Analysis of Efficient Medium Access Control Protocol for Vehicular Ad-Hoc Network

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ABSTRACT

VANET represents some extraordinary difficulties including dropping out of associations as the moving vehicle moves out of the scope range, joining of new hubs moving at high speeds, dynamic change in topology and availability, time changeability of sign quality, throughput and time delay. For asset administration in VANET, a medium access control convention is utilized, which ensures that restricted assets are circulated effectively. In this work, an efficient Multichannel Cognitive MAC (MCM) is developed, which assesses the quality of channel prior to transmission. MCM employs dynamic channel allocation and negotiation algorithms to achieve a significant improvement in channel utilization, system reliability, and delay constraints while simultaneously addressing Quality of Service. TDMA reduces transmission collisions due to node mobility on the control channel by assigning disjoint sets of time slots to vehicles moving in opposite directions and to road side units. TDMA likewise lessens transmission impacts along these lines making Control Channel (CCH) more reliable and provides high throughput over Service Channel (SCH) via maximum channel utilization.

Keyword: - *Vehicular Ad Hoc Network , Multichannel Cognitive MAC Protocol, Channel Utilization, TDMA , Traffic , Delay*

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1. INTRODUCTION

Vehicular Ad-Hoc Network with the utilization of Multichannel Cognitive Medium Access Control Protocol. A Vehicular Ad-Hoc Network or VANET is a sub type of Mobile Ad-Hoc Network or MANET that gives correspondence amongst vehicles and amongst vehicles and street side base stations. The principle utilization of VANET is the trading of wellbeing messages between hubs. In VANET, a Medium Access Control convention is utilized, which ensures that constrained assets are appropriated productively. Vehicular specially appointed system

(VANET) is a system of moving vehicles where taking an interest vehicles or foundations make a system that encourages vehicle to vehicle and framework interchanges. Because of the way of correspondence, VANET offers some outrageous difficulties, and some of these difficulties include: dropping out of associations as the moving vehicle moves out of the scope range, joining of new hubs moving at high speeds, dynamic change in topology and availability, time changeability of sign quality, throughput and time delay.

The IEEE 1609.4 draft standard for VANET defines the sync interval which constitutes of control channel interval (CCH interval) and service channel interval (SCH interval). The IEEE 1609.4 standard defines the time division scheme for WAVE radios to alternatively switch between CCH and SCH during a sync interval to support different applications concurrently. Start of a sync interval is synchronized with the coordinated Universal Time (UTC) second and multiples of 100 ms thereafter. A sync interval with a default length of 100ms is equally divided into 50 ms CCH and 50 ms SCH interval. According to the WAVE, a Wave Basic Service Set (WBSS) consists of one provider and one or more WBSS users. As described in the IEEE 1609.4, in VANET has to switch to CCH every 50ms to listen to safety messages and for network management processes. Therefore, SCH is not utilized during the CCH interval.

Multichannel Cognitive MAC (MCM) is produced, which surveys the nature of channel preceding transmission. The principle reason for the proposed multichannel intellectual MAC (MCM) convention is to enhance channel use and transmission dependability of wellbeing related information. As per the idea of the intellectual radio, essential suppliers (PPs) are mapped as hubs with wellbeing related information (e.g., crisis vehicles, for example, squad cars, emergency vehicle, fire trucks) and auxiliary suppliers (SPs) and optional clients (SUs) are mapped as business and general cars, while essential users(PUs) can be any hub in the framework which is 50% of every sync interval. This causes underutilization of available resources, which ultimately results in more waiting time, more jitter and increased frame error rates for the transmission of safety messages.

Versatile TDMA based multichannel MAC convention which abuses both channel access component and variable interim multichannel planning novelly to enhance the execution (bundle conveyance proportion and throughput) of the MAC layer in VANETs. Distributed TDMA based protocol has been proposed in using time slotted structure. The time is partitioned into repeated frames and each frame is composed of a fixed number of slots. Each vehicle selects a specific time slot to transmit data. If successful, it keeps on using the same slot at subsequent frames until a collision occurs or the slot is no longer needed. Since every vehicle is required to broadcast the slot information about all its one-hop neighbors, a vehicle is able to know which slot is still available.

2 LITERATURE SURVEY

Paper presented by Niravkumar Shah, Daryoush Habibi and Iftekhar Ahmad [1] that medium access control (MAC) protocol for WAVE system to improve the channel utilization (CU) and reliability of safety messages. The proposed protocol has been developed based on the concept of cognitive radio and it outperforms the existing channel access mechanism by a significant margin in terms of channel utilization, jitter and robust delivery of safety data. Simulation results confirm that the proposed cognitive MAC protocol increases the CU up to 70% compared to the IEEE 1609.4 standard, and improves reliability for the safety related data transmission.

Paper presented by Qi Chen, Daniel Jiang, Luca Delgrossi [2] that while IEEE 1609.4 is currently being updated and revised, this paper is intended to contribute to the technical discussions, and to bring attention to the most relevant and critical issues. This paper also contains results from software simulations conducted to study vehicle safety communications under stressful but realistic conditions. These results confirm concerns for the currently proposed scheme and provide a motivation for updating and revising the standard.

Paper presented by Liljana Gavrilovska, Daniel Denkovski, Valentin Rakovic, and Marko Angjeli chinoski [3] that C-MAC proposals is a complex task due to many C-MAC related aspects. Paper introduces and develops generic, modular and easily extensible layout for classification and systematization of C-MAC protocols referred as C-MAC cycle. Each C-MAC protocol can be easily fragmented, mapped and visualized using the C-MAC cycle, regardless of the operational scenario and settings. The survey offers extensive overview on the state-of-the-art advances in C-MAC protocol engineering by reviewing existing and up-to date technical solutions, identifies their basic characteristics and maps them into the C-MAC cycle. The survey also highlights the role of regulative and standardization activities on C-MAC cycle.

Paper presented by Duc Ngoc Minh Dang_, Hanh Ngoc Dangy, Cuong The Do_ and Choong Seon Hong [4] that Vehicular Enhanced Multi-channel MAC protocol (VEMMAC) for Vehicular Ad hoc Networks (VANETs). The VEMMAC adopts the IEEE 1609.4 with alternating sequences of the Control Channel (CCH) interval and the Service Channel (SCH) interval. Different from the IEEE 1609.4, the VEMMAC allows nodes to transmit non-safety messages during CCH interval and broadcast safety messages twice with each in the CCH and SCH interval. Our proposal can utilize the channel resources more efficiently than the IEEE 1609.4. The simulation results show that the proposed VEMMAC protocol achieves higher throughput for service data and is more reliable for safety messages broadcast than other protocols.

Paper presented by Hassan Aboubakr Omar, Weihua Zhuang, and Li Li [5] that VeMAC, a novel multichannel TDMA MAC protocol proposed specifically for a VANET scenario. The VeMAC supports efficient one-hop and multihop broadcast services on the control channel by using implicit acknowledgments and eliminating the hidden terminal problem. The protocol reduces transmission collisions due to node mobility on the control channel by assigning disjoint sets of time slots to vehicles moving in opposite directions and to road side units. Analysis and simulation results in highway and city scenarios are presented to evaluate the performance of VeMAC and compare it with ADHOC MAC, an existing TDMA MAC protocol for VANETs. It is shown that, due to its ability to decrease the rate of transmission collisions, the VeMAC protocol can provide significantly higher throughput on the control channel than ADHOC MAC.

3 BACKGROUND SUBTRACTIONS

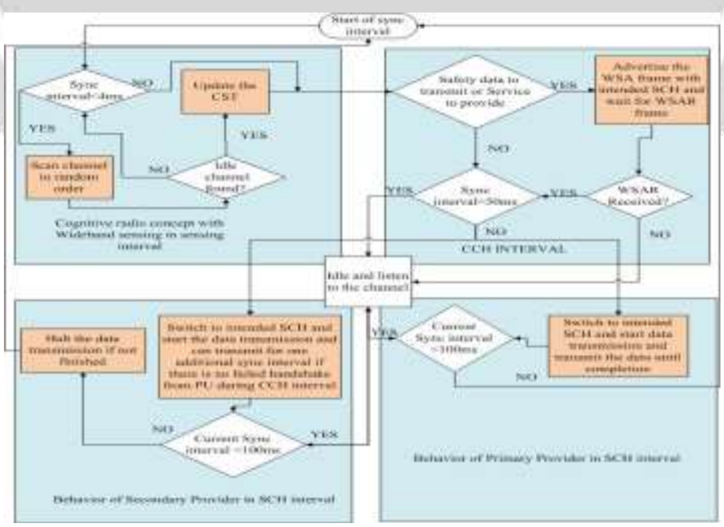
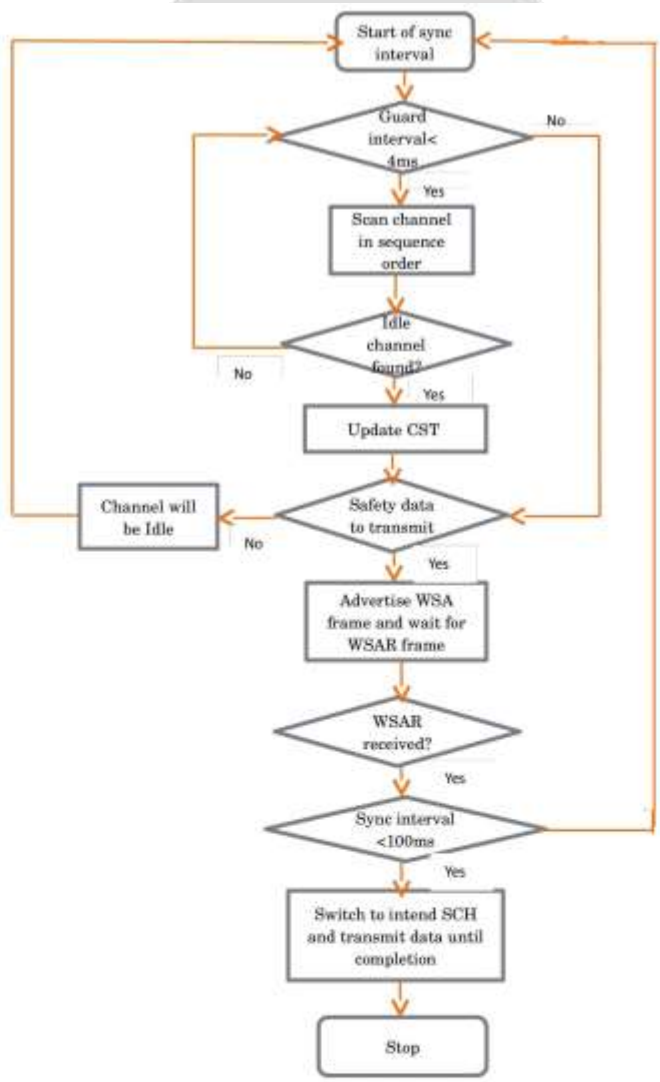


Fig 1 System flow diagram for the proposed MCM protocol [1]

In the MCM convention, every one of the hubs are required to perform wide-band range detecting [1] to use the psychological radio Figure 6. The operation of the proposed MCM convention idea which is introduced in the stream diagram as outlined in Fig 1. Every hub detects the range over each of the six SCHs utilizing its radio trans-recipients and overhaul the range condition toward the start of each CCH interim. When every one of the hubs experience the detecting stage, they build up their own Channel Status Tables (CST) which have the data about each of the six SCHs.

The CST shows whether the channel is accessible amid the wanted interims. As specified over, every supplier needs to adhere to a procedure conflict and arrangement process amid the CCH interim. A supplier promotes its WSA outline amid CCH interim for channel access and transaction process. The SCH that the supplier focuses to change to, is chosen in view of its own CST. When every single intrigued client recognize the WSA outline with a WSAR outline, the handshake procedure is done and the supplier is prepared to send it's information in the following SCH interim.



4 RESULTS

4.1 SIMULATION PARAMETERS

Simulator	NS-2.35 and Cognitive radio
Simulated Area	500*500 meter^2
Number of nodes	0 to 100
Vehicle speed	Random speed to 75km/h maximum
Each simulation time	10ms
Data rate	3 Mbps
Traffic	20m/h
Wide-band sensing interval	4ms at the start of CCH interval
Highest-priority traffic load	0% to 100%

Table : Simulation parameters

4.2 TASK COMPLETED SO FAR

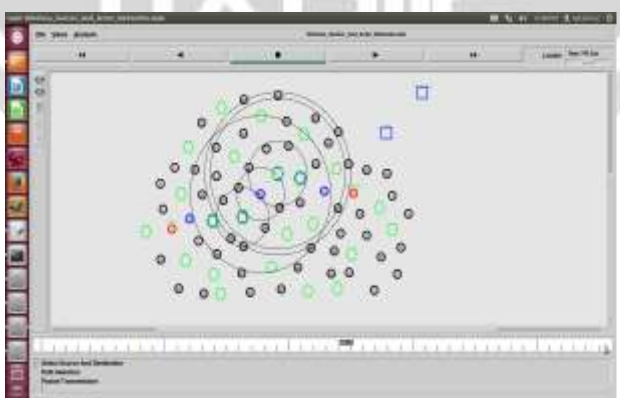


Fig 2 VANET Scenario

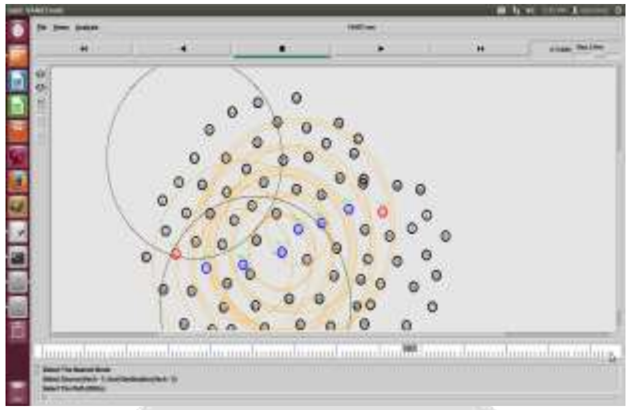


Fig 2 VANET Scenario of start procedure

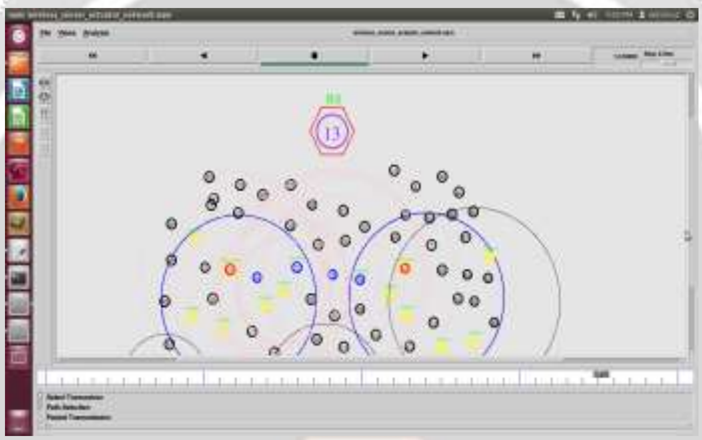


Fig 3 VANET Scenario of node establish

E2E delay comparison of AC[1],AC[2],AC[3] : E2E delay for AC[3] frames is 0.4ms and its remains approximately same throughout the simulation even for 100% traffic load while delay for other ACs increase with traffic load.

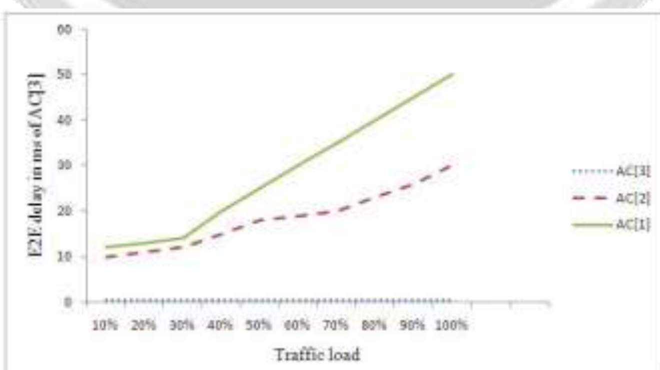


Fig 4 E2E Delay in ms of AC[1-3] Vs. Traffic Load

E2E delay from 10% to 100% traffic load: The E2E delay for existing EDCA protocol increases with traffic load and reaches up to 0.72ms while the E2E delay remains considerably lower throughout the simulations and reaches to 0.5ms which proves the superiority of proposed MAC protocol.

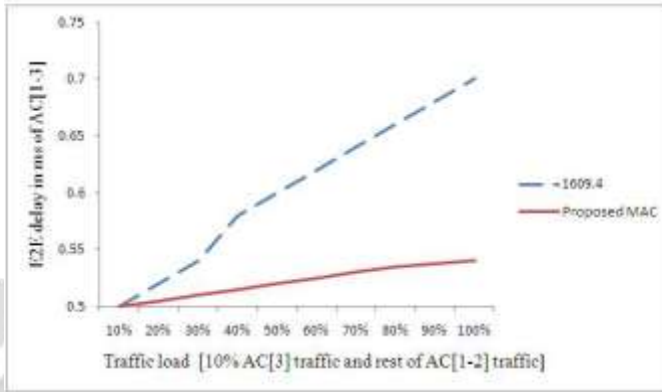


Figure 5 E2E Delay in ms of AC[3] vs. Traffc load [10% AC[3] Traffc and rest of AC[1-2] traffic.

Jitter:

Jitter for AC[3] and ACe[3] is compared in fig 4.7, and it is generated using the first two scenarios. The jitter for exiting EDCA protocol increases with tra-c load and reaches 0.22ms while the E2E delay remains considerably lower throughout the simulations and reach to very low value of 0.04ms, which proves the superiority of the proposed MAC protocol in-terms of jitter.

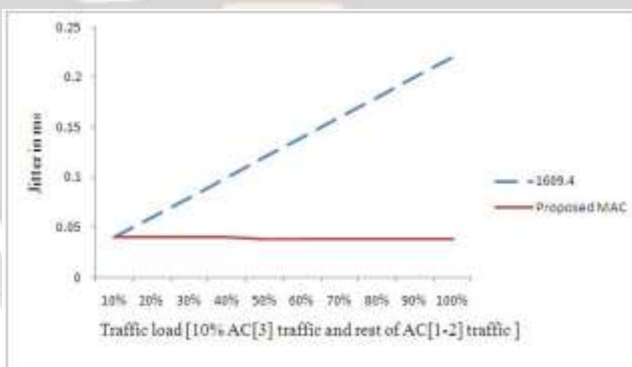


Fig 6 Jitter in ms Vs. Traffic load [10% AC[3] Traffic and rest of AC[1-2] Traffic

5 CONCLUSION

In this paper, a new multichannel cognitive MAC protocol is introduced, followed by modified of EDCA and safety message acknowledgment for improving the performance of MAC protocol. Modify Enhanced Distributed Channel Access protocol to improve the reliability for safety application, which will have capabilities to prioritize traffic to ensure QoS. Develop a simulation model for IEEE 1609.4, which is close to real model to simulate close to real scenario for VANET. The proposed protocol together with the enhancement mechanism were both evaluated with ns-2 and simulations showed improvement for the MAC in-terms of Channel utilization, waiting time interval, delay, jitter, and frame error rate. In real time scenario use TDMA approach for futuer work.

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