

## 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

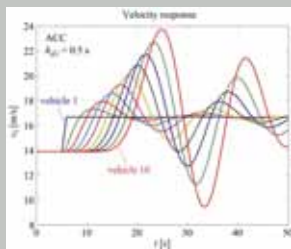
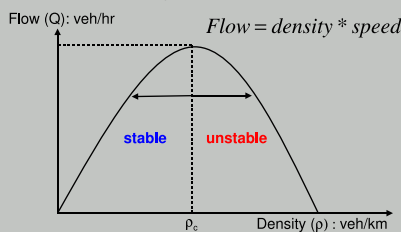
## Project Approach

- ▶ Multidisciplinary approach:
  - ▶ 3TUs, 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

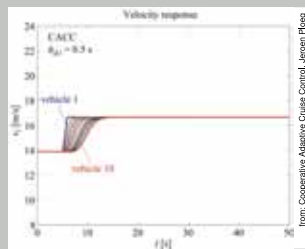


## Cooperative Adaptive Cruise Control

**Motivation:** Increased stability leads to increased traffic flow



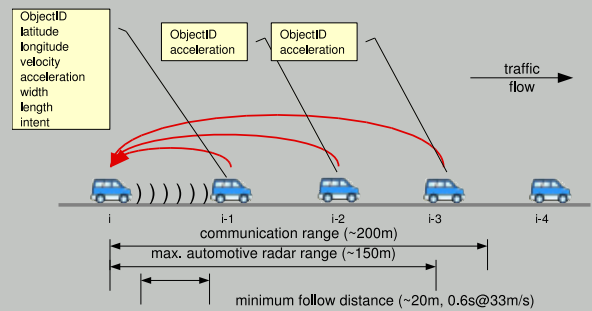
Reaction of ACC to speedup of lead vehicle



Reaction of CACC to speedup of lead vehicle

## 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

## Wireless Communication

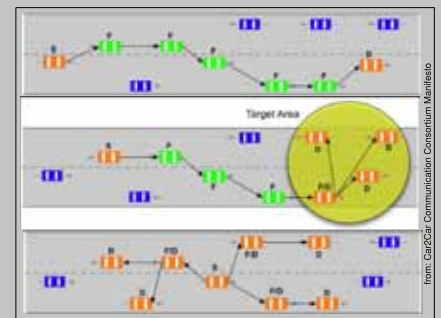
**IEEE 802.11p:** specifically designed for automotive purposes

- ▶ 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.

## Network Layer

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



## 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

## 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