TDMA Based Approach for Improving Quality of Service for VANETs

Manorama Sharma[1], Prof. K. K. Tiwari[2]
[1]*Mtech Scholar,* [2]*Asst. Professor*
Department of CSE, Satyam Edu. & Social Welfare Society Group of Institutions, Bhopal

Abstract - Vehicular ad hoc network is very popular in new era. In VANET vehicles are connected by wireless channel to each other. VANET is a kind of MANET. In VANETs V2V communication and V2R communication and it is part of ITS. Due to wireless communication and high speed of vehicles in VANETs have many packets loss during communication and End to end packet delay are the two major problems in VANETs. The main goal of this paper is to achieve high quality of service. In this paper proposed a new TDMA based quality of service technique. The IEEE 802.11p physical layer, which is suggested as VANET MAC convention encounters a huge amount of packet losses. In this paper utilizing Time Division Different Access (TDMA) plan to achieve rebuilding of TDMA slots with no central control. There are many proposals for a QoS in VANETS. Steering convention equipped for finding and setting up a way through cluster approach utilizing TDMA. Performance analysis simulation is done on ns-2, performance criteria such as End to end packet Delay, Packet drop rate, network throughput and packet delivery ration.

Keywords: VANETs, TDMA , LORA-CBF, VANETs Routing Protocols, AODV and Quality of service.

I. INTRODUCTION

In recent years, most new vehicles come already equipped with GPS receivers and navigation systems. This trend is expected to continue and in the near future, the number of vehicles equipped with computing technologies and wireless network interfaces will increase dramatically. These vehicles will be able to run network protocols that will exchange messages for safer, entertainment and more fluid traffic on the roads. Standardization is already underway for communication to and from vehicles. The development of vehicular systems would empower a few valuable applications, both security and non-wellbeing related, for example, programmed street movement alarms spread, element course arranging, administration inquiries (e.g., stopping accessibility), sound and feature record sharing between moving vehicles, and connection mindful commercial (1). To send these administrations, three sorts of interchanges including moving vehicles are viewed as, including cell system, vehicle to roadside framework and impromptu vehicle correspondences.

In recent years, with the advancement in network technologies and wireless communications vehicular adhoc network (VANET) has become possible. The principle goal of VANET is usually to provide safety and traffic information to its passengers, but as a result of mobility of men and women and wide use of internet, now the aim would be to provide commercial and infotainment information to its drivers and passengers. In north america, the Dedicated Short Range Communications (DSRC) [21] standard has been developed to aid vehicular communications even though the same has been designed in Europe by the Car2Car Communication Consortium [22].Vehicular ad-hoc network (VANET), is often a special type of mobile adhoc network(MANET) in which vehicles behave as mobile nodes that aims to deliver communications among nearby vehicles often known as inter vehicular communications(V2V or IVC) and between vehicles and nearby Roadside units or RSUs, referred to as vehicle to infrastructure communications (V2I or RVC). Besides this, there exists hybrid communication including V2V and V2I [23].

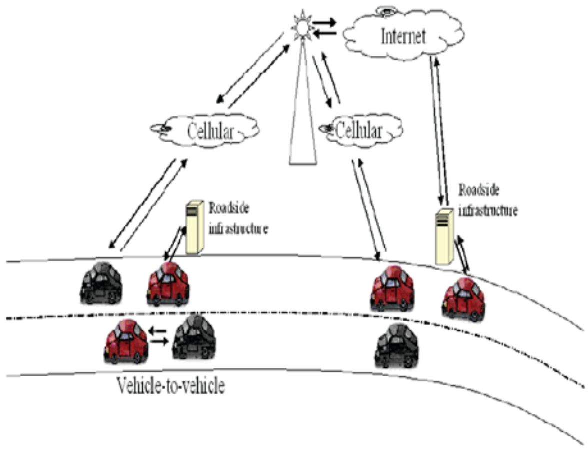

Figure 1: Vehicular ad hoc network

Vehicles equip with devices called on-board unit (OBU) that could speak with other motor vehicles using dedicated short range communication (DSRC). OBUs speak with other OBUs or RSUs. Communication is completed between roadside units through wired or wireless networks to spread the messages to larger regions. The Trust authority (TA) is often a trusted party to blame for authenticating vehicles and identifying a malicious identity if any dispute happens. The application form server (Traffic Monitoring Center) is in charge of making further analysis and giving feedback towards the RSUs after collecting the traffic related information. Some vehicles are equipped with a tamper proof device that carries certain secure operations. Applications are categorized as safety, transport efficiency and information /entertainment applications .

The term Quality of Service (QoS) is the measure of administration used to express the level of execution gave to clients [12]. The principle point of QoS provisioning is to accomplish a more deterministic system conduct, by doing as such the data conveyed by the system can be better conveyed and system assets can be better used. In any case, there still remains a huge test to give QoS arrangements and keep up end-to-end QoS with high versatility in VANETs.

QoS steering ordinarily includes two errands: gathering and keeping up a la mode state data about the system what's more, discovering doable ways for an association taking into account its QoS necessities [7]. To bolster QoS, an administration can be described by an arrangement of quantifiable pre indicated administration prerequisites, for example, least data transfer capacity, greatest deferral, most extreme postponement difference and greatest parcel misfortune rate. QoS directing methodology is not by any stretch of the imagination joined by any ordinary MANET steering conventions. However there are a few examines that endeavor to join such methodologies inside VANET routing protocols.

II. QUALITY OF SERVICES (QoS)

Quality of service (QoS) is the performance level of a service offered by the network to the user. [8] The goal of QoS provisioning is to achieve a more deterministic network behavior, so that information carried by the network can be better delivered and network resources can be better utilized [1-3], [6], [11, 12], [15, 16]. A network or a service provider can offer different kinds of services to the users. Here, a service can be characterized by a set of measurable Pre specified service requirements such as minimum bandwidth, maximum delay, maximum delay variance (jitter), and maximum packet loss rate. After accepting a service request from the user, the network has to ensure that service requirements of the user’s flow are met, as per the agreement, throughout the duration of the flow (a packet stream from the source to the destination) [1], [3],.

III. RELATED WORK FOR PROVIDING QoS SUPPORT

(i) Hard state vs soft state resource reservation:

QoS resource e reservation is one of the very important components of any QoS framework (a QoS framework is a complete system that provides required/promised services to each user or application). It is responsible for reserving resources at all intermediate nodes along the path from the source to the destination as requested by the QoS session. QoS resource reservation mechanisms can be broadly classified into two categories, hard state and soft state reservation mechanisms. In hard state resource reservation schemes, resources are reserved at all intermediate nodes along the path from the source to the destination throughout the duration of the QoS session. If such a path is broken due to network dynamics, these reserved resources have to be explicitly released by a deallocation mechanism. Such a mechanism not only introduces additional control overhead, but may also fail to release resources completely in case a node previously belonging to the session becomes unreachable. Due to these problems soft state resource reservation mechanisms, which maintain reservations only for small time intervals, are used. These reservations get refreshed if packets belonging to the same flow are received before the timeout period. The soft state reservation timeout period can be equal to packet inter-arrival time or a multiple of the packet inter-arrival time. If no data packets are received for the specified time interval, the resources are deallocated in a decentralized manner without incurring any additional control overhead. Thus no explicit tear down is required for a flow. The hard state schemes reserve resources explicitly and hence at high network loads, the call-blocking ratio will be high, where as soft state schemes provide high call acceptance at a gracefully degraded fashion.

(ii) Stateful vs stateless approach:

In the Stateful approach, each node maintains either global state information or only local state information, while in the case of stateless approach no such information is maintained at the nodes. State information includes both the topology information and the flow-specific information. If global state information is available, the source node can use a centralized routing algorithm to route packets to the destination. The Performance of the routing protocol depends on the accuracy of the global state information maintained

at the nodes. Significant control overhead is incurred in gathering and maintaining global state information. On the other hand, if mobile nodes maintain only local state information (which is more accurate), distributed routing algorithms can be used. Even though control overhead incurred in maintaining local state information is low, care must be taken to obtain loop-free routes. In the case of stateless approach, neither flow-specific nor link specific state information is maintained at the nodes. Though the stateless approach solves the scalability problem permanently and reduces the burden (storage and computation) on nodes, providing QoS guarantees becomes extremely difficult.

(iii) Hard QoS vs soft QoS approach:

The QoS provisioning approaches can be broadly classified into two categories, hard QoS and soft QoS approaches. If QoS requirements of a connection are guaranteed to be met for the whole duration of the session, the QoS approach is termed as hard QoS approach. If the QoS requirements are not guaranteed for the entire session, the QoS approach is termed as soft QoS approach. Keeping network dynamics of AWNs in mind, it is very difficult to provide hard QoS guarantees to user applications. Thus, QoS guarantees can only be given within certain statistical bounds. Almost all QoS approaches available in the literature provide only soft QoS guarantees.

Proposed TDMA based Quality of Service Scheme

TDMA (Time Division Multiple Access), that is a traditional procedure for remote correspondence, can give the collision-free packet transmission regardless of the activity load. There exist a various studies for utilizing TDMA in a specially appointed system however none of them considered the self-governing way of versatile hosts. Subsequently, it is unrealistic to ensure appointing time spaces for new part joining the system. Some couple of ordinary protocols[24][25] that distribute time spaces for another part joining the system demonstrated poor channel use just on the grounds that they give the required time openings for the new part hub which thus causes bunches of unassigned openings.

In our proposed design, vehicles inside of the same transmission extend and moving towards the same direction from cluster. Every last vehicle can either be a Cluster head (CH), gateway and ordinary member (OM). The hub in our plan be that as it may, is in three mode; transmitting mode ($T_{rmod)}$, accepting mode ($A_{mod)}$ and CH mode.

Trmod: 1: for node *ninitial* to transmits a data packet to its Cluster Head in time slot t_s *s*,: else 0.
Cmod: 1: for node nhead to apportion spaces to it individuals and transmit information packets to neighbors cluster in slots t_s, : else 0.

Amode: 1: for hub n_{join} to gets an information parcel from its source hub in time opening t_s, : else, 0

Node in transmission mode for case; Node($Snode_{)}$ needs to save an adequate QoS_route to forward packet to destination hub Dn through CH by consolidating the required number of accessible transfer speed (openings) for that Qos_Route outline.

In every edge, the first run through opening is being saved for a given versatile vehicle to transmit a security related messages to the CH with N hubs present in the system bunch. In any case, the CH gets a chance to transmit the control message on CCH to neighboring bunches and to the destination. The control message incorporates the accompanying data showed in the state Diagram below.

As an aftereffect of exchanging this sort of data between adjacent neighbors, every last node inside of the system is aware of the unallocated spaces in the edge which empowers it to allocate among the spaces to itself.

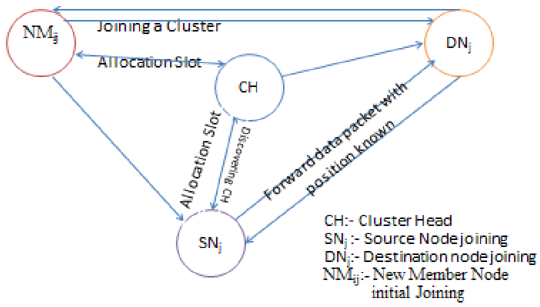

Figure 2: Node State transmission state machine

At last, the CH uses a long range transmission power when it needs to trade data with its neighboring CHs. At whatever point a CH needs communication with its group part; it picks a short range transmission energy to accumulate/transmit wellbeing messages over information channel utilizing upstream-TDMA/downstream-telecast strategy embraced. Substantially more, the CH assigns the available information channels towards the group part hubs for the non-realtime traffics. In this manner, each CH decides the TDMA outline structure in light of the quantity of OMs inside of the group. In this manner, to show the security related messages inside of the group, the CH utilizes its accessible smaller than normal openings to telecast the message on CH from the TDMA outline.

The route discovery would be an expansion of AODV and area demand instrument of LORA-CBF [6], to which QoS components are inserted in the determination and ensuring QoS administration in the movement administration.

Ordinarily, the QoS is infer regarding throughput, parcel misfortune and normal postponement for a given data transmission allotment. Accordingly, at present, our proposition would rely on upon two stages: neighborhood accessibility data and QoS_route request.

IV. SIMULATION RESULTS

Simulation is perform on network simulator (NS-2), NS-2 is powerful research tool for wireless network such as MANETs , VANETs and SANETs etc. In simulation 30 vehicular nodes are used, time simulation time is 100 second and AODV routing protocols is used for both existing QoS as well as for our proposed TDMA based QoS Network. Performance is measure in on the base of network throughput, packet drop rate , end to end packet delay , packet delivery fraction percentage.

1. End to End packet delay

Packet delay or propagation delay is traveling time of signal from source node to destination node. Figure 3 show the end to end delay of packet, in case of old QoS network having more delay with compare to proposed TDMA based QoS network.

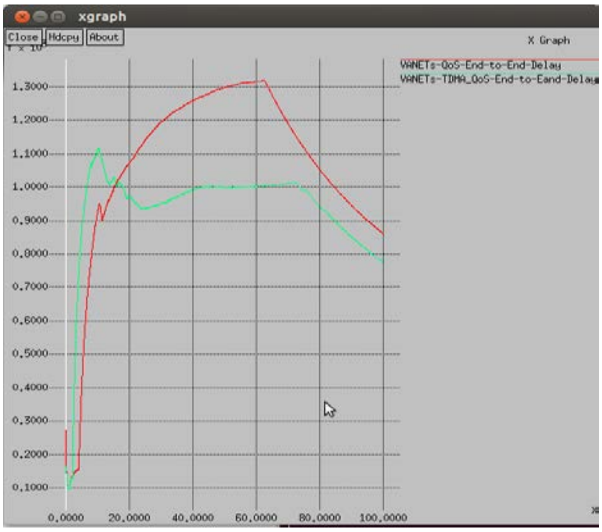

Figure 3: End to end delay of packet, in case of old QoS network and proposed TDMA based QoS network.

2. Packet Drop Rate:

Figure 4 shows the packet drop rate of both old network and proposed, in proposed network minimize the packet drop which improve network performance.

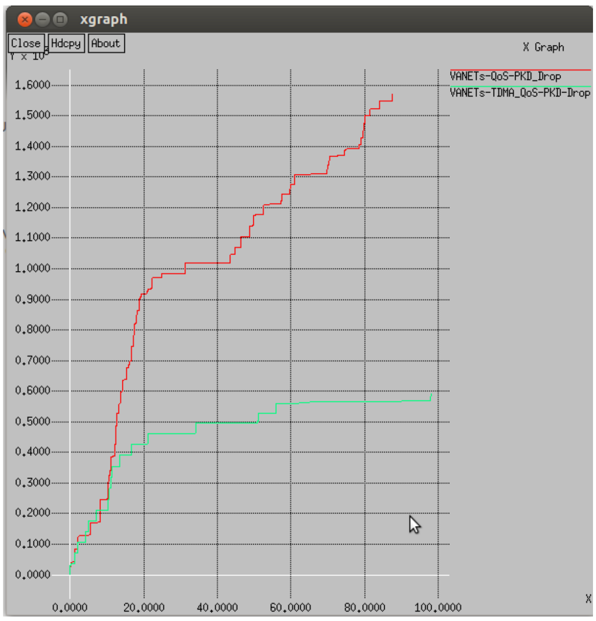

Figure 4: Packet Drop Rate comparison between old QoS based Network Vs proposed TDMA based QoS Network

3. Network Throughput:

Network throughput is measure as per unit successful transmission of packet. Network throughput is also improve in case of TDMA base network with compare to previous network which shown in figure 5

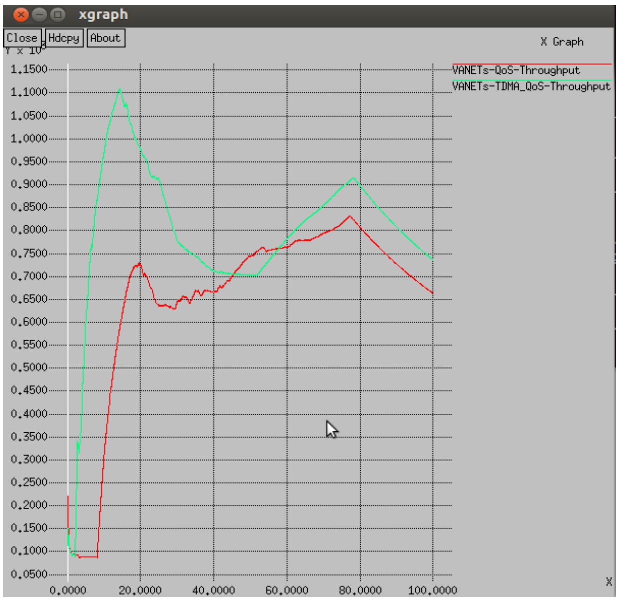

Figure 5: Network Throughput Comparison between old QoS based N/W Vs proposed TDMA based QoS N/W

4. Packet delivery Fraction(Ratio)

Packet delivery fraction is a ration between total number packet successfully received to the total number packet transmit in the network which shown in figure 6.

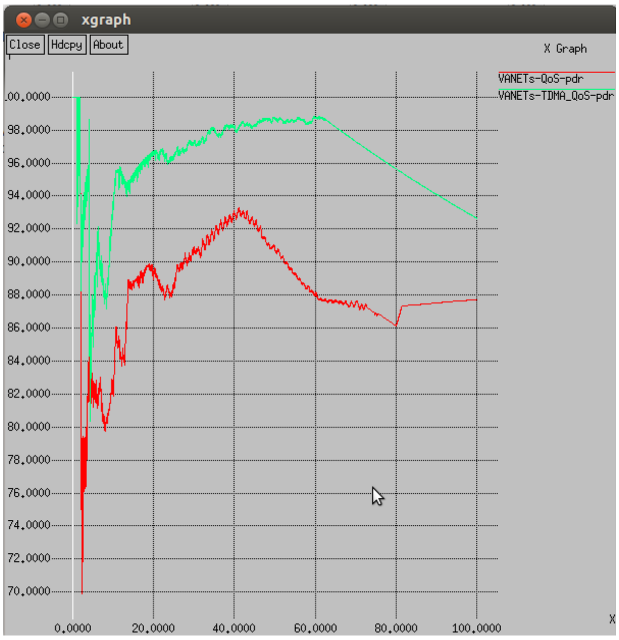

Figure 7: Packet delivery fraction comparison between old QoS based N/W Vs proposed TDMA based QoS N/W

V. CONCLUSION

The main concern in VANETs is to achieve high quality of service. Lots of protocols are design for Qos and researchers work at deferent layer of OSI model to achieve the Quality of service, some the work at data link layer and Network layer. All of the protocol gives great improvement in the QoS in VANETs our proposed TDMA based QoS is work at the data link layer of OSI model and it shows improvement in quality of service with compare to previous methods. There are still many of the areas where the impotents are possible in VANETs.

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