Integrated Networking Simulation Environment for Vehicular Networks

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Abstract

•To create a routing-efficient & realistic networking simulator
•Combine existing VANET protocols to provide simple solution
•Fully working network stack compatible with the widest range of vehicle applications
•Implementation and Analysis

Introduction

•Safety and driving comfort is becoming more of a necessity in current day scenarios
•Car manufacturers try to increase the intelligence in cars
•Establishing Efficient & Reliable network remains a challenging issue
•Even though multiple solutions exist, they are highly problem-specific

What makes VANET a specialty of MANET ? [1]

•Rapid topology changes
•Limited power constraints
•Highly variable network density
•Large scalability
•Communications must be able to cover long distances with short latency.

Application categories in VANET

Safety Applications Collision warning, road obstacle warning, cooperative driving, intersection collision driving or lane change assistance
Comfort and non-critical traffic applications Mobile Internet Access, Traffic Information Query

IEEE 802.11p

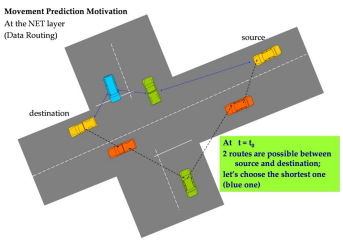
•Wireless Access in Vehicular Environments (WAVE) standard, specifically designed for VANETs
•Derived from the old 802.11a and 802.11e standards
•Reliability and low latency are very important requirements [2]

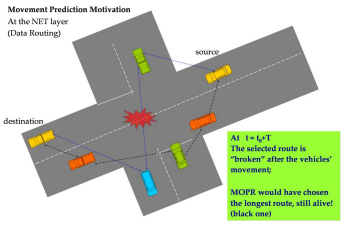
Multi Hop Vehicular Broadcast (MHVB) [3] [4]

•Periodic broadcast beaconing of position and speed to the neighborhood
•Beaconing is a very important and essential functionality in VANET for the network control purpose
•Typical Characteristics Backfire Algorithm for redundant message removal, Transmission Interval Control for load balance on the network, Dynamic scheduling for high priority safety messages
•Safety applications need active beaconing system enabling regular and quick transmission of speed and position to the neighbors

Movement Prediction based Georouting (GEO-MOPR) [5]

•Predicted Vehicles' movement is used to estimate the stability of each link in the network



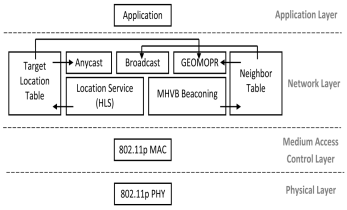


•MOPR requires a location service to give very-frequent updates on nodes' positions in order to compute their approximate speeds

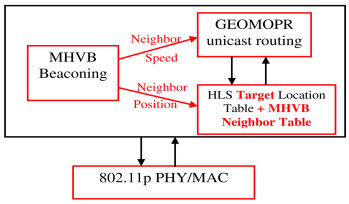
•Preferably MOPR can be interfaced with a speed beaconing service like MHVB to make GEOMOPR routing efficient

Improving Routing in VANETs

•Objective Combination of MHVB and GEOMOPR
•Forms the basis for a fully functional network stack suitable for VANETs management



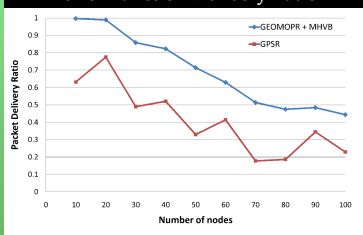
•Safety Applications Regular and quick transmission of position and speed information to the neighbors, as well as an efficient broadcast dissemination protocol (MHVB)
•Comfort Applications bandwidth-efficient routing protocol is needed
•Interfaces between modified agents in NS-2



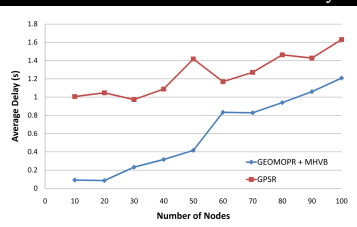
Scenario setting

•Bi-directional two –lane highway
•Avg. speed of cars: 120kmph
•Inter-vehicular distance: 100~200m
•Variable node density
•Transmission range: 250m
•Simulation time: 90 seconds

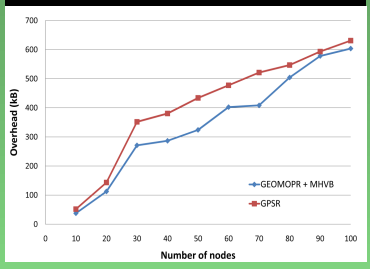
Performance on Delivery Ratio



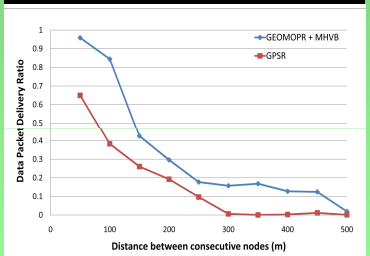
Performance on Transmission Delay



Performance on Control Overhead



Comparison with GPSR



Conclusion

•Combine a unicast routing protocol (MOPR-GPSR or GEOMOPR) and a beaconing service (MHVB)
•Increased routing efficiency
•Network stack compliant with requirements for both safety and comfort applications to vehicular networks.
•Combination of protocols – a privileged direction for future VANET research

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