solutions,” in CommunicationsSurveys & Tutorials, vol. 17, no. 4, (pp.2377 – 2396).IEEE, June2015.
[11]. Al-Sultan. S, Al-Doori.M, Al-Bayatti. A, Zedan.H” A comprehensive survey on vehicular Ad Hocnetwork,”in Journal of Network and Computer Applications,vol. 37, (pp. 380-392), Jan 2014.
[12]. GholamitabarFirouzjaee. S, Fathy. M, Raahemifar.K”ImprovingQoS in VANET Using MPLS,”in 7thInternational Symposium on Intelligent Systems Techniquesfor Ad-hoc and Wireless Sensor Networks (IST-AWSN),Niagara Falls, Canada., 2012
[13]. Saharan. S, Kumar. R “QoS Provisioningin VANETs Using Mobile Agent,” in International Journal ofComputer Science and Communication, vol. 1, no. 1, pp.199-202V.
[14]. Cisco IOS Quality of Service SolutionsConfiguration Guide, Cisco Systems, 2007.
[15]. Kaur. A” An Overview of Quality ofService Computer Network,”in Indian Journal of Computer Science and Engineering, vol. 2, no. 3, pp. 470-475, July 2011.
[16]. Cisco Networking Academy Program: IP telephony,Cisco Systems, 2005.
[17]. Yan. G, Rawat. D, Bista. B” ProvisioningVehicular Ad-hoc Networks with Quality of Service,”inInternational Conference on Broadband, WirelessComputing Communication and Applications, Fukuoda,Japan,2010
[18]. Kiani. H,Baigi. M” Performance Evaluationof MANET Using MPLS,” M.S Thesis, Bleking Institute ofTechnology, Sweden,2010.

Mr Amol S. Dudhe. " Improvement in Quality of Service (QoS) within VANETs: A Survey.” IOSR Journal of Engineering (IOSRJEN), vol. 08, no. 11, 2018, pp. 67-71.