A Novel Approach in the Evaluation of Broadcasting Application Over Vanets

G. Mary Valantina[1], S. Jayashri[2]
[1]Dept of ETCE
Sathyabama University
Chennai, Tamilnadu, India
[2]Adhiparasakthi Engineering College
Melmaruvathur, Kanchipuram District
Chennai, Tamilnadu, India
Valantina78@gmail.com, Jayaravi12010@yahoo.com

ABSTRACT: *Vehicular Ad hoc Network (Vanet) is one of the emerging technologies to support safety, traffic monitoring and comfort related services. Vanet is a subclass of* ***MANET*** *but its topology changes rapidly and network gets disconnected frequently. The prevailing routing protocol of* ***MANET*** *is very much applicable to Vanet. Because of its frequently disconnecting routes it is difficult to design an efficient routing protocol. Proper design of routing protocol for Vanet makes the network a successful one.. The challenges in* ***VANET*** *are, designing appropriate routing protocols suitable to the traffic model, ensuring proper delivery of emergency messages, security of the data and, avoiding the collision of messages, avoiding flooding of messages, etc. To support such services, broadcasting protocols are used. In this work, we review communication routing protocols for broadcasting mechanisms that alleviate the broadcast storm problem. A novel mechanism is one which includes mesh routers in the network reduces the broadcast storm problem and increasing the dissemination ratio.*

Keywords: ITS, Broadcasting Protocols, Flooding

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1. Introduction

With the rapid growth of wireless communication systems, there will be a need for the network deployment of self-governing mobile users [1]. Significant examples such as establishing survival, proficient, active communication for emergency/rescue operations, disaster management efforts, and secured military networks [2].Vehicular Ad-hoc Networks (VANETs) can be considered as a superclass of Mobile Ad hoc Networks (MANETs) with some unique characteristics. Vehicles move on the roads sharing information among them. Vehicles often move at high speed but their mobility is within regular constraints and predictable. An accurate estimate of vehicle's position can be made available through GPS systems or on-board communication unit. VANETs are used for high-speed car to car, communication and between vehicles and roadside infrastructure units [3]. Most (if not all) of the high priority safety applications proposed for VANETs are based on one-hop broadcast of information For instance, for V2V communication base applications such as pre crash sensing, blind spot warning, emergency electronic brake light and co operative forward collision avoidance each vehicle periodically broadcasts information about its position, speed, heading acceleration, turn signal status,etc to all the vehicles within one neighnourhood.similarly for V2R communication-based applications, such as the curve speed warning and traffic signal violation warning, an RSU periodically broadcasts to all the approaching vehicles information related to the traffic signal status and timing, road surface type, weather an RSU periodically broadcasts to all the approaching vehicles information related to the traffic signal status and timing, road surface type, weather conditions, [6], [7]. Co-operative collision warning, intersection collision warning, and emergency electronic brake, Information from other vehicles, public safety, sign extension.

2. Broadcasting Protocols

Broadcasting in VANET is very special form routing which depends on Network topology, Mobility patterns, Demographics, Traffic patterns at different times of the day. Conventional ad hoc routing protocols such as DSR and AODV will not be appropriate in VANETs for most vehicular Broadcast applications [8]-[12].

There are three different Traffic of operations in VANET.

2.1 Regular Traffic

In case of the regular traffic some nodes may have very few neighbours while some other nodes have many neighbours.

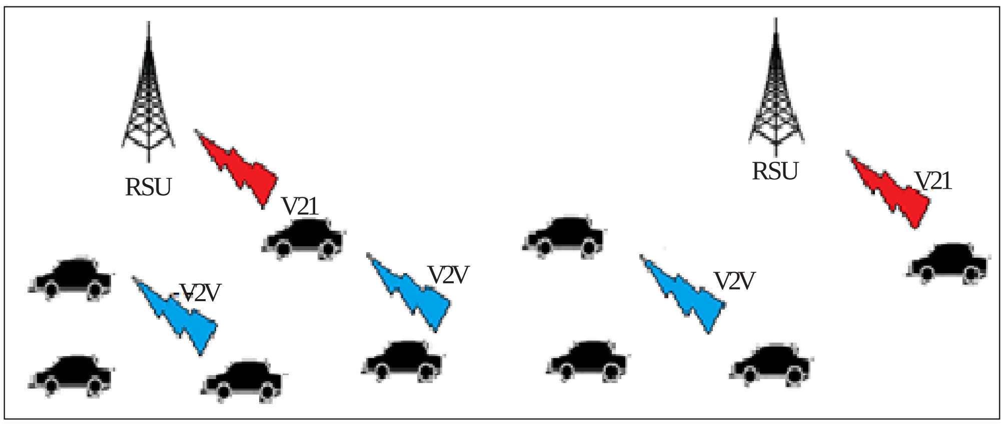

Figure 1. Communication in *VANETS*

2.2 Dense Traffic

Nodes simply broadcasting the packets leads to many collisions and conflicts in transmission among neighbouring nodes.

2.3 Sparse Traffic

The delay that incurs in delivering messages between disconnected vehicles can vary from a few seconds to several minutes. In this paper we develop a new mechanism of including mesh routers in the network which alleviates the broadcast storm problem as it happens in flooding technique.

2.4 Simple Flooding

Broadcast forms the basis of all communications [13]-[17] in Vehicular ad hoc networks. The simplest form of broadcast is referred to as flooding.

In simple flooding, if a collision occurs a node transmits a packet, which is received by all neighbouring nodes that are within the transmission range. In Figure 2. the vehicle *c*2 sends the information of collision to all the vehicles which are there in the transmission range. The vehicle c3 further transmits to vehicle *c*4, *c*5, *c*6. Upon receiving a broadcast packet, each node determines if it has transmitted the packet before. If not, then the packet is retransmitted. This process allows for a broadcast packet to be disseminated throughout the ad hoc network. Flooding terminates when all nodes have received and transmitted the packet being broadcast at least once. As all nodes participate in the broadcast, flooding suffers from the Broadcast Storm Problem.

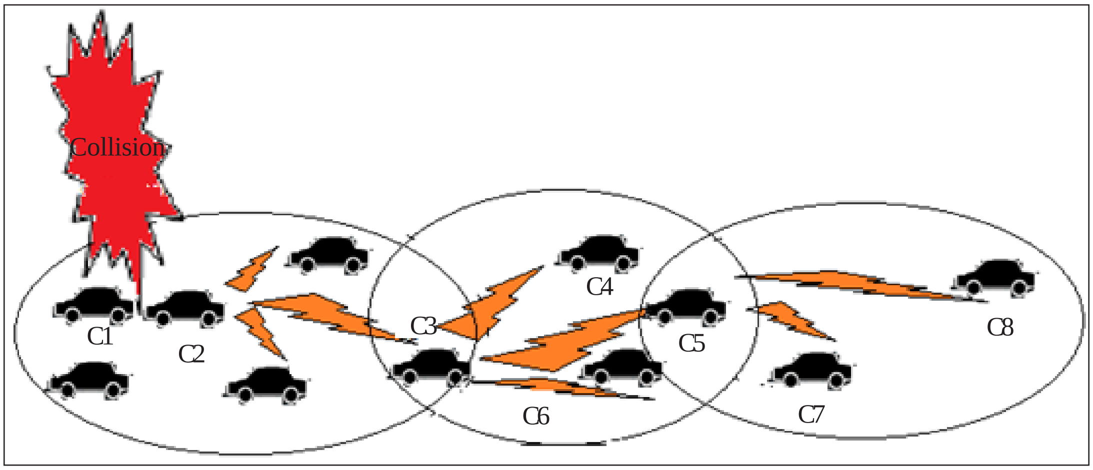

Figure 2. Broadcasting in *VANETS* by simple flooding

Flooding is extremely costly and may result in the following: Redundant rebroadcasts: It occurs when a node decides to rebroadcast a message to its neighbours; however, all neighbours have already received the message. Thus the transmission is redundant and useless. Due to repeated transmission the messages can become duplicated in the network further increasing the load on the networks and thereby it requires an method to eradicate which makes the processing complexity high.

There occurs a severe contention in the MAC layer because all the neighboring nodes after receiving the message it tries to rebroadcast the message. when trying to send the message to a longer distance since all the nodes are trying to rebroadcast the message, the packets collide with each other and the packets gets lost.

3. Mesh Deployment in the Network

Mesh routers constantly monitors the network activity and maintains lists of other devices in the vicinity [18]. If it finds a potential node, it broadcasts its address and networking capabilities. Mesh routers nearby will receive the broadcast, and change their own lists. Mesh routers constantly analyses the network and the link quality to dynamically construct an best display of paths to optimize network performance. Upon deployment, the routers automatically find out one another, and determine the optimal path selection quickly to the gateways. It dynamically monitors and adjusts power, delivers maximum capacity that enhances network reliability and scalability. If a known device broadcasts a request to send data to a particular location, and a router has the details of the receiving node with its list of active devices, it will complete the path and send out the data. If an individual mesh router unable to find a direct path between sending and receiving nodes, the data will be sent to another router in the network, where the process is repeated until a path is found.

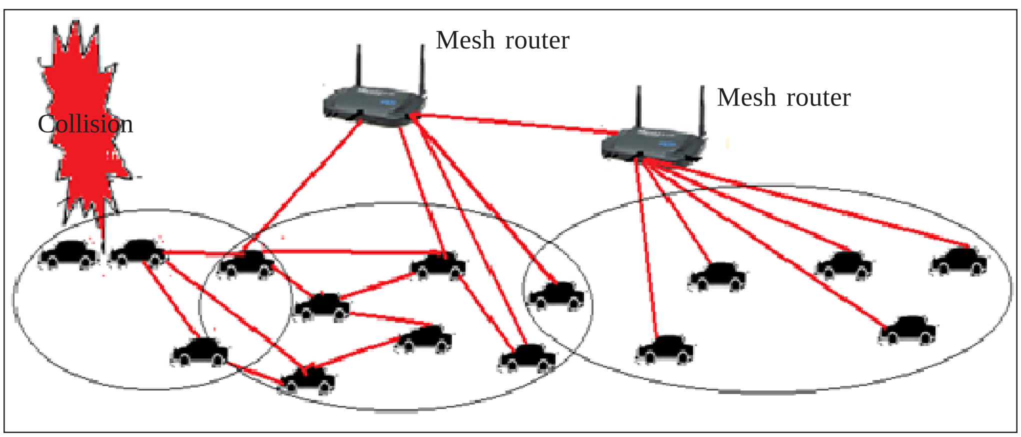

Figure 3. Mesh Deployment in the network

Since mesh routers are always adjusting to their surroundings, the network created is very robust, has greater bandwidth and highly reliable. There are mobile mesh routers also in existence normally; a dedicated mesh router will not be mobile. Several wireless access points are in fact mesh routers, possibly can be used to create geographically large wireless networks. The advantages of mesh routers are,It improves the throughput of network by choosing optimal routing paths, Improves network performance by providing graceful rerouting of traffic in the occurrence of any interference, or any other disruptions in the network, Supports client mobility without the need for special client hardware, software, or network reconfigurations.

Once mesh routers are deployed in the network, the working of the proposed protocol is as follows .When a vehicle encounters accident it floods the message in the network. The nodes start receiving the messages and thereby it reaches the mesh router also. The mesh router after receiving the message it sets a counter value and decrements it till it reaches zero value and thereby sends the message to the other vehicles. The vehicle after receiving the message from the mesh router, it stops sending the message to the other vehicles avoiding the storm. The flooding of packets is stopped but the messages are sending to all the remaining nodes in the network. This reduces the overhead caused due to flooding of packets in the network.

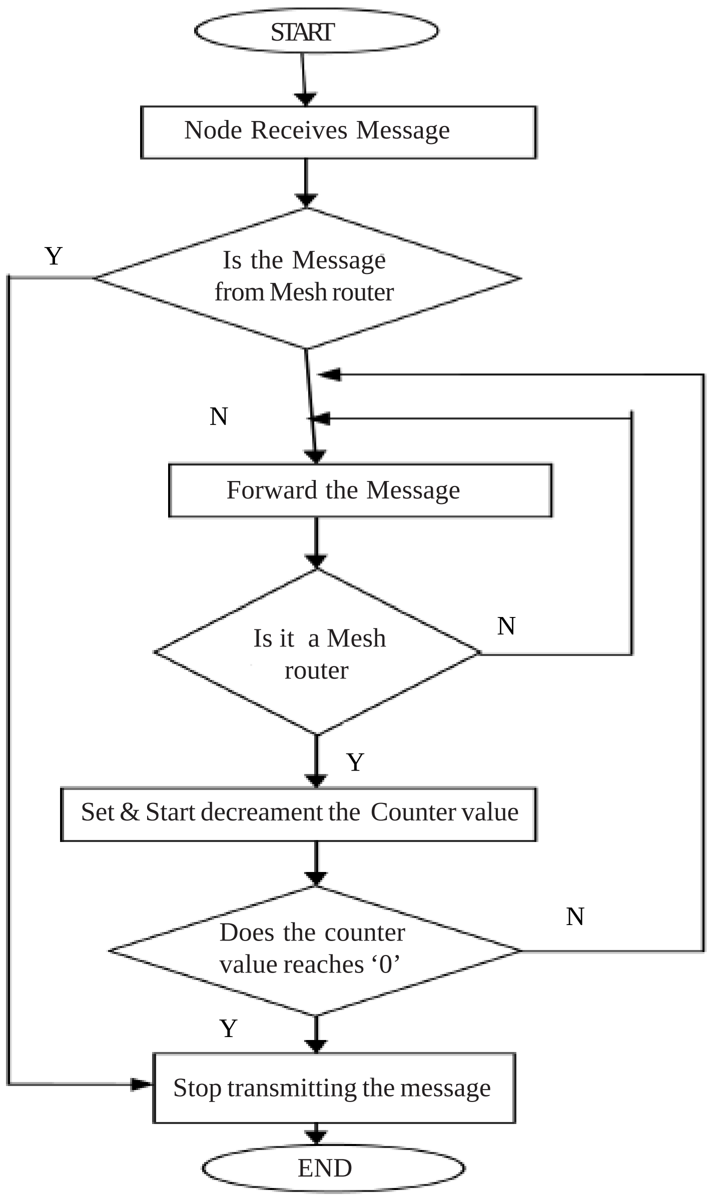

Figure 4. Flowchart of proposed

The mesh router does not require any predetermined path between them. Mesh routers are included in the network and they act in real time to find a active route. The mesh routers actively note down the activity of the network and monitor the nearby devices. Even mobile mesh routers has come into existence which can work at the speed of vehicle.

Upon deployment of the mesh routers, they monitor each other and automatically detect an optimal route which is free of contention. It provides graceful re-routing of packets when there is a network failure.

4. Simulation

Simulation is done in *NS*-2 simulator. The *ns*-2 accepts the input file that has the information of each node and the packets generated by each node. The time information of the packets are also present in that source file. The simulation parameter values are shown in table1.

Parameter	**Value**
Simulation area	1000 * 15000m
Propagation model	Two ray ground reflection
Mobility model	Random way point
Antenna used	Omni directional
Packet size	512bytes
Packet rate	32 pkts/s

Table 1. Simulation parameters

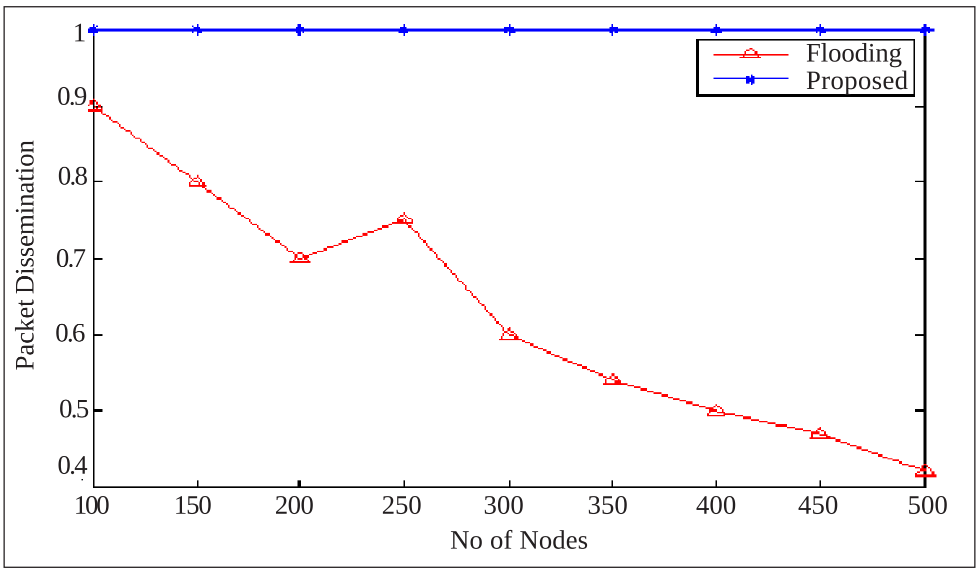

Figure 5. Packet Dissemination Ratio

4.1 Performance Metrics

There are a number of performance metrics in the literature, such as packet error, loss, or delivery ratios, end-to-end delay, normalized network load, and packet duplication [19], which are typically more common for an evaluation from a pure network performance point of view. Nevertheless, we want to put more emphasis on the network's performance with respect to safety application running on top of it. The criteria we are interested in are the following. The following metrics are used to evaluate the performance of the proposed protocol.

4.2 Packet dissemination ratio

Figure 5 shows the Packet dissemination ratio for range of nodes. In flooding, many nodes try to broadcast all at the same time which definitely introduces collision and the packets are dropped eventually. Thereby the dissemination ratio decreases as the density of nodes increases. Whereas the mesh router tries to minimize the hop count to reach a receiver. It does not send all at

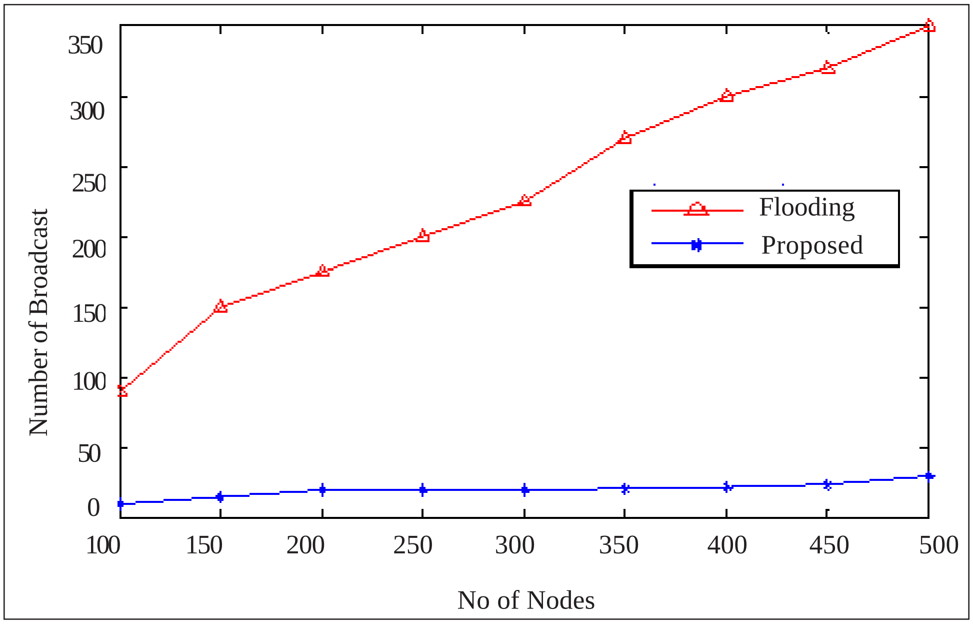

Figure 6. Number of Broadcast

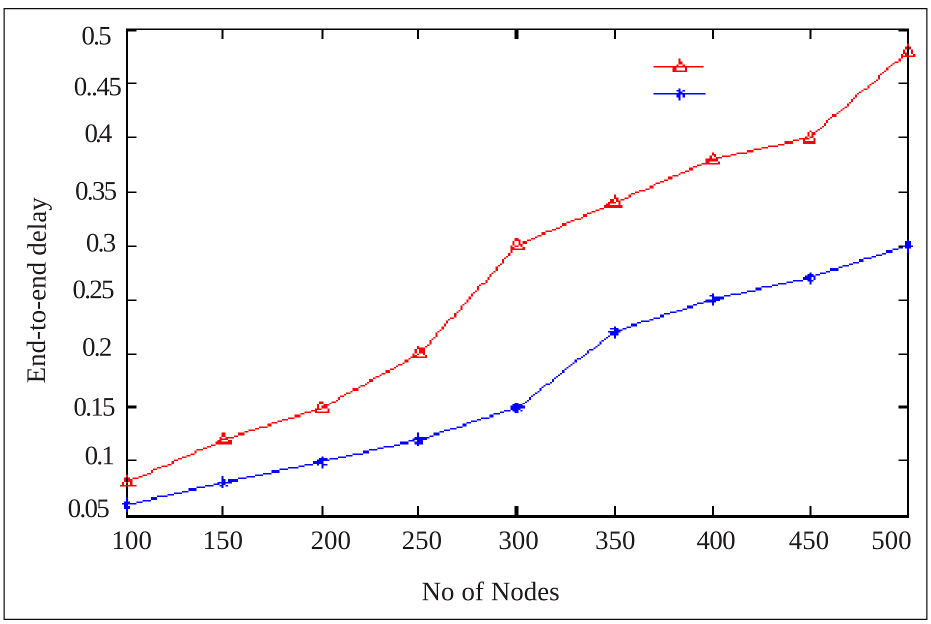

Figure 7. End to End Delay

the same time so no collision and packets are correctly received by the receivers. This eventfully increases the packet delivery ratio of the proposed protocol.

4. 3 Number of packets Broadcast

Since the number of rebroadcast is sufficiently very high as compared to the proposed one the number of broadcast that is needed to send the message to the receivers is very high. In flooding, on the other hand, the nodes that are at larger distance perhaps lose the packets due to packet collisions. As shown in Figure 6. the number of packets broadcasts by the proposed protocol is greatly reduced as the mesh router constantly notices the network and sends the message one by one to all the intended receivers.

4.4 End-to-end delay

End –to-end delay is an important parameter to evaluate the broadcast protocol's performance. Figure 7. shows end-to-enddelay for a range of nodes. The message has to be given to all the concerned receivers within the given stipulated time. In the end-to-end delay computation, the number of packets delivered successfully is only accounted. Flooding cannot broadcast messages faster because it encounters many redundant rebroadcast. From the fig it shows that in flooding, the delay increases as the node density increases because of the broadcast storm problem. The proposed protocol reduces the delay by using the mesh router in the network. The mesh router reduces the number of rebroadcast thereby decreasing the contention time that occurs in the MAC layer.

5. Conclusion

In this work, we made a review on flooding mechanism for broadcasting in vehicular networks. Every protocol has its own pros and cons. Logical concern about the requirements and constraints imposed by applications, communication, density and vehicular traffic flow are essential for broadcasting protocol design. A novel approach by introducing mesh routers in the network reduces the broadcast storm problem as it happens in flooding. The simulation showed that the proposed protocol has the highest Packet dissemination ratio and eventually reduction in the End to End delay in the network.

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