CPS Architecture for Real-Time Management of Vehicle Fleets

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Cyber-Physical Road Goods Transportation

Sensor and communication technology

Real-time traffic information

Vehicle platooning and semi-autonomous driving

Incentives for vehicle platooning

5-10% fuel reduction

Air drag reduction [%]

Relative distance in platoon [m]
Fuel-Optimal Truck Coordination

- Goods transported between cities over European highway network
- 2,000,000 long haulage trucks in European Union
- Large distributed control systems with no real-time coordination today

**Goal:** Maximize total amount of platooning with limited intervention in vehicle speed and route

- Position snapshot May 14 2013
- 2,200 Scania trucks
- 500,000 km² in Europe

Larson et al., 2013
Functional Architecture for Coordinated Goods Transportation

Transport Planner

Route Optimization

Road Planner

Road Segment Optimization

Discrete Platoon Coordination

Real-time Inter-Vehicle Control

Advanced Vehicle Cruise Control

Alam et al., 2012
Stockholm-Zwolle 24/7 Testing

- Real-time fleet management
- Platooning in real traffic
- Fuel reductions and safety
- Driver acceptance
- Public acceptance

**Scania Transport Lab**
Internal haulage company
20 trucks, 360,000 km/year
75 trailers, 92% loaded
65 drivers, 40 h work/week
CPS Architecture Challenges for Coordination of Heavy-Duty Vehicle Fleets

- **Circuit-switched vs packet-switched** goods transportation
- **Pricing** of platooning and traffic services
- **Local vs global** objectives: vehicular vs societal
- **Local vs global** decision-making: vehicle vs back office
- **Integration** with existing logistics infrastructure
- **Safety** with other vehicles and humans in the loop

http://www.ee.kth.se/~kallej