Improving the Message Delay Overhead using Nested Nemo Based Vanet

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Abstract- Vehicular Ad Hoc 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. Network mobility solutions can be divided into two broad categories, intra–domain and inter–domain solutions. So, mobility management for vehicular networks is required. However most of Mobility model currently used are very simple. In this paper we will focus on the Network Mobility Approach in Vehicular Ad Hoc Network, this model will describe the communication between Infrastructure to Vehicle and Vehicle to Vehicle i.e. NEMO Based VANET and Nested NEMO Based VANET.

Keywords: VANET, MANET, MobiSim, NEMO, Road Side Unit(RSU).

I. INTRODUCTION

For people living in developed countries the volume of road traffic can be a daily nuisance. Wireless communication technologies have now made a great impact in our daily lives. From indoor wireless LANs to outdoor cellular mobile networks, wireless technologies have benefited billions of users around the globe [1]. The era of vehicular *ad hoc* networks (VANETs) is now evolving, gaining attention and momentum. In addition, the road traffic conditions affect the safety of the population since 1.2 million people worldwide are estimated to be killed each year on the roads. For this reason, nowadays the automotive industry and governments invest many resources to increase road safety and traffic efficiency, as well as to reduce the impact of transportation on the environment. Researchers and developers have built VANET simulation software to allow the study and evaluation of various media access, routing, and emergency warning protocols. VANET simulation is fundamentally different from MANETs (mobile *ad hoc* networks) simulation because in VANETs, vehicular environment imposes new issues and requirements, such as constrained road topology, multi-path fading and roadside obstacles, traffic flow models, trip models, varying vehicular speed and mobility, traffic lights, traffic congestion, drivers, behavior, etc. The application of communications and information technologies for this purpose has opened a new range of possibilities.

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One of the most promising areas of research is the study of the communications among vehicles and road-side units, or more specifically the Vehicular Ad-hoc Networks (VANET). This kind of networks are self-configuring networks composed of a collection of vehicles and elements of roadside infrastructure connected with each other without requiring an underlying infrastructure, sending and receiving information and warnings about the current traffic situation.

1.1. VANET

VANETs have turned into an important research area over the last few years. VANETs are distinguished from MANET by their hybrid network architectures, node movement characteristics, and new application scenarios.

Characteristics

Drive behavior, constraints on mobility, and high speeds create unique Characteristics in VANETs. These characteristics distinguish them from other mobile ad hoc networks, and the major characteristics are as follows:

High mobility and Rapid changing topology: Vehicles move very fast especially on highways. Thus, they stay in the communication range of each other just for several seconds, and links are established and broken fast. When the vehicle density is low or existing routes break before constructing new routes, it has higher probability that the vehicular networks are disconnected. So, the previous routing protocols in MANET are not suitable for VANETs.

Geographic position available: Vehicles can be equipped with accurate positioning systems integrated by electronic maps. For example, GPS receivers are very popular in cars which help to provide location information for routing purposes.

Mobility modeling and predication: Vehicular nodes are usually constrained by prebuilt highways, roads and streets, so given the speed and the street map, the future position of the vehicle can be predicated. Vehicles move along pre-defined paths, this provides an opportunity to predict how long routes would last compared to arbitrary motion patterns like the random waypoint model [1].

Hard delay constraints: In VANETs applications, such as the collision warning or Pre-Crash Sensing, the network does not require high data rates but has hard delay constraints, and the maximum delay will be crucial.

No power constraint: Since nodes are cars instead of small handheld devices, power constraint can be neglected thanks to always recharging batteries.

1.1.1.Inter-Vehicle Communication

The inter-vehicle communication configuration (Figure 1) uses multi-hop multicast/broadcast to transmit traffic related information over multiple hops to a group of receivers.

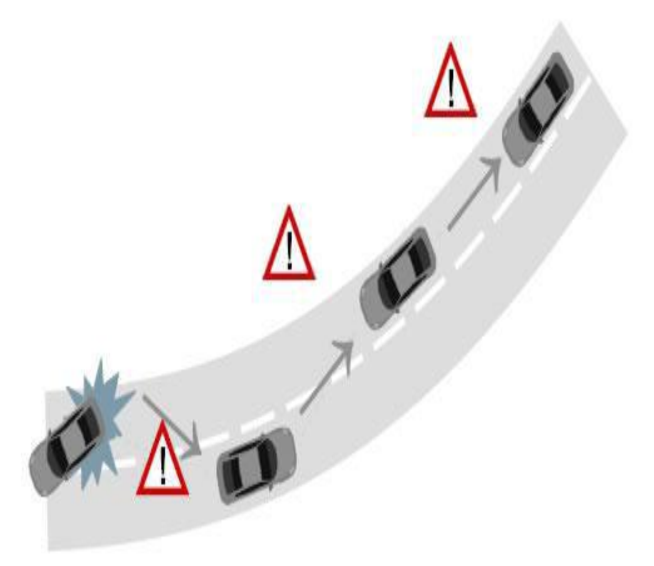

Fig 1: Inter-vehicle communication

In intelligent transportation systems, vehicles need only be concerned with activity on the road ahead and not behind.

1.1.2.Vehicle-to-roadside Communication

The vehicle-to-roadside communication configuration (Figure 2) represents a single hop broadcast where the roadside unit sends a broadcast message to all equipped vehicles in the vicinity.

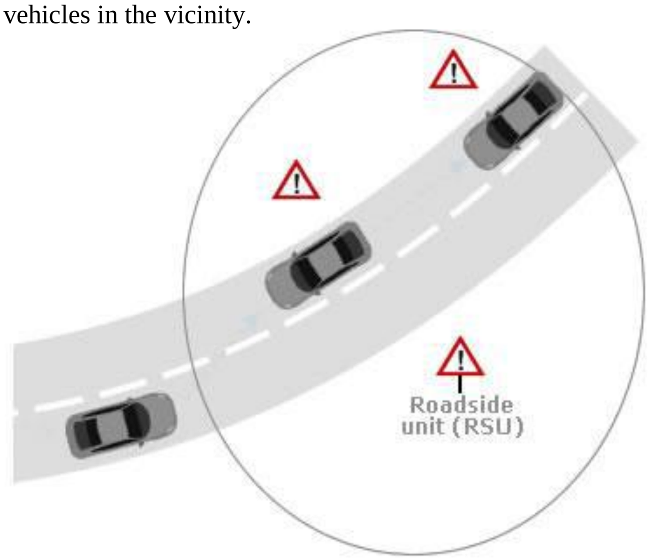

Fig 2: Vehicle-to-roadside communication

Vehicle-to-roadside communication configuration provides a high bandwidth link between vehicles and roadside units. The roadside units may be placed every kilometre or less, enabling high data rates to be maintained in heavy traffic.

1.2. VanetMobiSim

It is an extension of the CANU Mobility Simulation Environment (CanuMobiSim) which focuses on vehicular mobility[1], and features realistic automotive motion models at both macroscopic and microscopic levels. At the macroscopic level, VanetMobiSim can import maps from the US Census Bureau topologically integrated geographic encoding and referencing (TIGER) database, or randomly generate them using Voronoi tessellation. The TIGER/Line files constitute a digital database of geographic features, such as roads, railroads, rivers, lakes, and legal boundaries, covering the entire United States. VanetMobiSim adds support for multi-lane roads, separate directional flows, differentiated speed constraints and traffic signs at intersections. At the microscopic level, it supports mobility models such as Intelligent Driving Model with Intersection Management (IDM/IM), Intelligent Driving Model with Lane Changing (IDM/LC) and an overtaking model (MOBIL), which interacts with IDM/IM to manage lane changes and vehicle accelerations and decelerations, providing realistic car-to-car and car-to-infrastructure interactions. VanetMobiSim is based on JAVA and can generate movement traces in different formats, supporting different simulation or emulation tools for mobile networks including ns-2 [18], GloMoSim [19], and QualNet.

1.3. MOBISIM STRUCTURE

An overview on the mobility simulator structure is shown in figure 3.The mobility simulator general workflow is[2]:

1. Simulation Runner fetches simulation configurations from properties and XML files.
2. Creates corresponding models, maps and simulation objects.
3. If it was batch simulation it sets parameters according to variables and runs each simulation for run Number times.
4. In each simulation first the model initializes position of nodes.
5. In each time slot the model updates position of nodes. So each model only should initialize and update position of nodes.

Also some additional methods have been considered in "Model" class to enable models to change the order of node's location updating and the painting mechanism and trace outputs data. Traces can be written in plain text or XML, on a file or on a network socket. So each model only should initialize and update position of nodes. At the macroscopic level, VanetMobiSim can import maps from the US Census Bureau topologically integrated geographic encoding and referencing (TIGER) database, or randomly generate them using Voronoi tessellation

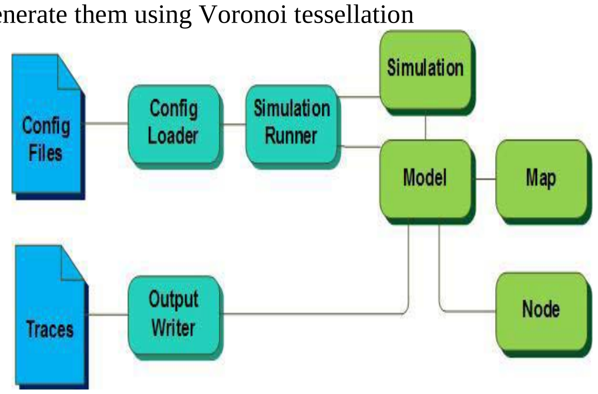

Fig 3: MobiSim General Structure

II. RELATED WORKS

Rezwana Karim et.al Several techniques to avoid the broadcast problem have been proposed. Timer based, Hop limited simple forwarding, Map based or geographic forwarding. Roberto Baldessaril et.al Classify possible approaches for integration of MANETs and NEMO adopting the terms MANET-centric and NEMO-centric but generalize them with respect to the roles of these protocols and Analyzed the approaches with respect to the defined VANET Requirements then Derived from the analysis fundamental features requested for future integrated solutions.

Y. Bi et.al In a cross layer broadcast protocol for multi hop emergency message dissemination in inter-vehicle communication systems is proposed. In order to provide satisfactory delay guarantee for safety related services in IVC, the priority based enhanced distributed channel access (EDCA) is adopted for service differentiation. But it do not consider the specific characteristics of IVC, i.e., high mobility of vehicles.

S. Biswas et.al In the cooperative collision avoidance , the mechanism of CCA is explained using a three-car highway platoon. In the example, all cars are assumed to cruise initially at a steady speed of 72 mph (32m/s), and with an inter car spacing (or headway) of 1 s (32 m).

F. Ye et.al In a prioritized broadcast contention control module/layer is proposed. This module processes both outgoing and incoming WAVE short messages, hence, handles single broadcast, periodic rebroadcast and multi-hop forwarding. These operations require neither MAC signaling nor explicit coordination among vehicles.

III. EXISTING SYSTEM

Using vanetmobisim tool, NEMO architecture is being implemented. In NEMO the message is transferred from Road Side Unit(RSU) to Vehicle based on the mobility of vehicle with in that environment[3]. In NEMO the message communication is between one to one *i.e.* from RSU to Vehicle.

Drawbacks:

- But in that schema we use a single cluster schema so we easily find the actual node from minimum of iterations
- The hidden terminal problem is a critical issue affecting the performance and reliability of ad hoc networks.
- Although support for reliable unicast using RTS/CTS has existed traditionally in IEEE 802.11 there has not been any MAC-level recovery or retransmission on frames for reliable broadcasting.
- Less reachability.
- Worst performance in both urban and highway scenario.

IV. PROPOSED SYSTEM

A Vehicular Ad-Hoc Network, or VANET [4], is a form of Mobile ad-hoc network, to provide communications among nearby vehicles and between vehicles and nearby fixed equipment, usually described as roadside equipment[5]. Thus in other words, it is combination of vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) communication. The main goal of VANET is providing safety and comfort for passengers as shown in *figure 2*.Using vanetmobisim tool, NEMO architecture is being implemented[8]. In NEMO the message is transferred from Road Side Unit(RSU) to Vehicle based on the mobility of vehicle with in that environment. In NEMO the message communication is between one to one *i.e.* from RSU to Vehicle.

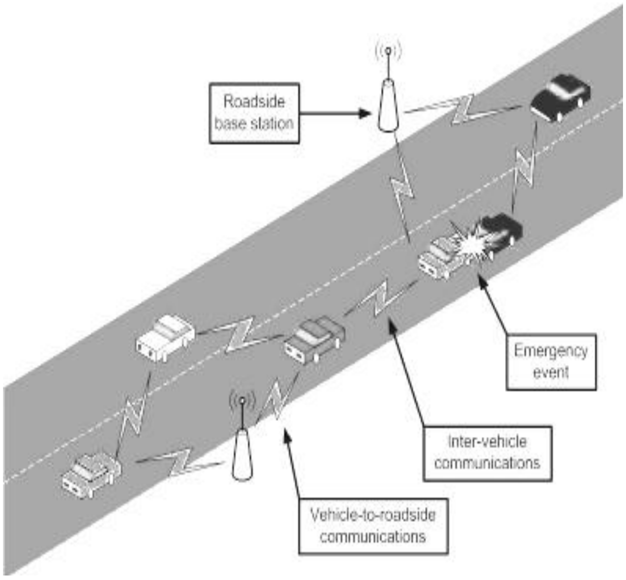

Fig 4: A VANET consists of vehicles and roadside base stations that exchange primarily safety messages to give the drivers the time to react to life-endangering events.

Multiple NEMO is implemented for Nested NEMO based VANET[6]. In Nested NEMO based VANET the message is transferred between Road Side Unit(RSU) to Vehicle and Vehicle to Vehicle. Our main challenge is to reduce the message delay overhead and energy consumption during the transmission of message.

4.1Security and Privacy

Security is an issue that needs to be carefully assessed and addressed in the design of the vehicular communication system. Several threats potentially exist, including fake messages causing disruption of traffic or even danger, compromising drivers' private information, etc. The issues to be addressed include trust (vehicles are able to trust the messages they receive), resiliency (resiliency for interference, easy maintenance) and efficiency, e.g. real-time message authentication. Privacy is also a major issue that will need to be addressed. Anonymity must be preserved - the communications should not make the vehicle tracking or identification possible for non-trusted parties. The lack of taking into account the privacy concerns at the early design stage could result in multiple law suits after the network is deployed.

Merits:

- High reachability.
- Threshold function design based on the node density, distribution pattern, and channel quality.
- Performs better in both urban and high way scenario.

V. CONCLUSION FUTURE ENHANCEMENT

Multiple NEMO is implemented for Nested NEMO based VANET. In Nested NEMO based VANET the message is transferred between Road Side Unit(RSU) to Vehicle and Vehicle to Vehicle. Our main challenge is to reduce the message delay overhead and energy consumption during the transmission of message.

In our future work, we extend the performance for nested nemo based vanet in which MNNs are controlled by an MR for reducing the message delay overhead and energy consumption during the transmission of message.

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