Study of Performance of the Vehicular Ad Hoc Networks in Dense Network Scenarios

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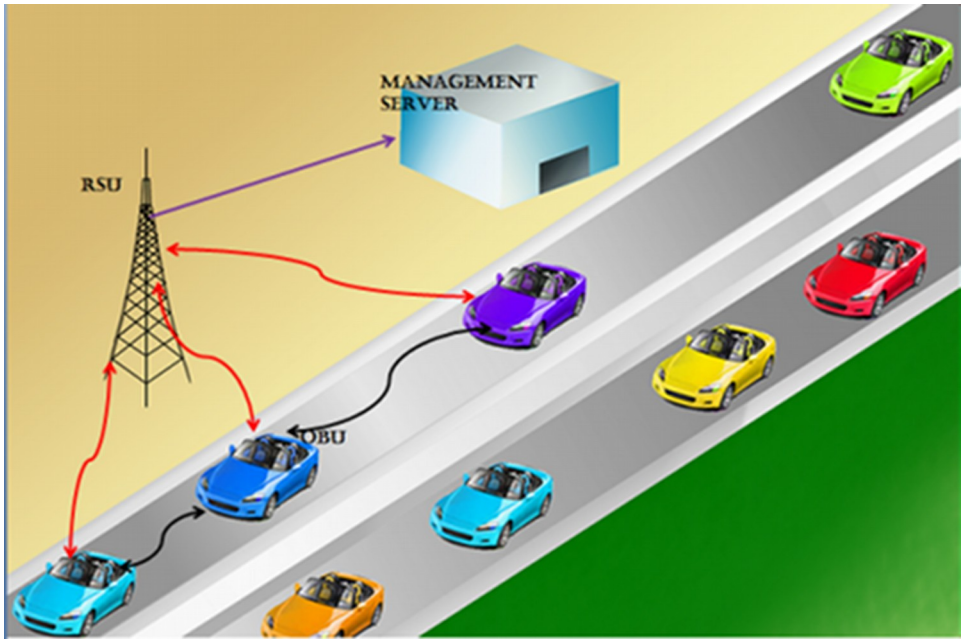
Introduction

- C-ITS -> one of key technologies in ITS
- Based on V2X communication
- Nodes form a VANET



Rasheed, A. , Zia, H. , Hashmi, F. , Hadi, U. , Naim, W. , & Ajmal, S. (2013). Fleet & Convoy Management Using VANET. Journal of Computer Networks, 1(1), 1-9.

Applications:

- Traffic Jam Warning
- Weather conditions
- Emergency brake light
- Emergency vehicle approaching
- Information on fuelling & charging stations for alternative fuel vehicles
- Traffic information & Smart routing

Motivation

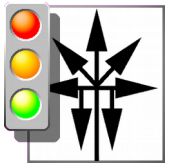
- C-ITS -> can introduce a new level of safety on roads
- Function reasonably well under low density conditions
- Network performance significantly drops when a lot of devices are communicating → limited channel bandwidth, CSMA/CA
- What would be the performance of the network in a very dense traffic urban scenario?
  - Very difficult to test it in real-life traffic
  - Realistic computer models can be used prior to real-life testing to make a picture of the network's performance

https://www.noction.com/blog/five_tips_for_reducing_congestion_in_enterprise_networks

Tools

- Riverbed Modeler
- Omnet++ Discrete Event Network Simulator
- SUMO Traffic Simulator
- Veins framework
- INET framework
- Custom traffic flow generator tool for SUMO

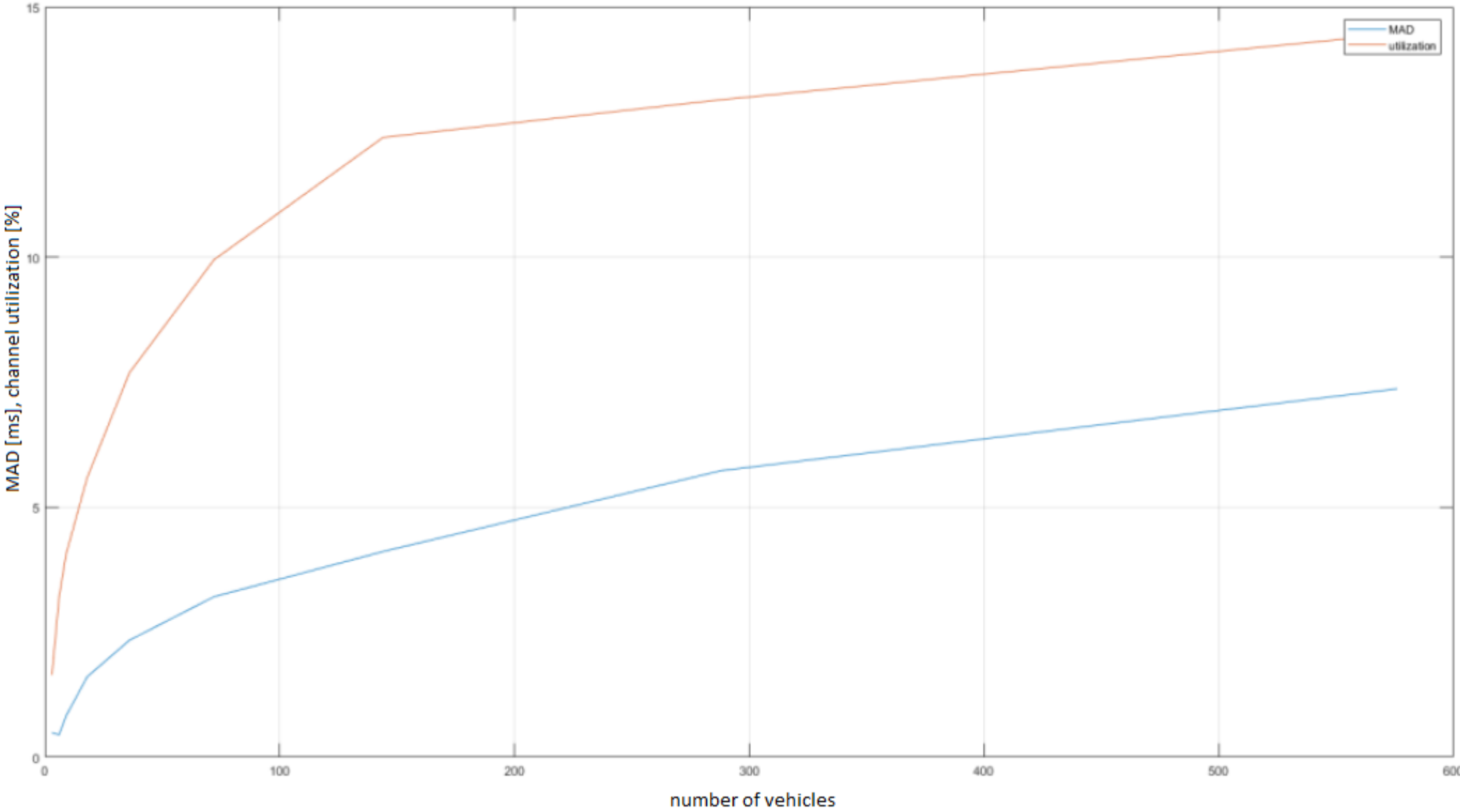
Simulation of Urban MObility



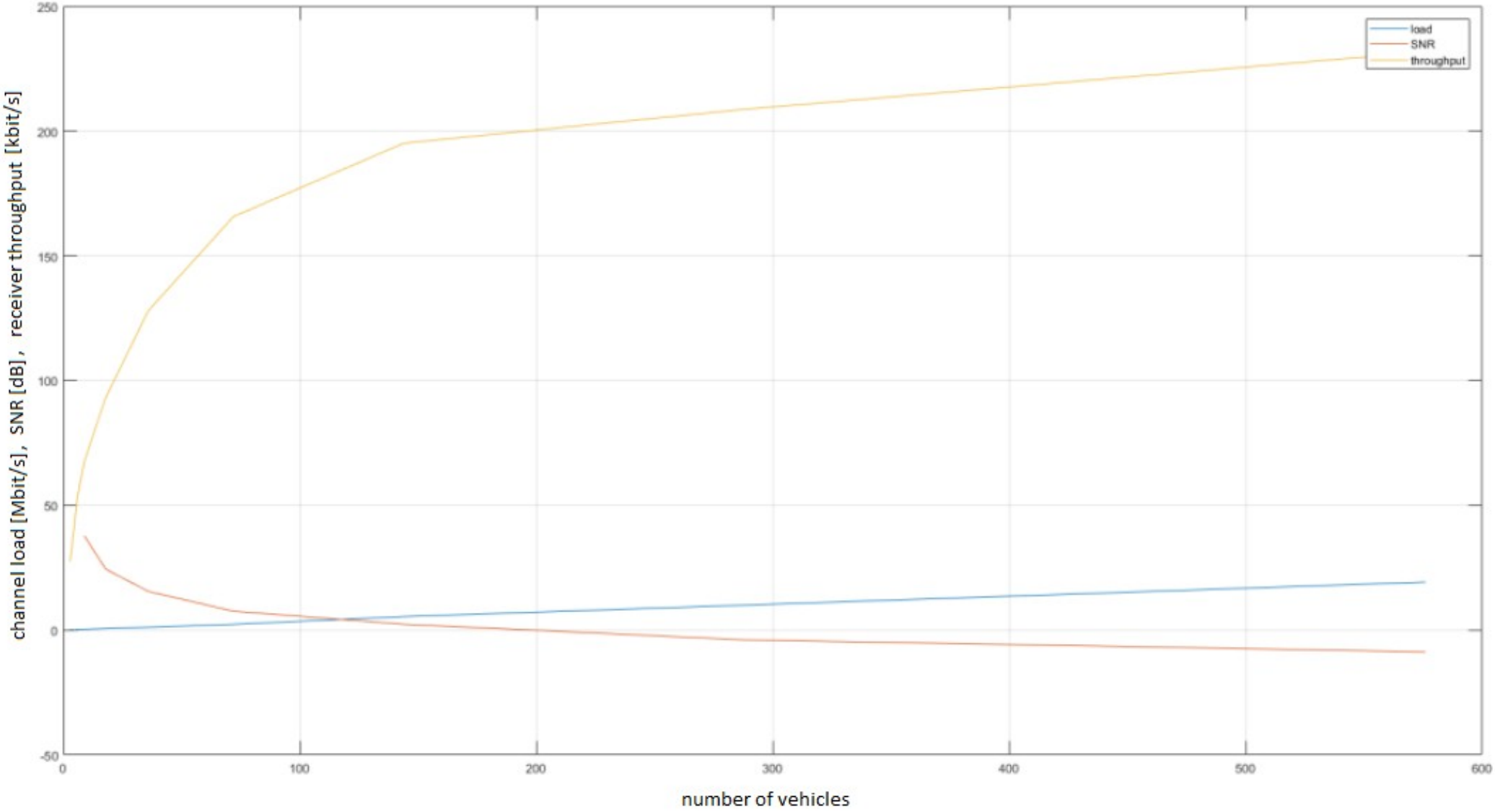
Method

- Build a model of VANET node using IEEE 802.11 – OCB PHY and MAC
- Find suitable PHY and MAC parameters according to the standards
- Create the simulation scenario
- Analyze the results

Results I


MAD
utilization
MAD [ms], channel utilization [%]
number of vehicles
0
5
10
15
0
100
200
300
400
500
600

Results II


load
SNR
throughput
channel load [Mbit/s], SNR [dB], receiver throughput [kbit/s]
number of vehicles
250
200
150
100
50
0
-50
0
100
200
300
400
500
600

Conclusion

- 10 simulations conducted
- TPC mechanism is crucial for VANETs in dense traffic scenarios
- Convolutional channel code can not correct bit errors when the SNR is extremely low
- Impact of the use of LDPC channel codes in VANETs should be further investigated
- Routing algorithms can be implemented to target the datagrams of higher layers to specific vehicles and reduce broadcasting

Further Scope

- Comparison of various routing algorithms in vehicular environment
- Determination of the most suitable routing algorithm in a specific communication scenario
- Explore the the possibilities of implementation of C-ITS to support emergency vehicles driving time decrease

Thank you for your attention