ISSN:1991-8178

Australian Journal of Basic and Applied Sciences

Journal home page: www.ajbasweb.com

Optimized Heuristic Buffer-based Routing For VMesh Milieu

[1]P. Dharanyadevi and [2]K. Venkatalakshmi

[1]*Research Scholar, Information and Communication Engineering, Anna University, Chennai, India.*
[2]*Assistant Professor, Electronics and Communication Engineering, Anna University Tindivanam Campus, Tindivanam , India.*

ARTICLE INFO

Article history:
Received 12 March 2015
Accepted 28 April 2015
Available online 5 May 2015

Keywords:
Vehicular ad hoc network, Mesh network, Buffer, Heuristic fitness function, Gridlock, Performance.

ABSTRACT

With the rising reputation of the vehicles, VMesh milieu is becoming a crucial part of wireless heterogeneous network. VMesh milieu is an impetuous ad hoc network fashioned over moving vehicles on the road. The proposed Optimized Heuristic Buffer-based Routing (OHBR) focuses on proficient routing based on the buffer size and heuristic fitness function, in order to reduce the packet loss, retransmission, gridlock, protocol overhead and delay in VMesh milieu. The maximum buffer size and minimum distance are considered as an objective of heuristic fitness function. The simulation results obtained by the logical as well as the packet-level simulator such as, Traffic & Network Simulator (TraNS) justify that the proposed OHBR outperforms the existing techniques.

© 2015 AENSI Publisher All rights reserved.

To Cite This Article: P. Dharanyadevi and K. Venkatalakshmi., Paper title. Optimized Heuristic Buffer-based Routing For VMesh Milieu ***Aust. J. Basic & Appl. Sci.,*** *9(11): 386-390, 2015*

INTRODUCTION

The upsurge in the growth of newfangled applications and services in VMesh milieu has fascinated unique attention from the research community (Wunderlich *et al*., 2008, Camacho *et al*., 2010, Li-Ling Hung *et al*., 2012, Taha *et al*., 2007, Zang *et al*., 2008, Taleb *et al*., 2007, Bononi *et al*., 2007). The vehicular ad hoc network is pervasive, ubiquitous and infrastructure-free without any centralized authority (James *et al*., 2009, Eiman *et al*., 2012). The vehicular ad hoc network provides a wireless communication between moving vehicles using a Dedicated Short Range Communication (DSRC) (Saif *et al*., 2014). A wireless mesh network is a multi-hop communication network in which the nodes are self-organized (i.e., without necessity of a central coordinator) (Eiman *et al*., 2012). VMesh is a hybrid network, which combines the features of vehicular ad hoc network and wireless mesh network. VMesh generates a loop among the moving vehicle. In the loop we can add, update or remove nodes (vehicles). There are many challenges due to the specificities of VMesh milieu, such as high mobility of vehicles, high rate of topology changes, lack of central coordination, high variability in nodes density and neighborhood configuration, broadcast /geocast communication, nature, error prone shared radio channel, hidden terminal problem, limited resource availability and insecure medium (Korkmaz *et al*., 2006, Yang *et al*., 2007, Zawodniok *et al*., 2007, Ozlem *et al*., 2011). The issues due to the challenges are packet loss, retransmission, gridlock, protocol overhead and delay. The main contribution of this paper is to overcome the issues in VMesh milieu, such as the packet loss, retransmission, gridlock, protocol overhead and delay by the proposed OHBR. The rest of this paper is structured as follows: related works, OHBR for VMesh milieu, simulation results and analysis and finally we concludes this paper.

Related Works:

The petty protocols have been proposed to reduce the packet loss, retransmission, gridlock, protocol overhead and delay in VMesh milieu. (Korkmaz *et al*., 2006) proposed a cross-layer protocol, called Controlled Vehicular Internet Access (CVIA), for vehicular Internet access on highway applications. The CVIA protocol employs two vehicles as routers in each segment for relaying packets in each channel. Similar to the CVIA scheduling protocol, (Yang *et al*., 2007) proposed another cross-layer protocol, called Coordinated External Peer Communication (CEPEC), for Internet access services and peer to-peer communications in VANETs. The existing CVIA and CEPEC approaches alleviate the packet collisions of the multihop transmission in VANETs. However, in CVIA and CEPEC, the transmission efficiency is low

Corresponding Author: P. Dharanyadevi, Research Scholar, Information and Communication Engineering, Anna University, Chennai, India.
E-mail: dharanyadevi@gmail.com

in terms of successful packet delivery and average transmission delay. (Zawodniok *et al*., 2007) has proposed the event-to-sink reliable transport protocol. ESRT monitors the local buffer level of nodes and sets a congestion notification bit in the packets, it forwards to the sink if the buffer overflows. If a sink receives a packet with the congestion notification bit set, it infers congestion and broadcasts a control signal informing all sources to reduce their common reporting frequency. Conversely in ESRT protocol overhead is high. (Ozlem *et al*., 2011) has proposed a cross-layer optimization scheme for congestion control in multi-hop wireless networks. They implement a differential backlog based MAC scheduling and router-assisted backpressure congestion control scheme using real off-shelf radios. The authors focus on fair bandwidth sharing between end to end flows, while maintaining an efficient overall throughput in the network. They propose a dynamic rate allocation solution that is based on a simple radio sharing model. The congestion control is based on probabilistic dropping based on buffer occupancy and hit frequency. (Li-Ling Hung *et al*., 2012) proposed MAC protocol with bandwidth utilization and fairness enhancements (BUFE-MAC) for mesh backbone based VANETs, aiming at improving the bandwidth utilization and maintaining the fairness opportunities of all vehicles. However, in BUFE-MAC as the packets are transferred through segments, the number of hops will be more and it leads to delay during the transmission. In summary till now in VANET the gridlock techniques are based on only detection of gridlock and recovery, but they cannot eliminate or prevent the occurrence of gridlock. In this paper, the OHBR with the aid of a buffer and a heuristic fitness function curtails the packet loss, retransmission, gridlock, protocol overhead and delay.

Proposed Optimized Heuristic Buffer-Based Routing (OHBR) For VMesh Milieu:

The OHBR is used to discover the optimized path from VMesh user to the service provider via an access point based on the buffer size and heuristic fitness function. In VMesh milieu each vehicle is equipped with the buffer. The buffer in the vehicle are amend timing by implementing a queue. The buffer consists of input and output buffer. The inward packets (received packets) are stored in the input buffer and outward packets (packets to be transmitted) are stored in the output buffer. The service method used for transmitting and receiving the packet is First In First Out (FIFO). The VMesh user, requests for the services to the service provider, the request is transmitted as the packets. The packets are transmitted within the coverage area.

As expressed in Eq.1, the vehicle coverage area is expressed as,

$$VCon \leq Tv \quad (1)$$

where, *'VCon'* is the coverage area of the vehicle and *'Tv'* is the threshold value. Generally *Tv* ranges from 100-300 meters, it depends upon the vehicle competence.

As illustrated in the Algorithm 1, the maneuvers to be followed in the OHBR are,

Maneuver 1:

The source vehicle (transmitting vehicle) dynamically scans for an access point in the coverage area.

Case 1:

As illustrated in Fig.1 (a), if there is an access point in the coverage area, the source vehicle will directly send the packet to an access point.

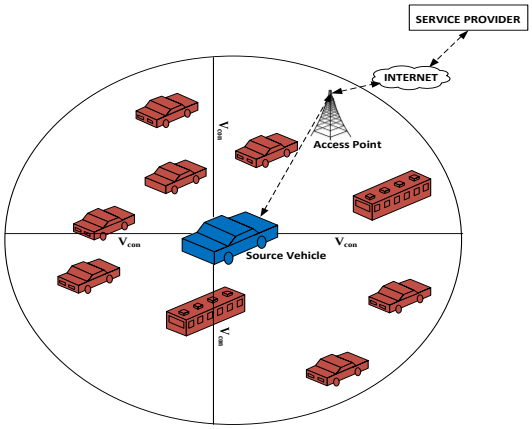

Fig. 1: (a)

Case 2:

If there is no access point in the coverage area, go to maneuver 2.

Case 1 and Case 2 can be expressed as,

$$Dest = Within\ VCon \begin{cases} Send\ Pkt\ to\ AP & if\ AP=1 \\ GOTO\ M2 & Otherwise, \end{cases} \quad (2)$$

where, *'Dest'* is the Destination, '*Pkt'* is the packet, *'AP'* is the Access Point and *'M2'* is the Maneuver 2.

Maneuver 2:

The source vehicle dynamically scans for an intermediate vehicle in the coverage area.

Case 3:

If there is one intermediate vehicle in the coverage area, the source vehicle will acquire *'Bp'* and '*MaxBSize'* of the intermediate vehicle and calculates *'B_Size'*. The B_Size is calculated by,

$$B_Size = (MaxBSize - (Bp * Ps * 1e-6)) \quad (3)$$

where *'B_Size'* is the free space in the buffer of the intermediate vehicle in terms of GB, *'MaxBSize'* is the maximum buffer size of the intermediate vehicle in terms of GB, *'Bp'* is the total number of packets in the buffer of the intermediate vehicle and ponder *'Packet size (Ps)*= 64 KB'. As expressed in Eq.4, if return buffer size is zero or less than Pse-6, go to maneuver 1. Else if the buffer size is greater than

Pse-6, the source vehicle will send the packet to an intermediate vehicle. Then go to maneuver 1.

$$Dest = \begin{cases} GOTO\ M1 & if\ B_Size = 0 \\ GOTO\ M1 & if\ B_Size < Pse\text{-}6 \\ Send\ Pkt\ to\ IV & if\ B_Size > Pse\text{-}6 \end{cases} \quad (4)$$

where, *'M1'* is the Maneuver 1 and *'IV'* is the intermediate vehicle.

Case 4:

As illustrated in Fig. 1 (b), if there are two or more intermediate vehicles in the coverage area. The source vehicle will acquire *'Bp'* and '*MaxBSize'* and calculates *'B_Size'* for each intermediate vehicle. As expressed in Eq.5, if return buffer size is zero or less than Pse-6, discard an intermediate vehicle and go to maneuver 1. Else, if the buffer size is greater than Pse-6, calculate Heuristic Fitness Function (HFF) for each intermediate vehicle.

$$Dest = \begin{cases} Discard\ IV & if\ B_Size = 0 \\ Discard\ IV & if\ B_Size < Pse\text{-}6 \\ Calculate\ HFF\ \forall\ n,\ n=1,2,3,\ldots,x & if\ B_Size > Pse\text{-}6 \end{cases} \quad (5)$$

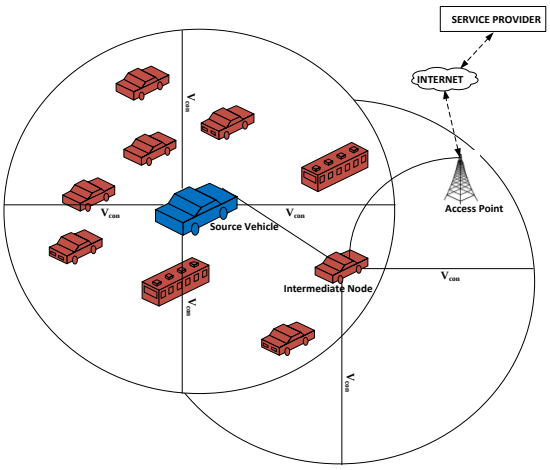

Fig. 1: (b)

where, *'x'* is the maximum number of intermediate vehicles in the coverage area. The HFF is calculated by,

$$HFF = \left(\frac{B_Size}{D_{s,i}} \right) \quad (6)$$

where, *'$D_{s,i}$'* is the distance between the source vehicle and intermediate vehicle. The calculated HFF values are updated in the routing table. From the routing table, the intermediate vehicle which has a maximum HFF value is chosen as an optimal intermediate vehicle. The packets are transmitted to an optimal intermediate vehicle. Then go to maneuver 1.

Case 5:

Further the intermediate vehicle is selected till the packet reaches the access point.

From the access point, the request will reach the service provider. The service provider processes the request and sends the response. The response follows the same request-path.

Simulation Results And Analysis:

In the real world, the deployment and testing of VMesh milieu cost are higher. However, simulators provide a vital alternative for conducting affordable and repeatable evaluations prior to actual deployment. OHBR and existing technique were implemented in Traffic and Network Simulator (TraNs). TraNS is a GUI tool that integrates traffic and network simulators (SUMO and NS2) to generate realistic simulations of VMesh milieu. TraNS allows the packet transfer in VMesh milieu to influence the vehicle behavior in the mobility model. The proposed OHBR and existing BUFE-MAC are evaluated using the metrics such as the packet collision ratio, average transmission delay and success rate.

Algorithm 1: OHBR
Source: *Source Vehicle*
Destination: *Access Point*

Maneuver 1:
SV scans for AP in VCon ***{***
If *(AP =1)* ***then***
Send Pkt to AP
Else
Call IV();
End If
}

B_Size() {
Acquire Bp, MaxBSize;
Ps = 64 KB;
B_Size= (MaxBSize-(Bp Ps* 1e-6)) ;*
}

Maneuver 2:
Call IV(){
Scan for IV in VCon {
If *(IV=1)* ***then***
Call B_size;
Return B_Size;
If *(B_Size = 0)* ***then***
GOTO Maneuver 1;
Else If*(B_Size<Pse-6)* ***then***
GOTO Maneuver 1;
Else *(B_Size>Pse-6)* ***then***
Send Pkt to IV;
GOTO Maneuver 1;
End If
Else *(IV>1)* ***then***
Call ProficientIV();
End If *}}*

Call HFF()
$\{ HFF = \left(\frac{B_Size}{D_{i,j}} \right); \}$

Call ProficientIV(){
fv=0;
For *each IV in the VCon*
Call B_size;
If *(B_Size = 0)* ***then***
Discard IV;
GOTO Maneuver 1;
Else If*(B_Size<Pse-6)* ***then***
Discard IV;
GOTO Maneuver 1;
Else *(B_Size>Pse-6)* ***then***
Call HFF();
Return HHF;
If*(HFF>fv)* ***then***
fv=HFF;
HFF=fv;
End If
End If
End For
Optimal IV=HFF;
Send Pkt to Optimal IV;
GOTO Maneuver 1;
}

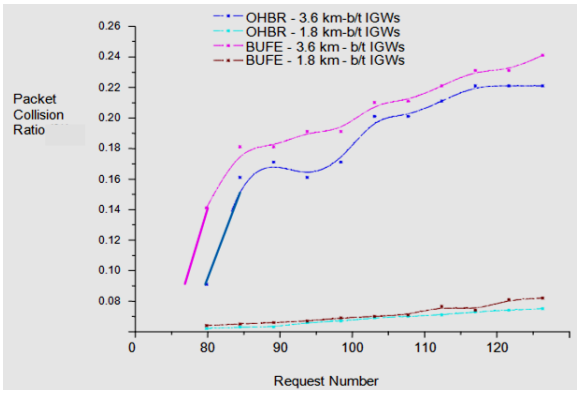

Fig. 2: Packet Collision Ratio.

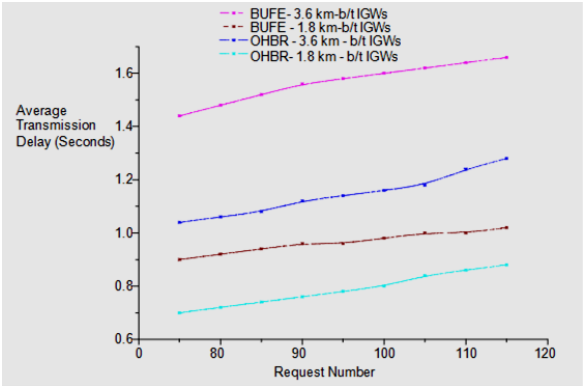

Fig. 3: Average Transmission Delay.

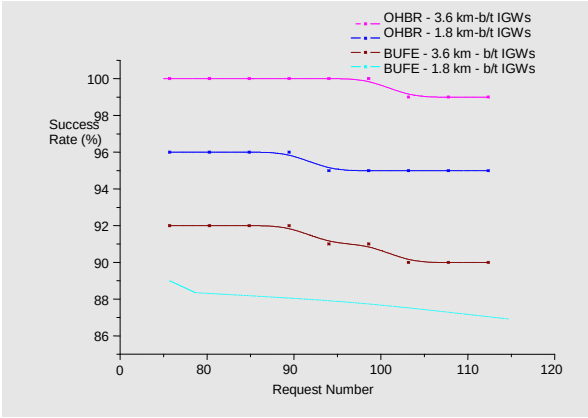

Fig. 4: Success Rate.

Packet Collision Ratio (PCR): PCR is defined as the ratio of the number of packets collided to the number of packets transmitted. As depicted in Fig. 2, PCR of BUFE-MAC and OHBR increases when the number of request increases. In OHBR, packet collision is handled by the HFF with the aid of the buffer. Hence the PCR of OHBR is less than the BUFE-MAC.

Average Transmission Delay (ATD): ATD is the average difference between the time a data packet is originated by an application and the time this packet is received at its destination. As depicted in Fig. 3, ATD of BUFE-MAC and OHBR increases when the number of request increases. OHBR reduces the channel load and packet collision probability thus leading to a shorter average transmission delay, thus the ATD of OHBR outperforms the BUFE-MAC.

Success Rate: Success rate indicates the total number of successful service reply received over the total number of service queries sent in the VMesh milieu during the simulation time. As depicted in Fig. 4, the success rate of BUFE-MAC and OHBR decreases when the number of request increases. The increase in request number causes packet loss, retransmission, gridlock, delay and protocol overhead. Consequently the success rate decreases. As in OHBR the packets are transferred based on the buffer size and HFF, it minimizes the packet loss, retransmission, gridlock, delay and protocol overhead during the transmission. Thus the success rate of OHBR outperforms the existing technique.

Conclusion:

This paper has proposed an Optimized Heuristic Buffer-based Routing for VMesh Milieu. A comparative study of OHBR with the existing has shown that our proposed wholly surpasses in terms of packet collision ratio, average transmission delay and success rate. And it is demonstrated that OHBR is proficient for the VMesh milieu in provisos of gridlock avoidance, successful packet delivery and devoid of packet loss, retransmission, delay and protocol overhead. Even though the presented outcome of OHBR is very promising, there are various problems we crave to address in prospect work which include noise interference and security in the milieu.

REFERENCES

Bononi and M. Di Felice, 2007. A cross-layered MAC and clustering scheme for efficient broadcast in VANETs. in Proc. IEEE MASS, 1-8.

Camacho, V. Kostakos and C. Mantero, 2010. A wireless infrastructure for delivering contextual services and studying the transport behavior. in Proc. 13th Int. IEEE Conf. Intell. Transp. Syst., 943-948.

Eiman Alotaibi, Biswanath Mukherjee, 2012. A survey on routing algorithms for wireless Ad-Hoc and mesh networks. Elsevier , Computer Networks, 56: 940-965.

James Bernsen, D. Manivannan, 2009. Unicast routing protocols for vehicular ad hoc networks: A critical comparison and classification". Elsevier, Pervasive and Mobile Computing, 5: 1-18.

Korkmaz, E. Ekici and F. Ozguner, 2006. A cross-layer multihop data delivery protocol with fairness guarantees for vehicular networks. IEEE Trans. Veh. Technol., 865-875.

Li-Ling Hung, Chih-Yung Chang, Cheng-Chang Chen and Yu-Chieh Chen, 2012. "BUFE-MAC: A Protocol With Bandwidth Utilization and Fairness Enhancements for Mesh-Backbone-Based VANETs. IEEE Transactions On Vehicular Technology, 2208-2221.

Ozlem Durmaz Ince, 2011. A survey on multi-channel communication in wireless sensor networks. Computer Networks, 55: 3081-3099.

Saif Al-Sultan, Moath M. Al-Doori, Ali H. Al-Bayatti, Hussien Zedan, 2014. A comprehensive survey on vehicular Ad Hoc network. Elsevier, Journal of Network and Computer Applications, 37: 380-392.

Taha and Y.M.Y. Hasan, 2007. VANET-DSRC protocol for reliable broadcasting of life safety messages," in Proc. IEEE Int. Symp. Signal 1049 Process. Inf. Technol., 104-109.

Taleb, E. Sakhaee, A. Jamalipour, K. Hashimoto, N. Kato and Y. Nemoto, 2007. A stable routing protocol to support ITS service in VANET networks. IEEE Trans. Veh. Technol., 56: 3337-3347.

Wunderlich, C. Liu, I. Elhanany and T. Urbanik, 2008. A novel signal scheduling algorithm with quality-of-service provisioning for an isolated intersection. IEEE Trans. Intell. Transp. Syst., 9: 536-547.

Yang, S. Ou, H.H. Chen and J. He, 2007. A multihop peer-communication protocol with fairness guarantee for IEEE-802.16-based vehicular networks. IEEE Trans. Veh. Technol., 56: 3358-3370.

Zang, L. Stibor, H.J. Reumerman and H. Chen, 2008. Wireless local danger warning using inter vehicle communications in highway scenarios. in 1052 Proc. Eur. Wireless Conf., 1-7.

Zawodniok, M., S. Jagannathan, 2007. Predictive congestion control protocol for wireless sensor networks. IEEE Transactions on Wireless Communications, 6: 3955-3963.