Simulation of Vehicle Adhoc NET Work (VANET) using Network Simulator (NS-2) Tools

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***Abstract*— In this paper we have discussed about the number of automobiles that has been increased on the road in the past few years. Due to high density of vehicles, roadaccident is increasing. The vehicular safety application should be thoroughly tested before it is deployed in a real time use. Simulator tool has been preferred over Adhoc networks experiment because it simple, easy and cheap. VANET requires that a network simulator(NS-2) should be used together to perform this test. Many tools exist for this purpose but most of them have the problem with the proper interaction. In this paper we present a tool SUMO, MOVE that allows users to easily generate real world mobility models for VANET simulations. MOVE tool is built on top of SUMO which is open source micro-traffic simulator. Output of MOVE is a real world mobility model and can used by NS-2.**

Keywords*— *Road safety; Vanet; Sumop; Move.

I. INTRODUCTION

Vehicular ad hoc network (VANET) is a vehicle to vehicle (Inter-vehicle communication-IVC) and roadside to vehicle (RVC) communication system.

The network is put forth with the novel objectivesof providing safety and comfort related services to vehicle users.[1] Collision warning,traffic congestion alarm, lane-change warning, road blockade alarm (due to construction works etc.) are among the major safety related services addressed by VANET. Vehicular Ad hoc networks (VANETs) are a special type of mobile ad hoc networks; where vehicles are simulated as mobile nodes. VANET contains two entities: access points and vehicles, the access points are fixed and usually connected to the internet, and they could participate as a distribution point for vehicles [1]. VANET addresses the wireless communication between vehicles (V2V), and between vehicles and infrastructure access point (V2I). Vehicle to vehicle communication (V2V) has two types of communication: one hop communication (direct vehicle to vehicle communication), and multi hop communication (vehicle relies on other vehicles to retransmit). VANET also has special characteristics that distinguish it from other mobile ad hoc networks; the most important characteristics are: high mobility, self-organization, distributed communication, road pattern restrictions, and no restrictions of network size.In the other category of comfortrelated services, vehicle users are equipped with Internet and Multimedia connectivity. VANET, therefore, has brought a lot of promises as a powerful and attractive emerging technology for the future. However, to meet this communication network successful, the data flow needs to be real time and interrupt-free. This has brought several research challenges in the communication field[1]. High mobility of vehicles, uncertainty in prediction of vehicle speed and direction, traffic density are some of the key issues that make VANET different from other ad hoc network and its operation.

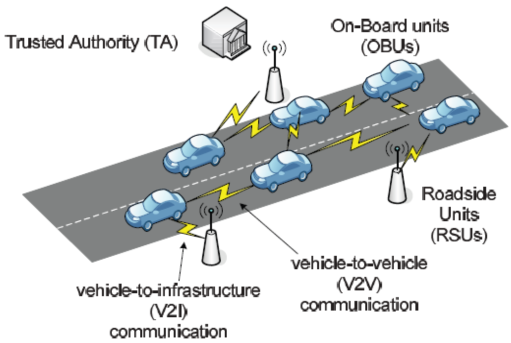

Fig. 1. Overview of vanet

The past few years the research work is going on mobile ad-hoc networks also called MANETS. Mobile ad-hoc network allow a mobile node to communicate in one to one and one to many nodes without any predefined infrastructure.[1] The required protocols to support MANET are more complex as compared to other non-mobile networks because due to mobility there is no predefined infrastructure or topology of MANET. VANET is a unique type of network which comes under the umbrella of MANET. VANET has some predefined basics which includes (1) Predictable mobility of vehicles because movement is in two directions only (2) The transmission mode is often broadcast (3) The power available is sufficient [2]. There are two communication modes which are vehicle to vehicle and vehicle to network infrastructure.

II. RELATED WORK

VEHICULAR Ad-Hoc Network (VANET) communication has recently become an increasingly popular research topic in the area of wireless networking as well as the automotive industries. While it is crucial to test and evaluate protocol implementations in a real world environment, simulations are still commonly used as a first step in the protocol development for VANET research.

Several communication networking simulation tools already existed to provide a platform to test and evaluate network protocols, such as ns-2. However, these tools are designed to provide generic simulation scenarios without being particularly tailored for applications in the transportation environment. On the other hand, in the transportation arena, simulations have also played an important role. A variety of simulation tools such as PARAMICS (P. M. T. Simulation, 2009), CORSIM (CORSIM, 2009) and VISSIM (P. simulation VISSIM, 2009) etc have been developed to analyze transportation scenarios at the micro- and macro-scale levels. However, there was little effort in integrating communication techniques and scenarios in a realistic transportation simulation environment.

III. VANET SIMULATION PROBLEM

VANET integrates on the multiple ad-hoc networking technologies. In VANET helps in defining the safety measures in the vehicles, streaming communication between different vehicles, infotainment and telematics. Vehicular Ad-hoc Networks are expected to implement a variety of wireless technologies like Dedicated Short Range Communications (DSRC) which is a type of WiFi. Vehicular Ad-hoc Networks can be viewed as component of the Intelligent Transportation Systems (ITS).

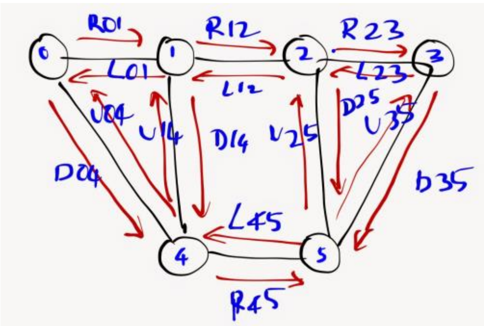

Fig. 2. My Own Road with Traffic Problems

The above diagram shows there are 6 junctions (0 to 5) and the Traffic signals are at 1,2,4 and 5. There are roads connecting the junctions. Each Road has two lanes named R for Right, L for Left, U for Up and D for down. R12 indicates a lane from 1 to 2 and L12 indicates 2 to 1.

A. Sumo

Simulation of Urban Mobility", or "SUMO" for short, is an open source, microscopic, multi-model traffic simulation. It allows to simulate how the given traffic demand that is consists of single vehicles moves through a given roadmap. The simulation allows addressing a large number of set of traffic management topics. It is purely microscopic in nature: each vehicle is modelled explicitly, has its own route, and moves individually through the network. After having generated a network, one could take the look at it with the help of SUMO-GUI, but no cars would be driving around. One must need some kind of description about the vehicles. We can it as his the traffic demand.The development of SUMO started in the year 2000. The major reason for the development of an open source, microscopic road traffic simulation was to support the traffic research community with a tool with the ability to implement and evaluate own algorithms. The tool has no need for regardingall the needed things for obtaining a complete traffic simulation such as implementing and/or setting up methods for dealing with road networks, demand, and traffic controls. By supplying such a tool, the DLR wanted to i) make the implemented algorithms more comparable by using a common architecture and model base, and ii) gain additional help from other contributors. Two major design goals are approached: the software shall be fast and it shall be portable. Due to this, the very first versions were developed to be run from the command line only - no graphical interface was supplied at first and all parameter had to be inserted by hand. This should increase the execution speed by leaving off slow visualization. Also, due to these goals, the software was split into several parts. Each of them has a certain purpose and must be run individually. This is something that makes SUMO different to other simulation packages where, for instance, the dynamical user assignment is made within the simulation itself, not via an external application like here. This split allows an easier extension of each of the applications within the package because each is smaller than a monolithic application that does everything. Also, it allows the usage of faster data structures, each adjusted to the current purpose, instead of using complicated and ballast-loaded ones. Still, this makes the usage of SUMO a little bit uncomfortable in comparison to other simulation packages. As there are still other things to do, we are not thinking of a redesign towards an integrated approach by now.A **SUMO network file** describes the traffic-related part of a map, the roads and intersections the simulated vehicles run along or across. At a coarse scale, a SUMO network is a directed graph.

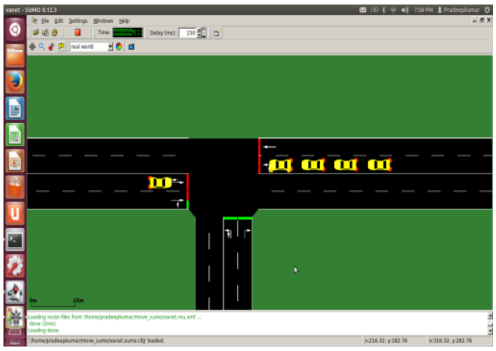

Fig. 3. Simulation for SUMO

B. Move

A key component for VANET simulations is a realistic vehicular mobility model that ensures conclusions drawn from simulation experiments will carry through to real deployments. However, VANET simulations raise many new questions about suitable levels of details in simulation models for nodes mobility. In VANET simulations, the mobility models used affect strongly the simulation output. The researchers need to decide what level of details are required for their simulations. In this chapter, the authors introduce a tool MOVE that allows users to rapidly generate realistic mobility models for VANET simulations. MOVE is built on top of an open source micro-traffic simulator SUMO. The output of MOVE is a realistic mobility model and can be immediately used by popular network simulators such as ns-2 . The authors show that the simulation results obtained when using a realistic mobility model such as MOVE are significantly different from results based on the commonly used random waypoint model. In addition, the authors evaluate the effects of details of mobility models in three case studies of VANET.

C. Node

All nodes have at location (x- and y-coordinate, describing distance to the origin in meters) and an id for future reference. Thus our simple node file looks as follows.

```
<nodes>
<node id="1" x="-250.0" y="0.0" />
<node id="2" x="+250.0" y="0.0" />
<node id="3" x="+251.0" y="0.0" />
</nodes>
```

Fig. 3. Node Creation in Move

IV. EVALUATION

We evaluate the impact of mobility models generated by MOVE on the performance of ad-hoc routing protocol. We compare the performance of AODV when used with the random waypoint model to that using the MOVE mobility model. The simulation experiments were carried out in **NS-2 version 2.35 on UBUNTU 20** operating system. Each simulation lasts for 900 seconds. We generated scenarios for 150 nodes moving in an area of 4 square kilometers. The number of source nodes from 10 to 50, each of which is a CBR traffic source transmitting UDP packets of a size 64 bytes at the rate of 4 packets per second. All nodes use 802.11 MAC operating at 2Mbps. We used a path loss exponent 2.56 with standard deviation 4.0 based on real world measurement data from an inter-vehicle experiment.

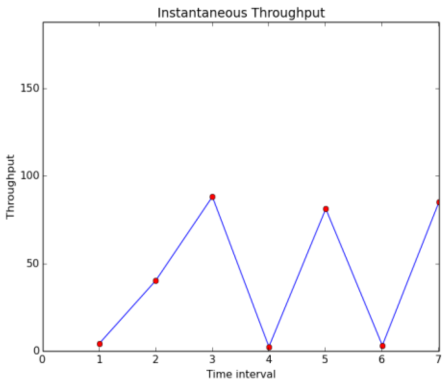

Fig. 4. Performance Results

Here the performance of the Packet Instantaneous throughput

1.00261	4.10974
2.00473	40.203
3.00628	88.1189
4.00641	2.37571
5.0128	81.2089
6.01384	3.11677
7.01836	85.318

Packet Delivery Ratio
GeneratedPackets = 1

ReceivedPackets = 56373

Packet Delivery Ratio = 5637300

Total Dropped Packets = 0

Each data point represents the average of six runs and the error bars represent the range of observed packet delivery ratios. Overall, the packet delivery ratios increase as the number of traffic sources increases, which suggest a higher density of nodes can increase the network performance as long as the increasing density does not create more radio interference. The packet delivery ratios when using MOVE mobility models are lower than when using Random Waypoint model and have larger variations. The larger variance in MOVE data points is possibly due to unstable network connectivity imposed by constrained node movements by roads and traffic control mechanisms.

V. CONCLUSION

One of the most important parameters in simulating ad-hoc networks is the node mobility. It is important to use a realistic mobility model so thatresults from the simulation correctly reflect the real-world performance of a VANET.By using SUMO and MOVE simulation software in Network Simulator -2,We gurantee that we can able to minimizing the Road Accidents and improving Road Safety to the users.

REFERENCES

[1] RaminKarimi, NorafidaIthnin ,ShukorAbdRazak and Sara Najafzadeh, “Non DTN Geographic Routing Protocols for Vehicular Ad Hoc Networks,”*International Journal of Computer Science Issues (IJCSI)*, vol. 8, Issue 5, no. 3, September 2011.

[2] Bijan Paul, Mohammed J. Islam, “Survey over VANET Routing Protocols for Vehicle to Vehicle Communication,”*IOSR Journal of Computer Engineering (IOSRJCE)*, ISSN: 2278-0661, ISBN: 2278-8727 vol. 7, Issue 5 (Nov-Dec. 2012), pp. 01-09.

[3] Vijayalaskhmi M., Avinash Patel, LinganagoudaKulkarni, “QoS Parameter Analysis on AODV and DSDV Protocols in a Wireless Network,” *International Journal of Communication Network & Security*, vol. 1, no. 1, 2011.

[4] Si Ho Cha1, Min-Woo Ryu and Kuk-Hyun Cho, "A Survey of Greedy Routing Protocols for Vehicular Ad Hoc Networks," *Smart Computing Review*, vol. 2, no. 2, April 2012.

[5] M. W. Ryu, S. H. Cha, J. G. Koh, S. Kang and K. H. Cho, “Position-based routing algorithm for improving”.

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[6] OPNET Simulator. http://www.opnet.com/.Pamramics: Microscopic traffic Simulation. http://www.paramics-online.com/
[7] Pamramics: Microscopic traffic Simulation. http://www.paramics-online.com/.Ye, Deborah Estrin, and Ramesh Govindan. Effects of detail in wireless network simulation. In Proc. Of Communication Networks and Distributed Systems Modeling and Simulation Conference, January 2001.
[8] F. K. Karnadi, Z. H. Mo, and K. c. Lan, "Rapid generation of realistic mobility models for vanet," in IEEE WCNC, 2007, pp. 2506–2511
[9] reliability of inter-vehicle communication,"Transactions on Internet and Information Systems (TIIS), vol. 5, no. 8, Aug. 2011. urlhttp://freepatentsonline.com/article/KSII-Transactions-Internet-Information-Systems/272246267.html.
[10] James. JongHyukPark, Victor C.M. Leung, Cho-Li. Wang and TaeshikShon, "Future Information technology, Applications, and Services", FutureTechSpringer,vol. 1, pp. 82-98, 2012, urlhttp://books.google.com/books?id=pggzUBASE4IC&printsec=copyright#v=onepage&q&f=false.
[11] Akhtar Husain, Ram Shringar Raw, Brajesh Kumar and AmitDoegar, "Performance Comparison of Topology and Position Based Routing Protocols in Vehicular Network Environments", International Journal of Wireless & Mobile Networks (IJWMN), vol. 3, no. 4, August 2011.