Communication solutions used in the WiSafeCar pilots:

- The main objective in communications is to optimize the benefits of the 3G mobile network and the IEEE 802.11p devices in transportation
- WiSafeCar utilises “Hybrid V2V, V2I and I2V Communications”
- Sunit PCs: GPRS/3G to/from Linking Point, LAN-connection to NEC Linkbird-MX v.3
- NEC Linkbird-MX v.3: LAN-connection to Sunit PCs, IEEE 802.11p connection to roadside units and other vehicles
- Road side unit: IEEE 802.11p connection to vehicles, fixed Ethernet connection to the Linking Point
Road friction monitoring

- Camera based road friction monitoring unit
- Application has been developed to adapt the system semi-automatically
- The synchronized camera pair is used to detect light polarization differences and texture of the road
- Calculated road state and friction value is sent via 802.11p communication channel to the other vehicles
Road Weather Monitoring Unit

Road surface temperature, aerial temperature, voltage and current consumption measurements of vehicle's safety, usage and handling devices

Classification of slippery road and poor driving conditions → warnings immediately, if detected

Road weather related measurement data delivered once a minute
Data Fusion Platform

- Receives data from GPS and IcOR data sources
- Depending on the vehicle speed calculates the correct time shift for the fused data package
- Reconstructs the data package to be sent to the IEEE 802.11p communication unit
Content Centric Network (CCN) & Car-to-Car (C2C)

+ Faster (30 times) than “today” IP solutions
+ Speed up implementation
+ Inherent security
+ Inherent distribute service
- Proof concept OK, but still under development
- Not yet commercial products

One of the world’s first CCN implementation in transportation area!
Dynamic carpooling services platform

Multi-Agent-System

- vCard (public Keys)
- Authentication Agent
- Server Agent
- Multi agent system
- WiSafeCar communication layer
- Local Agent
- WiSafeCar

Services

- Agent Interface
- Monitoring and warning
- External Traffic
- ESB
  MULE /SADDLE
- Planning
- Event detection and notification

Dynamic Carpooling Services

- Real time fleet management system
- Flexible service oriented platform
- Monitoring service: online detection of traffic events
- Scalable to include other services: traffic, meteorological, infotainment services, etc.
- Message level security, mutual authentication

Real Time Navigation

- Event
- Waypoints

Mutual Authentication

- vCard + RSA key
Traffic Information Service

- Collection of traffic and weather data measurements from various sources
- Modelling and management of the real time traffic situation and short term traffic forecasts
- Information delivery via DATEX2 service for the utilisers
- Graphical user interface for professionals
Road weather information

FMI produces road weather information to WiSafeCar pilot system

- Route weather
- Warnings for slipperiness and heavy rainfall or snowfall

Measurements by cars

Weather and weather related observations (temperature, fog lights on/off, wipers on/off) made by vehicles are used as input data in road weather modeling and forecasting
Realistic VANET Simulation Platform

Realistic Road Networks
- OpenStreetMap
  - Directions
  - Traffic lights
  - Lanes
  - Speed limits

Realistic Traffic Models
- Microscopic Level
  - SUMO Simulator
- Macroscopic Level
  - Real Traffic Data

Realistic Wireless Communication
- NS3 Simulator
  - Accurate physical layer model
  - IEEE 802.11p protocol
  - Scalable to wide areas

Online VANET Simulation
- SUMO
  - Vehicles Mobility
- Wireless Communication
  - NS3
  - new routes
  - vehicles mobility
Driver monitoring:
Examples of face detection options

Driver monitoring procedure:
1. Presence detection
2. Face detection and recognition by features
3. Tracking and model update, evaluations and actions
4. Exit detection