Realistic Propagation Modelling in VANET Simulations

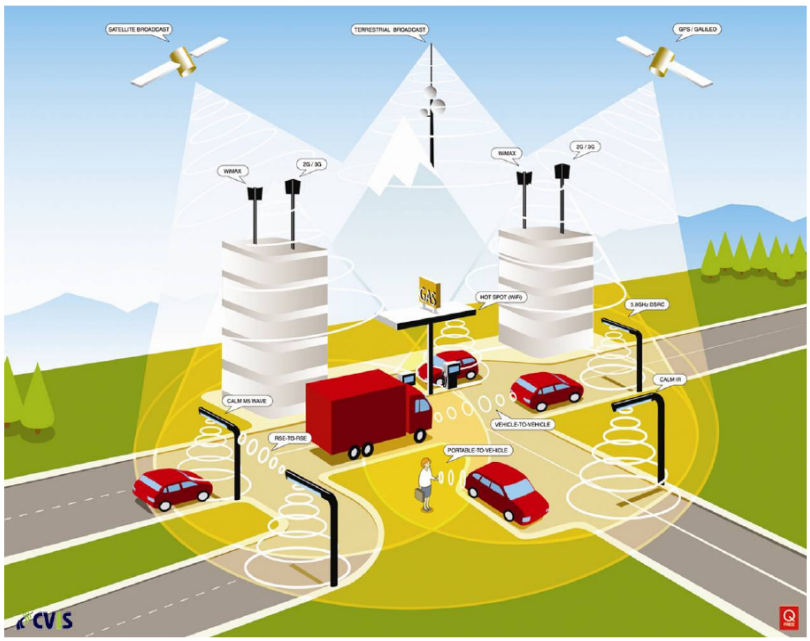
In the research of Vehicular Ad hoc NETworks (VANETs), radio propagation is often modelled with the Free Space, Two-ray Ground or including a Raleigh fading channel model. Parameters are often chosen based on very loose approximations (e.g. pathloss exponent between 3 and 6).

Furthermore, most network simulators (and research) focus on protocols and medium access, focussing on layers 2 of the OSI model and up. In this case drawing a random number to decide correct / incorrect reception (or a received signal strength) is a nice abstraction.

It is generally expected that the VANET radio environment is „cluttered“, e.g. signs, buildings, the road and not to forget, the vehicles themselves, all reflect, diffract and scatter the radio waves. Antenna placement may also be an issue, omnidirectionality is usually assumed. Due to the high mobility Doppler effects will also have a significant impact.

But exactly how for instance the number of vehicles, their arrangements and relative speeds influence radio wave propagation is (at least in VANET-related literature) never taken into account. Furthermore, models such as the Free Space model apply to a single carrier signal and an OFDM signal with 52 subcarriers may need to be modelled quite differently.

Context:
The smart vehicles of the future are expected to communicate with each other and with the roadside.



As vehicle densities can become quite high (up to 160 vehicles per lane per km) and IEEE 802.11p is proposed to have a maximum transmission range of 1km (!) this system will be interference-limited and scalability becomes a serious issue. To make good adaptive MAC and Network layer protocols, understanding of the underlying physical channel is in order.

This assignment includes the following:

- What are the effects of the environment: buildings, trees, tunnels, other cars on the channel? What has been done in the past? Perform a literature study.
- Set up experiment, perform measurements with a network analyzer.
- Derive a channel model + parameters
- Ultimate goal: an implemenation usable in discrete event simulator (based on Analogue Models, generic propagation modelling interface in MiXiM/OMNeT++ 4.0)

for more information, please contact one of the persons below:

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