ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 2, Issue 11, November 2014

Data Broadcasting Using Backbone Driven Operation for Two Dimensional Highways in VANET

T. Nagalakshmi[1], P.Gokulakrishnan[2]

PG Scholar, Dept of CSE, PSNA College of Engineering & Technology, Dindigul, Tamil Nadu, India

Assistant Professor, Dept of CSE, PSNA College of Engineering & Technology, Dindigul, Tamil Nadu, India

ABSTRACT: Vehicles connected to each other through an ad-hoc system form a wireless network called vehicular ad-hoc network (VANET).VANET is a special kind of communication network which transfers data from vehicle to infrastructure (V2I) as well as vehicle to vehicle (V2V).In VANET, Road Side unit (RSU) acts as wireless LAN access point and it provide communication with infrastructure. In the existing system RSU act as server which transfer the packet to the vehicles through an antenna. Vehicular Backbone Network (VBN) is the network in which the vehicles are self elected as Relay Node (RN) and RN forward the packet to neighboring vehicles in one dimensional highway. The proposed work enhance the throughput capacity for two dimensional highways, here vehicles are self elected as Relay node (RN) based on their location but RSU has two folds which will send and receive the packet from vehicles. Based on the dynamic formation of a multi-hop backbone network the event that has occurred in roads are transmitted to RSU. Vehicles are equipped with a sensor that detects the road accidents and informs to nearest RSU via the VBN. In enhanced VBN, the network is constructed along various directions according to road path. The throughput between vehicle and RSU is increased as well as packet drops are reduced.

KEYWORDS: VBN, RSU, relay node, V2V, V2I

I. INTRODUCTION

Vehicular networking has significant potential to enable applications associated with traffic safety, info-mobility, urban sensing and infotainment. The interest in this area is proved by the definition and use of specific standards, namely the IEEE 802.11p and 1609, to support Wireless Access in Vehicular Environment (WAVE) and to deliver safety and non-safety applications to vehicles on the road. Safety application is time critical and it helps to overcome collision avoidance, lane changing, post crash, road condition warnings etc. Non-safety application is not time bounded it is related to driver's comfort.

A key component for providing services by using VANETs involves the use of data broadcasting that allows users in vehicles to receive information relevant to an event that is detected on the road as well as to receive data from a road oriented infrastructure, through the Road Side Unit (RSU).Several solutions have been proposed for data broadcasting with the goal of addressing the broadcast storm problem, extending the coverage area, and controlling the dissemination delay. The basic idea of the Vehicular Backbone Network (VBN) scheme is to have, at any given instant of time, certain vehicles elect themselves as relay nodes (RNs) [1]. RNs act as base stations do in a cellular network, except that they are mobile, dynamically elected, and may serve as backbone forwarding nodes for a limited period of time, and/or for a limited number of packets

A RSU is typically installed at busy road junctions serves as data buffer point so that vehicles can upload and download data when it passes through the coverage area of an RSU Location and time dependent data can be temporarily stored at certain RSUs, which can be useful to provide services including location-based advertisement, real-time traffic notification, digital map downloading and so on.

A single Road Side Unit (RSU) located along the road generates downlink message traffic; such messages are continuously generated aiming to reach all vehicles that travel along the highway. Since the RSU is able to broadcast its message flows across only a limited span of the highway, we introduce a network forwarding scheme under which

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 2, Issue 11, November 2014

certain vehicles are elected to act as RNs. Packets issued by the RSU are then forwarded by a RN. When a packet is transmitted from a RN to a neighboring RN, all vehicles located along the stretch of the highway that connect these two RNs are able to receive the corresponding packet.

II. RELATED WORK

The deployment of sensors in wireless networks is to improve communication. Messages transmitted in the VANET, such as those involving public safety and infotainment applications, are of broadcasting nature. However, without the institution of appropriate coordination mechanisms among vehicles, broadcasting in such an ad hoc network may result in inducing broadcasting storm problems [3], leading to frequent packet collisions and retransmissions. To tackle this problem, a number of broadcasting protocols have been proposed, often restricting the number of vehicles employed to simultaneously transmit packets by using distance-based protocols to elect forwarding vehicles [3], [4], and to synthesize cluster-based forwarding layouts. However, many such protocols induce a high rate of control messaging used for cluster formations and protocol implementation. We adopt a GPS-based packet forwarding protocol in this paper, coupled with the use of adaptive coding and uni- directional antenna systems. Pre-determined nominal positions along the highway are computed to identify the best locations for relay nodes that serve to achieve the networks highest broadcast throughput capacity rate. The idea of forming such a GPS-based VANET operation has been proposed in [4], identified as a Vehicular Backbone Network (VBN), where vehicles are assumed to employ Omni-directional antennas. In this paper, we assume that each vehicle has the capability to employ a directional antenna system to communicate with its neighboring vehicles, yielding a network system that exhibits superior performance behavior. While several papers have been published in evaluating VANET systems that use vehicles equipped with directional antennas [4], [5], [2], none of them have proposed a VBN like protocol; no analytical evaluations that determine the optimal parameters to be selected in the operation of such a network, or used to characterize its performance behavior, have as of now been published. In this paper, we provide a numerically efficient algorithm to determine the optimal values for the nominal positions that should be used by relay node (RN) vehicles to maximize the system's broadcast capacity under high traffics density conditions. In evaluating performance under stochastic vehicular traffic flows, we consider stochastic deviations of vehicles elected to serve as RNs from the underlying nominal RN positions and identify the optimal selection of the inter-relay distance levels. We demonstrate that by using the Directional Vehicular Backbone Network (DVBN) protocol, the broadcast throughput capacity level achieved by the Omni-directional VBN system can be improved by a factor 10.In two dimensional highways vehicles are self elected as relay node and it is reactive so in my proposed work Dynamic Source Routing Protocol is established .It is a reactive routing protocol which is able to manage a MANET without using periodic table-update messages like table-driven routing protocols do. DSR was specifically designed for use in multi-hop wireless ad hoc networks. Ad-hoc protocol allows the network to be completely self-organizing and self-configuring which means that there is no need for an existing network infrastructure or administration. For restricting the bandwidth, the process to find a path is only executed when a path is required by a node (On-Demand-Routing). In DSR the sender (source, initiator) determines the whole path from the source to the destination node (Source-Routing) and deposits the addresses of the intermediate nodes of the route in the packets. Compared to other reactive routing protocols like ABR or SSA, DSR is beacon-less which means that there are no hello-messages used between the nodes to notify their neighbors about her presence.DSR was developed for MANETs with a small diameter between 5 and 10 hops and the nodes should only move around at a moderate speed.DSR is based on the Link-State-Algorithms which mean that each node is capable to save the best way to a destination. Also if a change appears in the network topology, then the whole network will get this information by flooding. This paper investigate the impact of different factors, such as the roadside infrastructure deployment, the vehicle-to-vehicle relaying, and the penetration rate of the communication technology, even in presence of large instances of the problem. Results highlight the existence of two operational regimes at different penetration rates and the importance of an efficient, yet 2-hop constrained, vehicle-to-vehicle relaying.

II. METHODOLOGY

In the existing work the network forwarding schemes are used to forward the packet from RSU to RN and from relay node to other vehicles. The network forwarding scheme is Distance Based forwarding (DBF), Probability Based Forwarding (PBF) and VBN in one dimensional highways.

3.1 DISTANCE BASED FORWARDING

In DBF scheme elect the ‘X’ node that is located far away from the current forwarding node ‘S’ (source node) to act as the next forwarding node. If a vehicle ‘X’ receive the packet from the forwarding node ‘S’ it sets a timer value based on distance and transmission range. Source node elect the vehicle with in its transmission range, before the time expire the node ‘X’ elects the other vehicle as relay node. Timer is set by the receiving packet by

$$T\ (1-d_{sx}/TR)$$

Where T-Constant Parameter, d_{sx}-distance between source node and X, TR-Transmission Range**.** If the elected node hears that another node forwarding the same packet it cancels its own forwarding action.

3.2 PROBABILITY BASED FORWARDING

In Probability Based Forwarding source node sends the packet to ‘X’ vehicle, this vehicle will check the packet ID of the sender vehicle if the packet received by ‘X’ is first time then it re-broadcast the packet to its neighboring vehicle otherwise it discard the packet and it is calculated by

$$P_{sx}=d_{sx}/TR$$

Where P is probability, d is distance, T is Transmission Range. If the rebroadcasting probability is greater than ‘X’ it chooses the farthest vehicle to transmit packets.

3.3 MULTI HOP FORWARDING

Multi hop cooperative communication is an emerging technique to extend the coverage area of the network and it increase the capacity. This type of technique is used to adapt the transmission and increase the relaying method. It ensures reliable forwarding of information which will increase the throughput of multi hop networks.

3.4 VEHICULAR BACKBONE NETWORK

Under the Vehicular Backbone Network (VBN) architecture certain vehicles travelling along highway are elected to act as relay nodes. Each relay node will establishes a communication link with its neighboring relay nodes forming the VBN network. During election time some of the vehicles elect those vehicles which are reside closest to the optimal position or identified locations. Normally relay node is for a particular period of time we need to perform a particular task and then replacing by the similar group of nodes. Node is a point in a network, within the network the relay node vehicle will forward the packet to other neighboring vehicles.

In VBN at any instant of time vehicles are self elected as relay nodes. Relay nodes are elected based on optimal values of nominal position in order to maximize the system’s broadcast capacity. Nominal positions are predetermined by the link capacity which represents the throughput capacity rate. The vehicle nearest to optimal position is elected as relay node to maximize the broadcast capacity. The packets are forwarded using Forwarding Layer (FL).FL resides above the MAC layer and it instructs the MAC layer to schedule the transmission for the next RN.RN re-election is initiated periodically to forward the packets, and to create VBN network. The operation is accessed in particular with TDMA or CSMA/CA. Service Channel and Control Channel are used for data scheduling, Control Channel select the RN Service Channel will forward packet to selected RN.

IV. SYSTEM MODEL

Our system model aims to transfer data from RSU to Vehicle and from vehicle to RSU, vehicle to vehicle. RSU select the vehicle as relay node based on speed and location of the vehicle and it calculates the optimal position, here slower moving vehicle is chosen as relay node so that it can act as long time as relay node. The relay node vehicle will send the data to nearby vehicles, when the relay node vehicle crosses the optimal position it transfer the control to the another vehicle which is far away from the position.

In two dimensional highways this model is proposed to reduce the packet drop and to increase the throughput while data transfers. An upstream distribution of broadcast flows from the RSU to Vehicle and from Vehicle to Vehicle.

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 2, Issue 11, November 2014

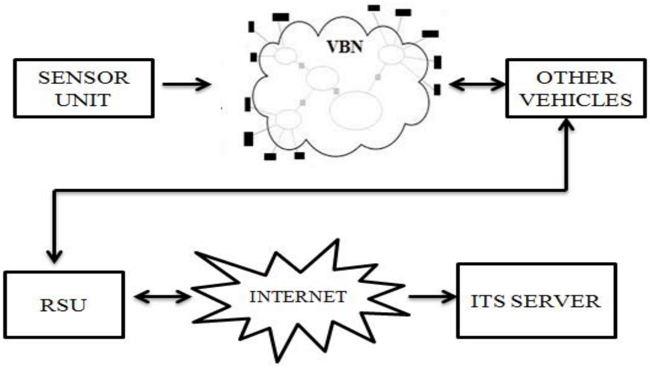

Fig1.System Model

A sensor is placed in vehicle, if the vehicle detects any abnormal status in highways like pits, accident between any vehicles or lane change the vehicle sensor detects that event and searches the nearest RSU to transfer the detected event via vehicular backbone network. This network will transfer the events to nearby vehicle and RSU transfer its control to another RSU. In two dimensional highways when vehicle change its location from one path to another path there is a chance of packet drops to avoid this type of problem here we assume vehicle as relay node which takes its control for a particular period of time to transfer the packet.

V. **PROPOSED WORK**

5.1 TOPOLOGY FORMATION

In NS-2.35 simulator, nodes are deployed in the environment. Here each vehicle have an individual id and location, when an vehicle enters into RSU range its id and location is registered in RSU.RSU acts as an server to transfer the requested information to the requested vehicle. When a vehicle (Source node) “X” request a packet to RSU it verify its id and location then transfer the packet to requested vehicle i.e (Destination Node).

5.2 DATA DISSEMINATION

In this model , when a vehicle “X” request a data to Road Side Unit the RSU will verify its Id and location if the ID and location is registered in RSU it transfer the packet to the requested vehicle. The vehicle must be in the optimal location and it is fixed by the service provider when we design the node creation model is mainly used to reduce packet drops as well as to reduce delay while packet transfers.

5.3 VBN FORMATION

In highways VBN network is formed in order to transfer packets from source to destination. Normally Backbone network is a part computer network infrastructure that interconnects various pieces of network, provides a path exchange the information between different sub-networks. Backbone capacity is always greater than the network. In this model RSU acts like a server and it initiate the message, data’s are updated in RSU via vehicle.RSU has a static map which is used to find the location of vehicle and to forward the dynamic information sensed by the vehicle.

A slower moving vehicle is chosen as RN or a static vehicle act as relay node for a particular period of time, if no vehicle is arriving for a period of time the last vehicle chosen as relay node will serve as a RN for some other time until it selects the another RN .RSU will select the RN which is in optimal location, the optimal location is calculated based on speed and time by the service provider. RN will create VBN and forward packet to neighbor nodes.RSU is used to improve communication between vehicles on highway, these infrastructure nodes are fixed base stations deployed along the road to increase overall coverage of a vehicular network. It is equipped with better hardware than the units. Due to its cost we can’t fix as many RSU on roadside so we move on to the concept of relay selection. Relay nodes will help to cover the area more than RSU so that efficiency of data broadcasting is improved. This method is

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 2, Issue 11, November 2014

suitable for both one and two dimensional highways, and also it is a solution for broadcast storm problem (Congestion avoidance).In one dimensional highway only the info-tainment packets are forwarded from RSU to vehicle, that is it includes communication, games, internet access, weather reporting, multimedia etc…

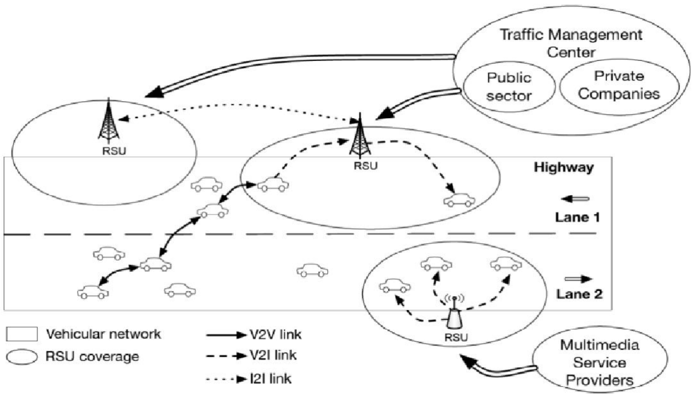

Fig 1.1 Data Broadcasting Model

5.4 TWO DIMENSIONAL HIGHWAY NETWORK

In two dimensional we detect the road side events through sensor which is fixed in the vehicle based on the abnormal condition the vehicle will send data to nearest RSU, then RSU will send the packet to another RSU via vehicle as to cover more area then the normal network. This reduces the packet drops and increases the throughput with low delay transmission in a dynamic formation of multi hop distribution.

VI. **PERFORMANCE EVALUATION**

Our result shows that increase in throughput capacity and low end-to-end delay in both one dimensional and two dimensional highways. The performance results obtained by our evaluations well demonstrate the benefits achieved by using the VBN paradigm, both in terms of attained broadcast capacity and packet delivery ratio.

VII. **CONCLUSION**

Data broadcasting in two dimensional highways enhanced the throughput capacity and low end-to-end packet delays. Under VBN scheme this model is proposed to avoid packet drops, and it allows only a limited number of vehicles to act as relay node so that we found solution to broadcast storm problem which leads to congestion while data transferring.

REFERENCES

[1] Andreas Festag, Alban Hessler, Roberto Baldessari, Long Le, Wenhui Zhang, Dirk Westhoff "Vehicle-To-Vehicle And Road-Side Sensor Communication For Enhanced Road Safety", IEEE 2009.
[2] Atef Abdrabou, Member, IEEE and Weihua Zhuang, "Probabilistic Delay Control and Road Side Unit Placement for Vehicular Ad Hoc Networks with Disrupted Connectivity" Selected Areas in Communications, IEEE Journal on (Volume:29 , Issue: 1) 2011.
[3] Bartłomiej Błaszczyszyn Paul M¨uhlethaler Yasser Toor. "Maximizing Throughput of Linear Vehicular Ad-hoc NETworks (VANETs) — a Stochastic Approach", Author manuscript, published in "European Wireless (2009)".
[4] Celimuge Wu, Satoshi Ohzahata, and Toshihiko Kato. "Data Dissemination with Dynamic Backbone Selection in Vehicular Ad Hoc Networks" Vehicular Technology Conference (VTC Fall), IEEE 78th, 2013
[5] Evellyn S. CavalcanteAndre L. L. Aquino Gisele L. Pappa, Philadelphia, PA, "Roadside Unit Deployment for Information Dissemination in a VANET: An Evolutionary Approach" , GECCO'12 Companion, July 7–11, 2012.

ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

(An ISO 3297: 2007 Certified Organization)

Vol. 2, Issue 11, November 2014

[6] Francesca Cuomo, Izhak Rubin, Andrea Baiocchi, “Enhanced VANET broadcast throughput capacity via a dynamic backbone architecture”, 1570-8705/Ó 2014 Elsevier B.V 21 april 2014.

[7] Francesco Malandrino, Claudio Casetti,Carla-Fabiana Chiasserini,Marco Fiore, “Optimal Content Downloading in Vehicular Networks”,IEEE Transactions On Mobile Computing, Volume:12 , Issue: 7 July 2013

[8] Izhak Rubin, Andrew Horng, Chun-Yu Yang, “Lane Based Backbone Synthesis Protocols for Vehicular Ad Hoc Networks”, IEEE 2014.

[9] Izhak Rubin, Andrea Baiocchi, Francesca Cuomo and Pierpaolo Salvo, “Vehicular Backbone Networking Protocol for Highway Broadcasting Using Directional Antenna”, Globecom Workshops (GC Wkshps), 2013.

[10] Pierpaolo Salvo, Izhak Rubin, Andrea Baiocchi, and Francesca Cuomo, “GPS Aided Inter-Vehicular Wireless Networking”, Information Theory and Applications Workshop (ITA), 2013.

[11] Sang-woo Chang, Sang-sun Lee, “A Study on Distance-based Multi-hop Broadcast Scheme for Inter-Vehicle Communication” , 978-1-4799-2845-3/13/$31.00 ©2013 IEEE.

.