Improving Transmission efficiency in VANET using MAC and Multichannel

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Abstract-Vehicular Adhoc Network (VANET) is the network that work like Mobile Adhoc Network(MANET) in this cars act as nodes in the network same as computers are nodes in Mobile Adhoc Network. These nodes in the form of cars are assumed as mobile devices carried by people from one place to another. Participating every car in the VANET system acts as a wireless router. Connection drop out when any car goes out of the particular signal range and to accomplish thta new connection is established. We found some issues related to VANET that need to be resolved by the system. Media Access Control(MAC) and Multichannel assignment are only the two issues from them we will consider for our work. Multi channels can easily increase the capacity of network to send data in the form of packets in large amount but we need to use some new protocols for and this can expand the capacity of the available network so that we can improve transmission efficiency. In this paper we have present the method for data transmissions that can improve the various parameters. We will also discuss for efficient data transmission with MAC protocol and multichannel using the technique of channel segmentation.

Keywords-Vehicular-Ad-Hoc Network, V2V, Packet Size, MAC Protocol, IEEE80211p, Multichannel

1. INTRODUCTION

A VANET is a mobile adhoc network but in case of vanet there are number of vehicles such as cars, truck and so on. These vehicles make connection with each other for the communication purpose. The range for communication between these vehicles is approximately between 300 to 500 meterMost commonly three types of communication is present in vanet vehicle-to-vehicle (V2V), vehicle-to-infrastructure (V2I) and vehicle–to-roadside. Vehicle to vehicle coomunication is used to provide information about traffic conditions or we can say the safety services. These type of communications are based on wireless inter-vehicle communications. The technology used for this communication is wireless local area network. The technology used in VANET are almost same to the technology used in MANET but the details of both the technologies are totally different.

There are number of channel assign algorithms has already been proposed by the researchers these are adaptive channel assign using V2I and dynamic channel assign algorithm according to node density. Channel assignment in VANET is the main topic that can improve the efficiency of the network easily. The systems used these days like navigation system and GPS provide benefit in this area because they could be work with traffic reports and can provide the fastest route to work. GoogleTalk and the Skype are the VoIP services that are provided to the people free of cost. These are the telecommunication services that can be used in VANET system.

IEEE802.11p standard is used in vanet as transmission protocol, IEEE 802.11p is an amendment of IEEE 802.11 standard to add wireless access in vehicular environments(WAVE) for easy and effective communication between vehicles with dynamic mobility[3]. IEEE 802.11p standard provides the quality of service support for the Intelligent transportation System applications. The original IEEE 802.11p standard is based on MAC sub-layer. The service differentiation capability of the IEEE 802.11p standard is improved by the multichannel extension. Both safety services and non safety services are provided on different channels. Every channel has different frequency from one another. There are two types of channels service channel (SCH) and control channel (CCH). One control channel is provided for safety services and other six service channels are for non safety services.

There are some shortcomings from which MAC sub layer is sufferd:

1) Strict synchronization is required;

2) The synchronous MAC sub layer operations gives result of inefficient utilization of service channel and control.

3) Fixed duration of control and service time interval prohibits intelligent allocation of time intervals in response to variable traffic demands.

4) Due to possible collisions inefficiency occur due to contention in service channel. There are some solutions have been proposed for these problems in recent years.

1.1 VANET System

Vehicular networking is promoted by another term called Intelligent vehicular ad-hoc network (InVANET). Multiple networking technologies such as Bluetooth, Wi-Fi IEEE 802.11p, WiMAX IEEE 802.16, WAVE IEEE 1609, IRA and ZigBee are integrated by InVANET.

Dedicated short-range communications (DSRC) are expected to implement which is a type of Wi-Fi in Vehicular ad hoc networks wireless technologies. There are some other candidate wireless technologies such as satellite, cellular, and WiMAX. Vehicular-ad-hoc networks is a component of the intelligent transportation systems (ITS).

In ITS all the vehicles communicate via inter-vehicle communication (IVC) with each other and roadside-to-vehicle communication (RVC) help to communicate with roadside base stations.

1.1.1 ***Intelligent Transportation Systems (ITSs)***

In intelligent transportation systems, each vehicle acts as an sender, receiver, and router so that it can broadcast information to the vehicular network and vehicular network uses the information to ensure safe, free-flow of traffic. For communication between Roadside units and vehicles, vehicles should be aligned in such a way so that it can be equipped with radio interference which enables wireless ad-hoc networks formation with short-range. Fixed Roadside Units(RSUs) are connected to the main network and it can be placed in area from where it can facilitate proper communication. The communication protocol used defined the number and distribution of roadside units. This means there are some protocols which require roadside units placed at region borders, some require at intersections and some require it throughout the network. It is not realistic that vehicles should always have wireless access to RSUs.

1.2 Overview of VANET

1.2.1 Dedicated Short Range Communication (DSRC)

Dedicated Short Range Communication(DSRC) come into existence so that it can support vehicle to vehicle and vehicle to roadside communications. It is a short to medium range communication service. There are many number of applications covered by it like traffic information, vehicle to vehicle safety messages, driven through payment, toll collection and several others. The United State Federal Communications commission allocated 75 MHz of spectrum at 5.9 MHz in 1999 used by DSRC. DSRC allow low communication latency in small communication zones and provide high data transfers. In 2003, the ASTM-DSRC standard approved by The American Society for Testing and Materials (ASTM) and it was based on the IEEE 802.11a physical layer and 802.11 MAC layer. In February 2004 the FCC established service and licensing rules which described the use of DSRC band. DSRC is free means FCC never charge for the use of the spectrum but it is licensed which means that it is more restricted in terms of its usage. The DSRC spectrum is defined into 7 channels and each channel is 10 MHz wide. The FCC requires the use of specific channels. One channel is used for safety communications from seven channels and other two channels are reserve for special purposes e.g high power public safety and critical safety of life. All the other channels are used for safety or non safety applications and these channels are called service channels. Applications are divided according to safety or non safety applications. Safety applications are given higher priority on the other hand non safety applications given less priority. It avoid performance degradation.

1.2.2 ***Dynamic MANET on demand (DYMO) routing protocol***

DYMO is a reactive routing protocol. This means that it do not update routing table time to time. This is the protocol that works in multi hop wireless networks. It is developed for use in ad-hoc networks. This protocol is considered as the successor to the AODV routing protocol. Design of DYMO routing protocol is very simple and can be implemented easily. DYMO protocol discover route and perform maintenance of route. For discovering the path to destination node, a route request(RREQ) message is broadcast all over the network. Every node in between the path passes the messages and records the route from where the message is originated. At last when this destination node get this RREQ message, then it send back the unicast RREP message to the originating node. Every node in between the path receiving the message creates route to the destination node. Therefore it looks like that DYMO protocol work same as AODV protocol but there is some difference that in addition to route found, it also get information about the intermediate nodes that comes in the newly discovered path. But in case of AODV we can only get the information about the destination node. On the other hand in DYMO path to every intermediate node is also known.

1.2.3 802.11 Medium Access Control

There are three functional areas covered by 802.11 MAC such as Access Control, Data control and Security. Frame exchange protocol is included in Reliable data control. In this case if ACK is not received by the source in a short period of time, the reason behind this is data frame damaged or the returning ACK damaged then source retransmit ACK. Distributed Access protocol and centralizes access protocol are two modes of Access Control. A distributed access protocol is very useful for ad-hoc wireless network. On the other hand centralized access protocol is useful for configurations.

MAC is required to provide authorized access to resources and utilization of Bandwidth efficiently. MAC layer also perform various types of other tasks such as association with an access point, authentication, encryption and data delivery.

Physical and MAC Layers

There are two layers that are based on IEEE802.11p standard such as physical and MAC layers. On physical layer IEEE 802.11p has seven channels in 5.9GHz band. The IEEE802.11p uses 10MHz bandwidth for each channel but on the other side IEEE 802.11a uses 20Mz bandwidth for each channel. In order to increase data transmission rate physical layer of 802.11p uses OFDM technology. It also useful to overcome signal fading in wireless communication. To provide fair access to the channel and to reduce collisions IEEE 802.11p uses CSMA/CA.

Multichannel Operation

IEEE 1609.4 is the standard of IEEE 1609 protocol family. In this standard there are seven channels. Each channel provide its own services. From these seven channels six channels are service channels and one channel is control channel. Every channel have different frequency. Every station continuously switches between channels such as service channels and control channel. Control channel is used for safety data transmission and service channels are used for non safety data transmission.

1.3. Applications of VANET

Applications of VANET are classified into different categories:

i) Safety related

ii). Automatic parking

iii). Traffic signal

iv). Driver assistance

v). Vision enhancement

2. LITERATURE REVIEW

1. In 2013 "**Measuring the Performance of Packet size and Data rate for Vehicular Ad Hoc Networks",** Chan-Ki Park, Si-Ho Cha described that Intelligent Transportation System has technology called Vehicular Ad-hoc Networks (VANETs). The Wireless access in Vehicle Environments (WAVE) that is based on IEEE802.11p and IEEE1609) in Intelligent Transportation System. WAVE provide safety service by giving information to driver and passenger. Some resolution have

already been proposed for high velocity and rapid topology change. It only related to packet size that would be equal. Various services could not be provided for VANETs due to this problem of limited data packet size.

2. In 2012 "**Performance Analysis of Routing Protocols for Vehicular Delay-Tolerant Networks",** Joel J. P. C. Rodrigues Vasco N. G. J. Soares, described about store-carry-and-forward routing protocols for vehicular delay tolerant networks(VDTNs) provide simulation-based performance analysis study. Eight routing protocols (Direct Delivery, GeoSpray , GeOpps,First Contact, Epidemic, Source Spray and Wait, Binary and and PRoPHET) are compared in case of traffic load and time-to-live values.

3. In 2012 **"An IEEE 802.11p-Based Multichannel MAC Scheme With Channel Coordination for Vehicular Ad Hoc Networks**", Qing Wang, Supeng Leng, described about VANET that control channel (CCH) and service channels (SCHs) implied by multiple channels to provide open public road safety services and efficiency of driving. This paper proposes a variable CCH interval (VCI) multichannel medium access control (MAC) scheme to dynamically adjust the length ratio between CCH and SCHs. The transmission delay of service packets is reduced by it.

4. In 2013 **"Performance Evaluation of IEEE 802.15.4 for V2V Communication in VANET",** Sishan Wang, Airong Huang, Tao Zhang described that information about traffic conditions can be transmitted in Vehicle to Vehicle(V2V) communication. The IEEE 802.15.4-2006 which is complimant to 2.4GHz is used in hardware. Communication range is evaluated based on the experimental data Packet Error Rate(PEP), Receiver Input Power(RIP).

5. In 2010 **"A Multicast Routing Scheme for Efficient Safety Message Dissemination in VANET**", Alvin Sebastian, Maolin Tang, Yanming Feng, and Mark Looi, in this paper described about Cooperative Collision Warning System. By passing safety messages between the two or more cooperative vehicles this system is the safety application to provide situational awareness and warning to drivers. This paper presents an efficient multicast routing scheme so that it can reduce also use adaptive transmission and unnecessary transmission. This type of multicast routing problem can easily be transformed into delay-constrained minimum Steiner tree problem. Various road traffic scenarios, and prioritize the receivers are supported by this routing scheme.

6. In 2013 "**Context Aware Driver Behaviour Detection System in Intelligent Transportation Systems (ITS)**", Saif Al-Sultan, Ali H. Al-Bayatti decribed that Dadicated Short Range Communication (DSRC) is used by VANET so that vehicles have close proximity to communicate with each other. Road safety can be improved and reduction in number of fatalities By applying Wireless access that are reason of road accidents. Context Aware System is mainly discussed by this paper which will detect the novel and non-intrusive behavior of driver that will warn the other vehicles to avoid accidents. In this system the temporal and static aspects of driver are captured by the dynamic behavior system.

7. In 2012 **"An Energy Efficient Multi-channel MAC Protocol for wireless ad-hoc networks",** Duc Ngoc Minh Dang, Choong Seon Hong described about this that the IEEE 802.11 provide multi channels at the Physical Layer for wireless communications. Basically Medium Access Control (MAC) protocol only have the property to work for single channel. If multiple channels can be used by multi-channel MAC protocol on different channels there can be multiple transmission possible. Power control algorithm works fantastically to improve the reuse of wireless channels

8. In 2010 **"An efficient dynamic adjusting MAC protocol for multichannel cognitive wireless networks",** Chih-Shun Hsu, Chih-En He described that to enhance the usage of radio spectrum wireless network named as the cognitive wireless network is used. Users that are not licensed allowed by this network to use idle radio spectrum and scan it. For cognitive wireless network for designing MAC protocols there are some important issues such as enhance the throughput of the network and avoid collisions. This papers described dynamic adjusting MAC protocol for cognitive wireless networks.

3. PROPOSED WORK

It is seen that with different transmission rates increase the efficiency in the data transfers but channel may get overloaded with different transmission requests, so to overcome this problem we need to implement multiple channels and Mac protocol. This will not only reduce the problem of channel overloading but also efficient data transfer.

Proposed Algorithm for data transmission using multichannel

1. Broadcast Route Request (RREQ) message over the network.

2. Get back Route Reply (RREP) massage from the destination node.

3. After getting reply message request for the channel.

4. Check load on the particular channel.

5. If there is load on the channel

Then make five segments on the channel with different frequencies

Else if

there is no load on particular channel

Then send data on particular channel.

End if

6. Check least traffic in segmented channel.

7. Select segment to send data.

8. Send message on selected segment.

9. Forward request for data transmission.

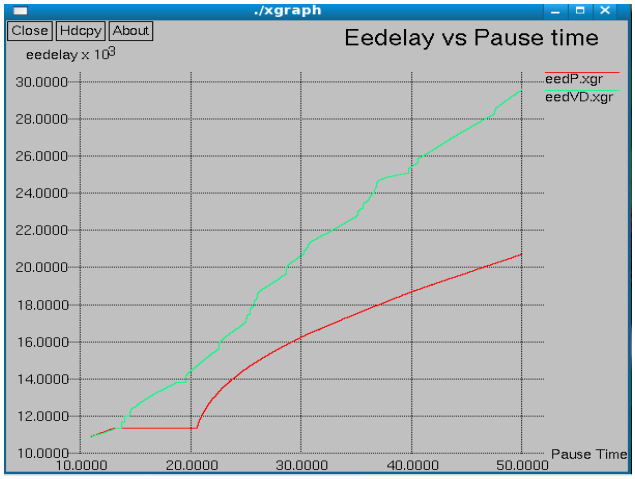

Figure 1: End to end delay v/s Pause time

Figure 2: Calculations of end to end delay

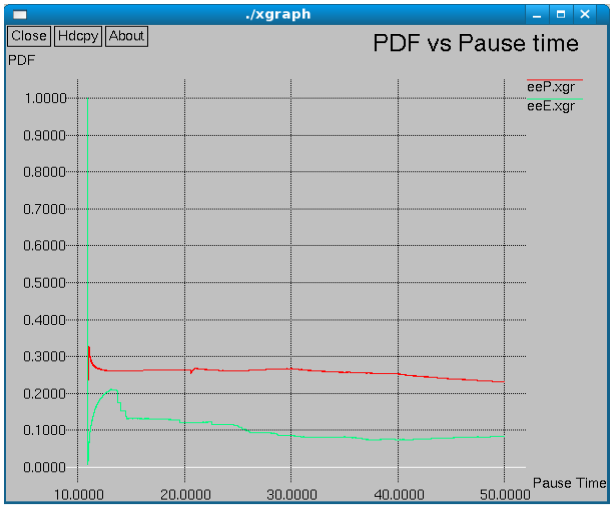

Figure 3: Packet Delivery Fraction v/s Pause time

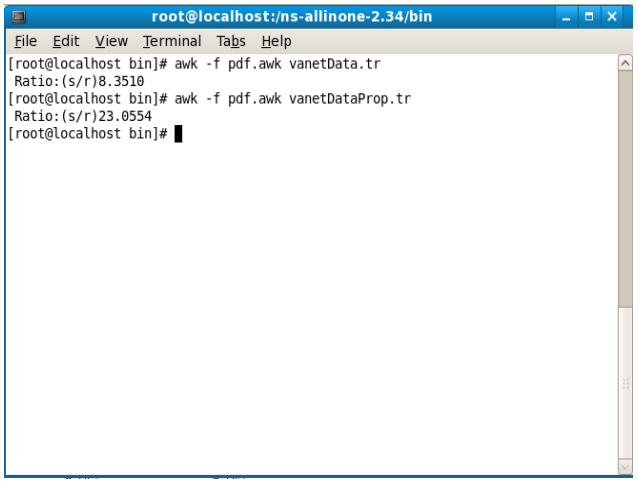

Figure 4: Calculations of packet delivery fraction

Figure 7: Jitter v/c Pause Time

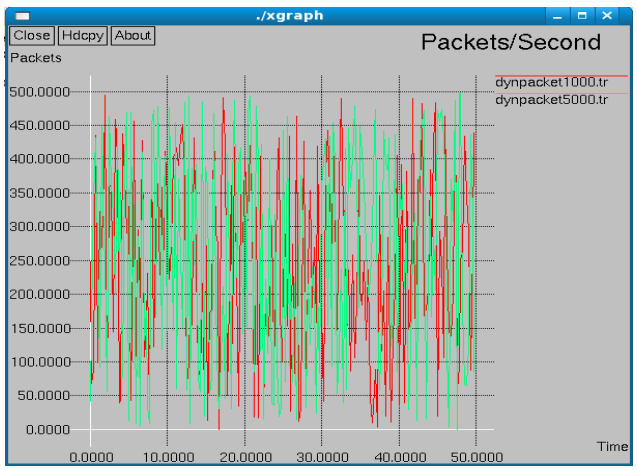

Figure 8: Packets v/s Pause time

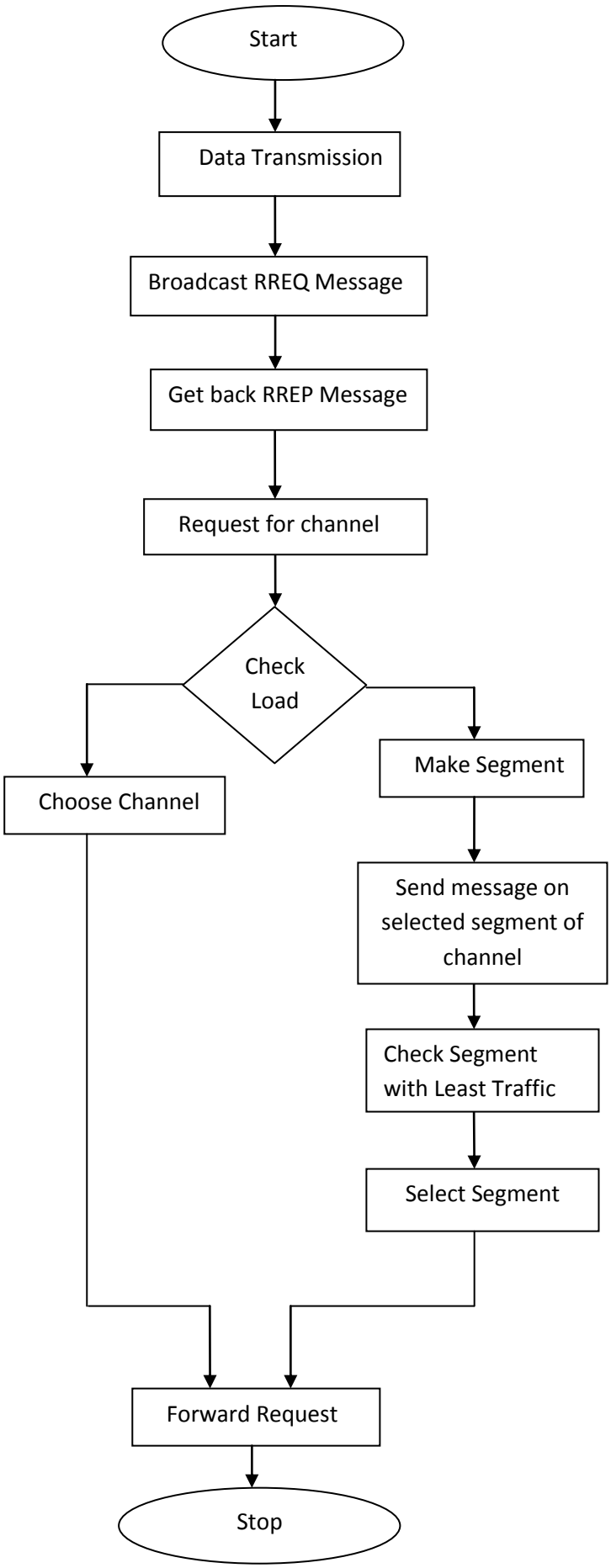

Figure 9: Flow Chart of Proposed System

Table 1 : Simulation Parameter

Parameter	Value
Number of vehicles	50
Data Rate	1Mbps
Packets	UDP,TCP
Traffic Type	CBR
Packet Size	1000 byte & 5000byte
Packet Generation Rate of Vehicle	10Mbps
Transmission Range of Vehicle	300m to 500m
Propagation Model	Two Ray Ground Reflection model

4. CONCLUSION and FUTURE WORK

From above survey it is observed that transmission plays a vital role for efficient data transfer. There are many open challenges needs to readdressed. Multi-Chanel assignment concept may help full and can transfer data with different transmission speed very effectively. In future we will implement the technique that can handle number of requests using the concept of multichannel assignment with multiple segments and MAC protocol for improving transmission efficiency. This will remove the drawback of slow transmission.

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