Connect&Drive project

A large portion of traffic congestion is caused by human behaviour. The human is a controller limited both in reaction and visual field.

Objective: Design, implement and test a next-generation Cruise Control based on Vehicle-2-Vehicle and Vehicle-2-Infrastructure communication.

Goals:
- Improve capacity of road infrastructure
- (Further) improve traffic safety
- Reduce emission of vehicles

Cooperative Adaptive Cruise Control

Motivation: Increased stability leads to increased traffic flow

![Flow vs Density](image)

Wireless Communication

IEEE 802.11p: specifically designed for automotive purposes
- Dedicated frequency bands in 5.9GHz
- Data rate: default 6 Mbit/s, up-to 27 Mbit/s
- Transmission range: 500 – 1000 meter (los)
- Transmit power control
- Default association
- More resilient to multipath effects
- Less susceptible to Doppler drifts

Standardisation still ongoing.

Challenges
- Medium is shared between all nodes
  - multi-access
  - CSMA/CA (hidden terminal)
- Communication range is limited
  - multi-hop
  - road-side units
  - delay-tolerant networking
- Capacity is limited
  - scalability
  - transmit power control
- Wireless medium is inherently unreliable
- Security

Project Approach

- Multidisciplinary approach:
  - 3TU, TNO and companies
- Build prototype
  - test design at limited scale (15 vehicles)
  - demonstrate feasibility
- Use simulators
  - consider "end-product"
  - investigate additional use cases
  - investigate scalability

Scenarios

Cooperative following – vehicles assume efficient following behaviour.

Assisted Merge – a vehicle can enter a busy highway without causing flow instabilities

Assisted Exit – a vehicle can exit a highway without causing flow instabilities

Network Layer

- Geo-unicast
- Geo-broadcast
- Topological-broadcast (e.g. beaconing)

Ongoing Work

- Design a communication system for CACC
  - High update rates
  - Control load on the medium
  - More realistic scenarios
    - Multiple lanes
    - Multiple directions
    - Junctions
  - Interaction road traffic - wireless communication
    - Operate under wide range of conditions
    - Signal propagation (multipath, fading)
  - Validation by means of simulation and prototype on highway