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# BEACONING IN WIRELESS VEHICULAR NETWORKS

**Abdurashitova Muniskhon**
Department of Control and Computer Engineering, Turin Polytechnic University in Tashkent, Uzbekistan
Email: abdurashitova.munisxon@gmail.com

**Abstract**– Vehicular wireless communication has already become an essential topic in the sphere of wireless networks. This paper analyzes how wireless networks among vehicles create and exchange information to increase road safety by alerting drivers about incidents and traffic congestion in advance.

**Key words**– Beaconing, wireless vehicular networks, SUMO, OMNET++, Veins

## I Objective

We have to analyze the performance of a simple beaconing scheme. Following a road accident, a WSM (WAVE short message) is broadcast and replicated, according to predefined policy, from one vehicle to another. The vehicle that stops due to an accident starts transmitting the WSM after 15 seconds. A vehicle that receives the WSM will retransmit it with probability p=0.5. An RSU (Roadside Unit) that receives the WSM will always retransmit it.

## II Introduction

VANETs (Vehicular ad-hoc networks) are created by applying the principles of MANETs (Mobile Ad Hoc Networks) – the spontaneous creation of a wireless network of mobile devices – to the domain of vehicles [1]. VANETs were first mentioned and introduced [2] in 2001 under "car-to-car ad-hoc mobile communication and networking" applications, where networks can be formed and information can be relayed among cars. It was shown that vehicle-to-vehicle and vehicle-to-roadside communications architectures would co-exist in VANETs to provide road safety, navigation, and other roadside services. VANETs are a key part of the ITS (Intelligent Transportation Systems) framework. Sometimes, VANETs are referred to as Intelligent Transportation Networks [3]. Vehicular networks are emerged to improve traffic safety-related applications through beacon (periodic) and event-driven messages [4]. Beacon messages are crucial to enable safety applications. Each vehicle broadcasts periodic beacon messages to inform neighbor nodes about their address, location, and other relevant information. These status messages can be used to detect abnormal situations on the highway and urban scenarios. On the other hand, dangerous situations like car accidents will trigger event-driven messages to be disseminated with the highest priority to nearby vehicles [5].

## III Main part

To perform the simulation, the open-source vehicular network simulation framework Veins is used. Veins is based on two well-established simulators: OMNeT++, an event-based network simulator, and SUMO, a road traffic simulator. As an example, maps of Crotone city (Italy) and Albuquerque city (New Mexico) are used. Maps are downloaded from OpenStreetMap https://www.openstreetmap.org/map=19/39.08076/17.12261 in .osm format and Sumo compatible files filename.net.xml, filename.poly.xml, filename.rou.xml, filename.sumo.cfg, filename.launchd.xml are generated with following commands

```
netconvert   --osm-files
<filename>.osm -o <filename>.net.xml
--output.street-names true
--output.original-names true

polyconvert --net-file
<filename>.net.xml --osm-files
<filename>.osm --type-file
typemap.xml -o <filename>.poly.xml

python ~/src/sumo-0.32.0/tools/randomTrips.py
-n <filename>.net.xml -e 100 -l

python ~/src/sumo-0.32.0/tools/randomTrips.py
-n <filename>.net.xml
-r <filename>.rou.xml -e 100 -l
```

Figure 1 demonstrates two traffic flows in Crotone city:

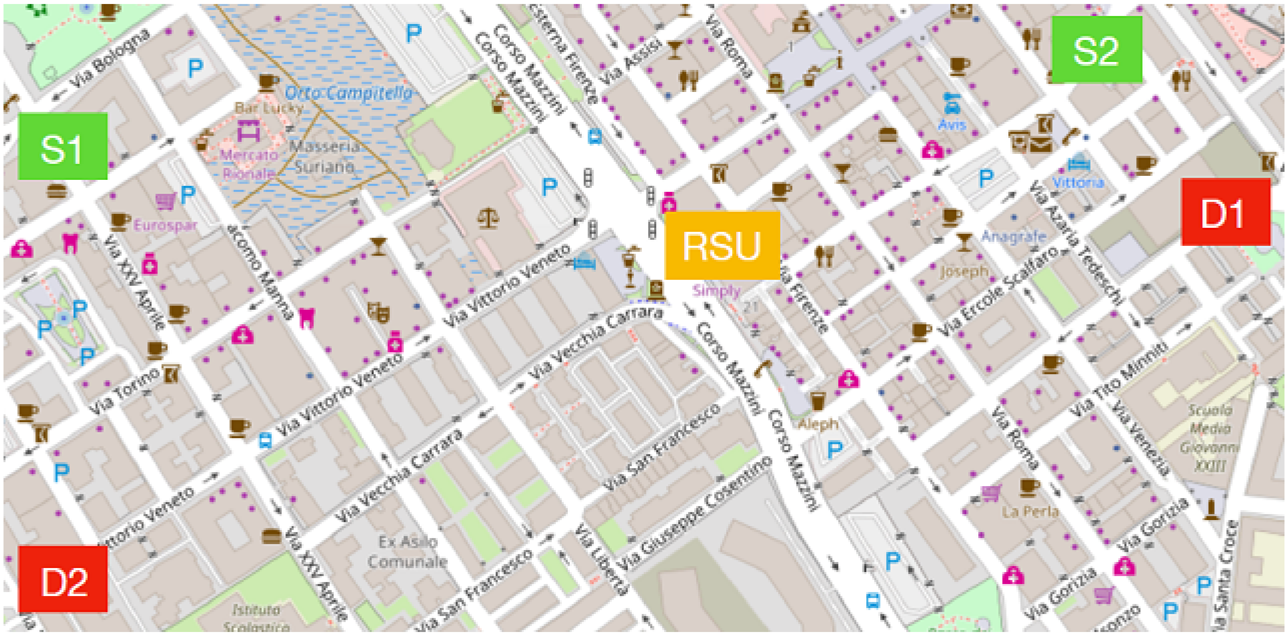


**Fig. 1:** Map of Crotone city (Italy) (approx coordinates 44.54N, 10.78E:)

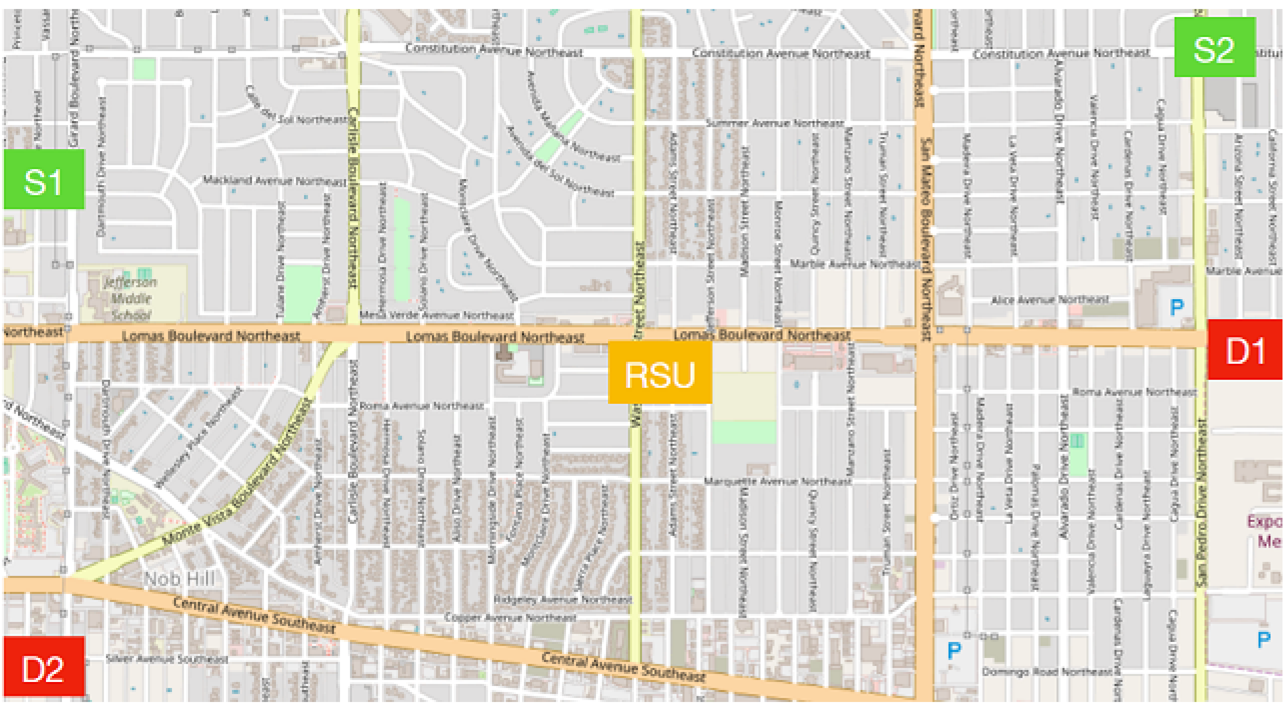


**Fig. 2:** Map of Albuquerque city (NM) (approx coordinates 35.06N, 106.59W:)

flow1 starting from S1 (Source1 of car generation) and going to D1 (Destination1 of car arrival), flow2 from S2 to D2. RSU placement is also shown. Figure 2 demonstrates two traffic flows in Albuquerque city: flow1 starting from S1 and going to D1, flow2 from S2 to D2. RSU placement is also shown. The above-generated file filename.rou.xml creates a random flow of cars in the map, and we changed the <route/> and <flow/> attributes according to the given source and destination points. Routes are obtained by listing appropriate edge ids in sequence.

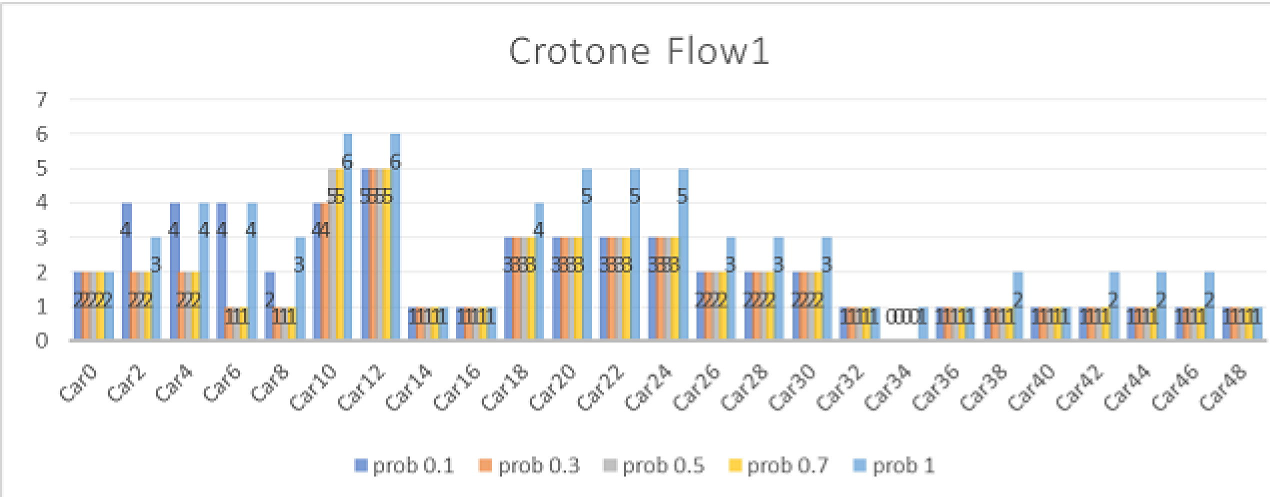


**Fig. 3:** The number of WSM per second received by each car (x-axis= car id 0,1,2,. . . .; y-axis=WSM/s). for different values of p = (0.1, 0.3, 0.5, 0.7, 1) in Crotone city.

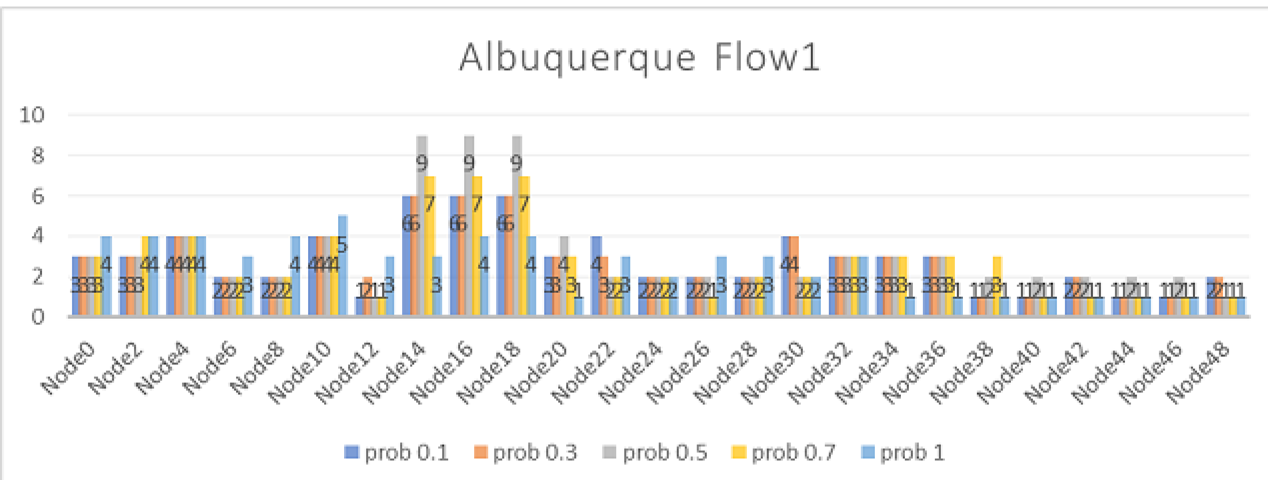


**Fig. 4:** The number of WSM per second received by each car (x-axis= car id 0,1,2,. . . .; y-axis=WSM/s). for different values of p = (0.1, 0.3, 0.5, 0.7, 1) in Albuquerque city.

**Simulation of traffic flows in Sumo**
Converted files are simulated in sumo with command sumo-gui <filename>. sumo . cfg. By observing the simulation, we defined the suitable show-up of cars (changing the period parameter of filename.rou.xml) in order to make the traffic flow smooth.

**Simulation of the project in Omnet++**
After collecting all the necessary files, we created two different projects. Simulation is performed to observe the number of WSM per second received by each car (for the first 50 cars generated in the scenario) and an average value of the channel busy time (the scalar busyTime collected by the phy802.11p module) as seen by the car causing the accident, as a function of at least five different car creation rates Rcar.

## IV CONCLUSION

The quantities of WSM per second received by each car are calculated with different probabilities of retransmission p = (0.1, 0.3, 0.5, 0.7, 1), and overall results are collected into the charts. By observing the above graphs, it can be noticed that during the traffic flow in Crotone city, the number of received WSMs is increasing with the increase of retransmission delay, while in Albuquerque, the number of received WSMs decreases with the increase of retransmission delay, for both cities average busy time of car which causes accident decreases with decreasing of car generation rate(car/s).

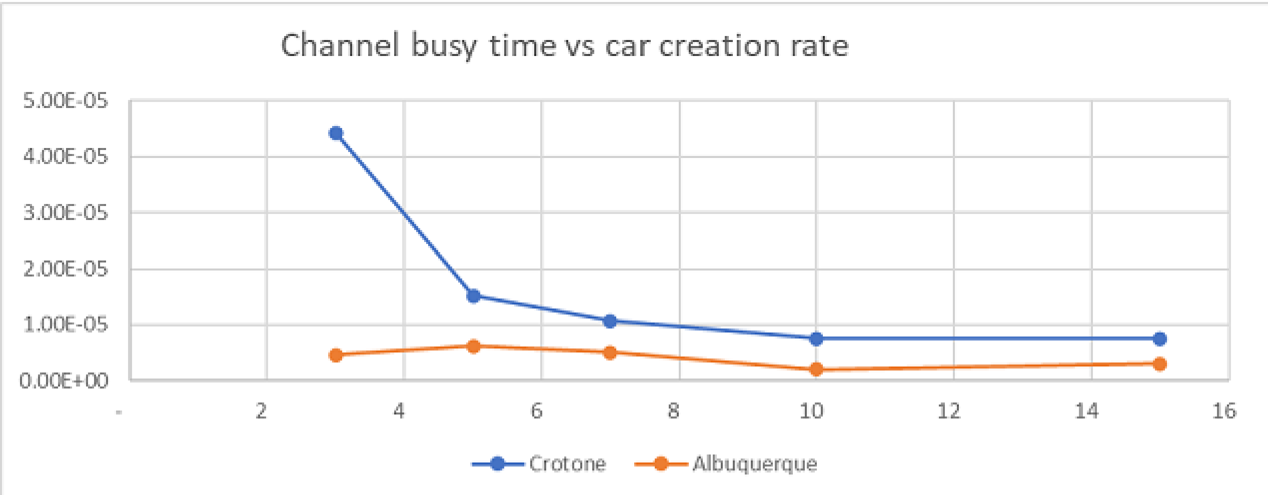


**Fig. 5:** Average value of the channel busy time (the scalar busyTime collected by the phy802.11p module) seen by the car causing the accident. (x-axis = car creation rates Rcar, y-axis = average channel busy time).

## REFERENCES

1. Morteza Mohammadi Zanjireh; Hadi Larijani (May 2015). A Survey on Centralised and Distributed Clustering Routing Algorithms for WSNs
2. Toh, Chai K. (2001-12-03). Ad Hoc Mobile Wireless Networks: Protocols and Systems, Prentice-Hall, 2001
3. "Research Challenges in Intelligent Transportation Networks, IFIP Keynote, 2008"
4. L. Cheng, B. Henty, D. Stancil, F. Bai, P. Mudalige, Mobile vehicle-to-vehicle narrow-band channel measurement and characterization of the 5.9 GHz dedicated short-range communication (dsrc) frequency band, IEEE Transactions on SelectedAreas in Communications 25 (8) (2007) 1501–1516. IEEE.
5. Kayhan Zrar Ghafoor, Jaime Lloret, Kamalrulnizam-Abu Bakar, Ali Safa Sadiq, Sofian Ali Ben Mussa. Beaconing Approaches in Vehicular Ad Hoc Networks: A Survey
6. https://veins.car2x.org/