CHAPTER 9
Mobility Management in Vehicular Adhoc Network (VANET)

Dr. KANNAN.R
Nehru Institute of Engineering and Technology, Coimbatore, India
Dr. MANORAJAPAUL.M
Nehru Institute of Engineering and Technology, Coimbatore, India
Dr. SAKTHIVEL.S
Nehru Institute of Engineering and Technology, Coimbatore, India
Dr.SOBHA MANAKKAL
Nehru College of Engineering and Research Centre, Kerala, India

ABSTRACT

Now a day's Vehicular AdHoc Network (VANET) is an emerging technology. Mobility management is one of the most challenging research issues for VANETs to support variety of intelligent transportation system (ITS) applications. VANETs are getting importance for inter-vehicle communication, because they allow the communication among vehicles without any infrastructure, configuration effort, and without the high costs of cellular networks. The access is provided by Internet gateways located on the site of roadside and the packet routing scheme is based on a multichannel medium access control protocol called VMAC using time division multiple access. We propose a graph model to characterize the observed mobility pattern. Then the gateway deployment problem is transformed into a vertex selection problem in a graph. By reducing it the minimum vertex coverage problem, we show the gateway deployment problem is NP-complete, so a heuristic algorithm MobGDeploy is proposed to search greedily the optimal deployment points. Extensive simulations are carried out to evaluate the performance, and the results show that the proposed algorithm out performs others.

Key words: VANET, RSU, MAC protocol, ITS and VMAC protocol, MobGDeploy

INTRODUCTION

In past decades, Vehicular Ad hoc Network (VANET) have gained more popularity in the field of automation and research because it has the features like security and also entertainment such as traffic detection, emergency braking, chat room facilities and Internet access etc. VANETs are a type of ad hoc network that contains thousands of mobile nodes like cars which produces a mobile network for vehicular communication and it has the facility to connect the movable cars approximately between 100-300 meters

ISBN: 978-93-5782-920-5, www.aetsjournal.com "Handbook of research in Big data Analytics, Artificial intelligence and Machine learning"

which creates the wide range of network. [1-4]. In order to communicate among the movable nodes it utilizes the RSU (Road Side Unit). Generally, the vehicular communication is classified into two types one is Vehicle to Infrastructure communication (V2I) and Vehicle to Vehicle communication (V2V) which enhances the efficiency of the movable network. The wireless communication devices are fitted with each node (i.e., cars) of VANETs which can act like a computer along the road during travelling which is an inspired concept of travelling. VANETs provide travel safety as well as fun too. [5].

The ITS applications mostly on infrastructure based communications and used for the Internet Access by the Vehicles. In NEMO there ate multihop communication is not supported as they designed for the direct communication (single hop) with the Access Point. In this paper we present a Network Mobility Model for vehicular Ad Hoc Network and it is the scheme basically used wired cum Wireless Scenario. By the analysis of simulation, we show that our scheme provides better robust and seamless handover compared to other scheme

RELATED WORK

Hassan Omar [6] presented VeMAC as a novel multi-channel TDMA protocol which supports an effective one-hop and multi-hop communication services. At the control channel, this protocol renders an authentic one-hop broadcasting services without any hidden terminal problems and an effective multi-hop broadcasting services in order to transmit data packets all over the network. The proposed TDMA is based on the Ad hoc MAC [12] which is specially designed for vehicular networks. During transmission the protocol decreases collisions owing to node mobility at the control channel by allotting disjoint sets of time slots in order to move vehicles in opposite directions and to RSUs. Besides the VeMAC protocol needs novel techniques for the network nodes to access the uncommitted time slots and also to discover the transmission collisions. It is clearly shows that the VeMAC protocol renders appreciably higher network throughput at the control channel than that of Ad hoc MAC protocol.

R.Mangharam et al [7] proposed a new technique called Location Division Multiple Access (LDMA) in order to inhibit the broadcast storm trouble. It also assures bound end-to-end delay throughout the multiple hops. The LDMA technique needs participating vehicles with the GPS system to synchronize vehicle time with the GPS time. It receives definitions of regional map comprising of temporal slot schedules and spatial cell resolutions through the channel control of FM/RDBS which is out-of-band. To measure the performance of the proposed LDMA, the Groove Net vehicular ad hoc network virtualization platform with practical mobility and a vehicle following the congestion model is employed. J.W. Wang et al [8] presented this paper; the author considers a probability that m out of n boxes in which each box have exactly only one ball causing from issuing k balls into n boxes. A set of recursive expression can provide a solution for this problem. The numerical results are obtained by converting the formulae into computer programs.

M.I. Hassan et al [9] designed our proposed model which is validated by employing extensive simulations. Here we have showed that our proposed model provides improved predictive accuracy than conventional models. Then, this model is applied to explore the performance of a modified DCF which utilizes a fixed number of sequential retransmissions in order to enhance the reliability of data packet delivery. We discover it through sequential retransmissions that the packet delivery ratio is better at low vehicle density but poor at high density where higher collisions caused by the retransmissions outweighs the gain of replicated attempts.

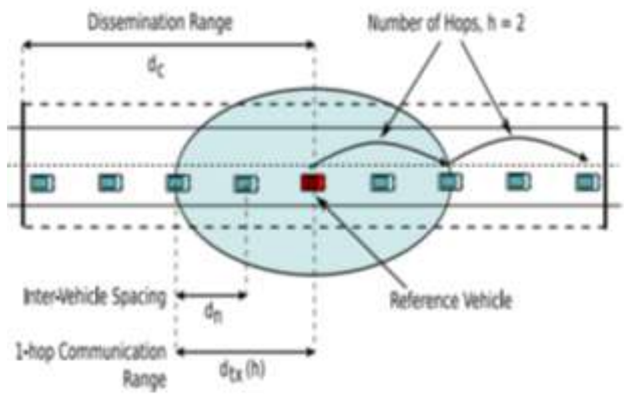
ORGANIZATION OF THE PAPER

The rest of the paper is organized as follows. A qualitative comparison of the existing greedy routing protocols for VANETs are presented in Section 2. An overview of greedy routing algorithms is described in Section 3. In Section 4, we present the simulation results and analysis with the Conclusion in Section 5.

ISBN: 978-93-5782-920-5, www.aetsjournal.com "Handbook of research in Big data Analytics, Artificial intelligence and Machine learning"

VEMAC MODEL

Vehicular Ad hoc Network (VANET) comprises of set of RSUs and it is assumed that a set of nodes moving in opposite directions on a two-way track vehicle traffic roads. If these two vehicles moving in opposite direction on the two-way track means one is moving along a left direction and another one is moving along right direction. VANETs posses' one control and multiple-service channels; employed for the transmission of information and short applications with high priority. The nodes required control information to decide which time slot they should access on the channel. Service channels are employed for secure transmission or non secure related application messages. Service provider is a type of node that declares on channel for service provided on a particular service channel. User node obtains the declaration for a service determines to make utilization of this service. Each and every node posses two transceivers in which transceiver1 is tuned to the channel c and the transceiver2 is tuned to any of the service channel c. Level of transmission power of all channels are constant which is known to all nodes.



GATEWAY NODE-BASED GREEDY ROUTING ALGORITHM (GNGR)

GNGR is a greedy position based reliable routing algorithm and it is designed for sending messages from any node to any other node [8]. In this, the sending of message is from one node to another node (i.e., Unicast) or from one node to all other nodes (i.e., roadcast/Multicast) in a vehicular ad hoc network. The common design goals of GNGR algorithm are to deliver messages with high reliability and to optimize packet behavior for ad hoc networks with high mobility.

There are six basic functional operations of GNGR algorithm.

1. Identification of Neighbor Node (INN) 2. Calculation of Distance (CD) between nodes

3. Identification of Moving Direction (IMD) of the nodes

4. Link Stability Calculation (LSC) between nodes.

5. Weighted Score Calculation (WSC) to identify the next hop which is closer to the destination

6. Gateway Node Selection (GNS).

At any point of time the INN takes the responsibility for collection of all neighbor nodes information, which is all present within the transmission range of source/forwarder node. The CD takes the responsibility for calculating the closeness of next hop using distance information from the GPS. The IMD takes the responsibility to identify the direction of motion of neighbor nodes and verifies that these

ISBN: 978-93-5782-920-5, www.aetsjournal.com "Handbook of research in Big data Analytics, Artificial intelligence and Machine learning"

nodes are moving towards the direction of destination. The LSC takes the responsibility for calculating the link stability between the source/forwarder node and its corresponding neighbor nodes. The WSC takes the responsibility for calculating the largest weighted score and also identify the largest weighted score neighbor node which is further forwarding of a particular packet to destination. The GNS takes the responsibility for selection of gateway node and this node will have high weighted score in different levels of transmission range.

PERFORMANCE ANALYSIS

In this section, we evaluate the performance of routing protocols Vemac and GNGR in an open environment. The simulation is performed using Ns2 2.0 [10], a novel vehicular network simulator tool. The movement of vehicles was controlled by setting vehicle movement and information related to this is stored in node movement scenario configuration file. Simulations for each of the routing protocols were carried out with varying number of nodes with specific parameters. Initially the nodes were placed at certain specific locations, and then the nodes were moved with varying speeds towards new locations. The parameters related to mobility model and wireless communications are shown in Table 1

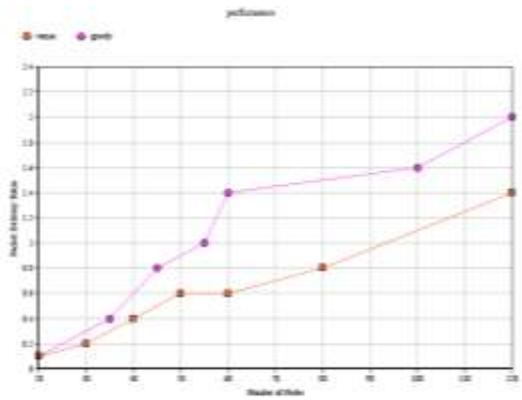
Table 1
Simulation Parameters

Parameter	Value
Simulation Area	2400m * 2400m
Number of Vehicles	20 - 140
Average speed of vehicles	15 – 60 (km/hr)
Number of packet Senders	30
Transmission Range	250m
Constant Bit Rate	2(Packets/ Second)
Packet Size	512 Bytes
Vehicle beacon interval	0.5 (Seconds)
MAC Protocol	802.11 DCF
Simulation Time	500s

PACKET DELIVERY RATIO VS. NUMBER OF NODES

In this division, packet delivery ratio is compared with number of nodes as shown in Fig.1. In the beginning, the packet delivery ratio is less due to less number of vehicles for GNGR,VeMAC. The packet delivery increases depending on the increase of nodes in the routing algorithms. In PDGR, next hop selection for packet forwarding is done through prediction and it is not reliable at all situations. When the vehicles are moving in high speed, the packet forwarded to the corner of transmission range will be lost. To overcome this kind of situation, the GNGR uses weighted score calculation for selection of next hop. By increasing the number of vehicles, the GNGR reduces the packet loss at highest transmission range and also packet delivery ratio increases as compared with VeMAC.

ISBN: 978-93-5782-920-5, www.aetsjournal.com "Handbook of research in Big data Analytics, Artificial intelligence and Machine learning"



(b) Fig 1: Packet Delivery Ratio vs. Number of Nodes

PACKET DELIVERY RATIO VS. MOBILITY

In this division, packet delivery ratio is compared with different speed of vehicles as shown in Fig.2. The packet delivery ratio of VeMAC decreases due to increase in the speed of vehicles. The high speed of vehicles paves way for the packet loss at the corner of highest transmission range. By increasing the speed of vehicles, the packet loss at the corner of highest transmission range is reduced considerably in GNGR as compared with VeMAC.

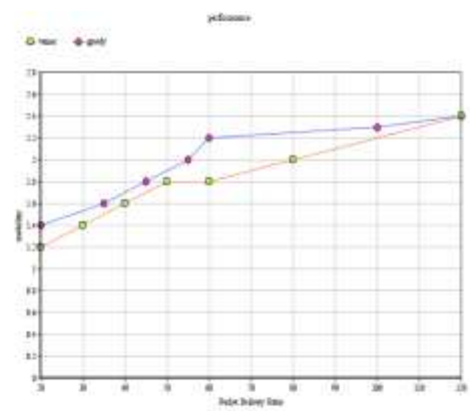


Fig 2:Packet Delivery Ratio vs. Mobility

CONCLUSION

Thus the problem of deploying gateways for mobile vehicles in the vehicle to roadside communication system. The design goal is to satisfy the connectivity requirement for all vehicles passing the coverage region while minimizing the deployment cost. We use a mobility graph characterize the time stable mobility pattern, and show the gateway deployment problem is NPcomplete by reducing it into the minimum vertex coverage problem. Finally, we propose a heuristic greedy algorithm MobGDeploy to find the optimal installation places. Extensive experiment in the synthetic scenarios is carried out to evaluate the performance of our solution.

ISBN: 978-93-5782-920-5, www.aetsjournal.com "Handbook of research in Big data Analytics, Artificial intelligence and Machine learning"

REFERENCES

[1] X. Lin, R. Lu, C. Zhang, H. Zhu, P.H. Ho, and X. Shen, "Security in Vehicular Ad Hoc Networks", IEEE Communications Magazine, Vol. 46, No. 4, 88-95, 2008

[2] Nai-Wei Lo and Hsiao-Chien Tsai, "Illusion Attack on VANET Applications", IEEE Globecom Workshops, pp. 1–8 (2007)

[3] IEEE Std. 1609.2-2006, “IEEE Trial-Use Standard for Wireless access in Vehicular Environments-Security Services for Applications and Management Messages,” 2006.

[4] S. Eichler, F. DÄotzer, C. SchwingenschlÄogl, J. EberspÄacher, and F.J. Fabra Caro, \Secure Routing in a Vehicular Ad Hoc Network", 60th Vehicular Technology Conference, Los Angeles, USA, 2004.

[5] Pradeep B, Manohara Pai M.M and M. Boussedjra, J. Mouzna, Global Public Key Algorithm for secure location service in VANET, IEEE 2009.

[6] H.A. Omar, W. Zhuang, Li Li “VeMAC: A TDMA-based MAC Protocol for Reliable Broadcast in VANETs”, Mobile Hoc, 2011, pp. 190-201.

[7] R.Mangharam, R. Rajkumar, M. Hamilton “Bounded-Latency Alerts in Vehicular Networks”, University of Pennsylvania, 2007.

[8] J.H. Wen, J.W. Wang “A recursive solution to an occupancy problem resulting from TDM radio communication application”, Applied Mathematics and Computation 101(1-3), 1999.

[9] I. Hassan, L. Vu, T. Sakurai “Performance Analysis of the IEEE 802.11 MAC Protocol for DSRC with and without Retransmissions”, the University of Melbourne, 2010.

[10] L. Kleinrock and F. Tobagi, “Packet Switching in Radio Channels: Part I – Carrier Sense Multiple-Access Modes and Their Throughput-Delay Characteristics,” IEEE Trans. Communication, vol. 23, no. 12, Dec. 1975, pp. 1400-1416.

[11] IEEE Std 802.11, “Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications,” IEEE, New York, 1999.

[12] B. Sharp, E. Grindrod, and D. Camm, “Hybrid TDMA/CSMA Protocol for Self Managing Packet Radio Networks,” 4th IEEE

ISBN: 978-93-5782-920-5, www.aetsjournal.com “Handbook of research in Big data Analytics, Artificial intelligence and Machine learning”