CICSyN MADRID 2013

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TEAM - CO2 Reduction

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CO2 Reduction through Weather Assistant

CICSyN 2013

TEAM - CO2 Reduction through online Weather Assistant for Cooperative ACC Driving

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Content

1. INTRODUCTION

TEAM – Tomorrow‘s Elastic and Adaptive Mobility

- Mission – to make travelers and infrastructure acting as a TEAM
- Adapting in any situation and creating always optimal mobility
- Leads to (eco-) efficient, flexible and safer traffic
- TEAM started 2012 and is due to end of 2016

TEAM – Essentials

- Cooperates trough communication
- Motivated and sharing individual and common goals
- Delivers better results than the sum of individual players
- Rewarded, individually and globally

1. INTRODUCTION

TEAM - Vision

- V2X Communication + LTE technology
- Integrate Smartphones and Cloud-Services
- Drivers and Travelers
- Cooperation becomes Collaboration
- Acting as a TEAM

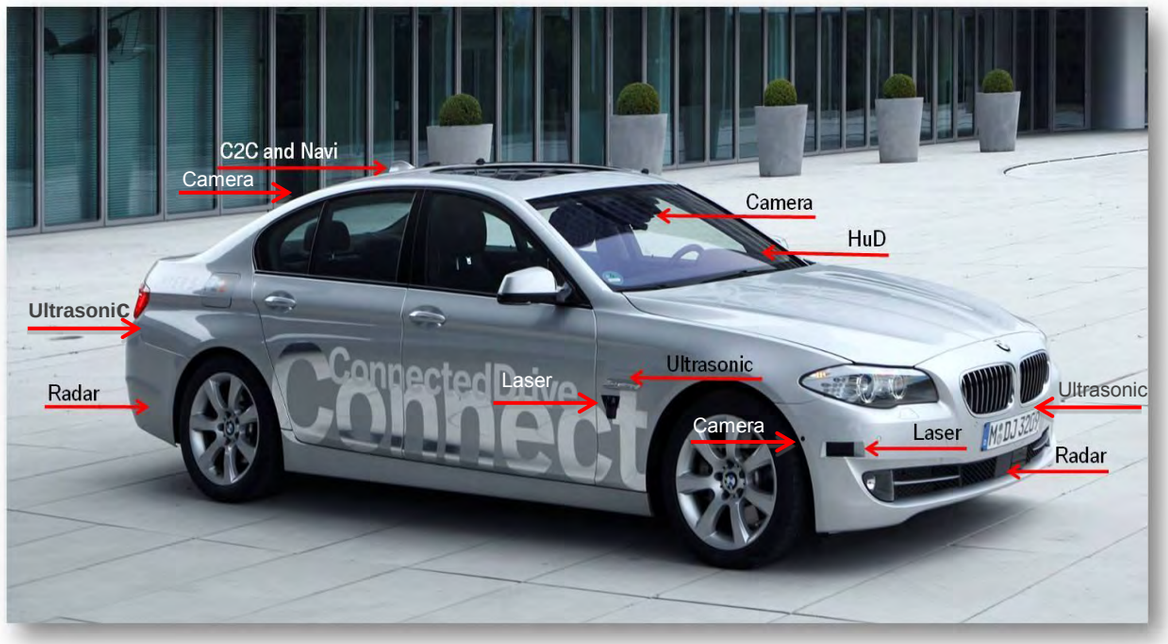
1. INTRODUCTION

Research Focus

- Efficient data acquisition technologies
- Reliable algorithms for its interpretation
- Influence of weather onto ITS (transportation systems)
- Awareness of current weather situation
- Mobile (local) weather monitoring systems
- CO2 efficiency and safety of transportation systems
- Cooperation and collaboration of drivers and travelers
- Sensor technologies and sensor fusion techniques

2. ECO DRIVING TO REDUCE CO2 EMISSIONS

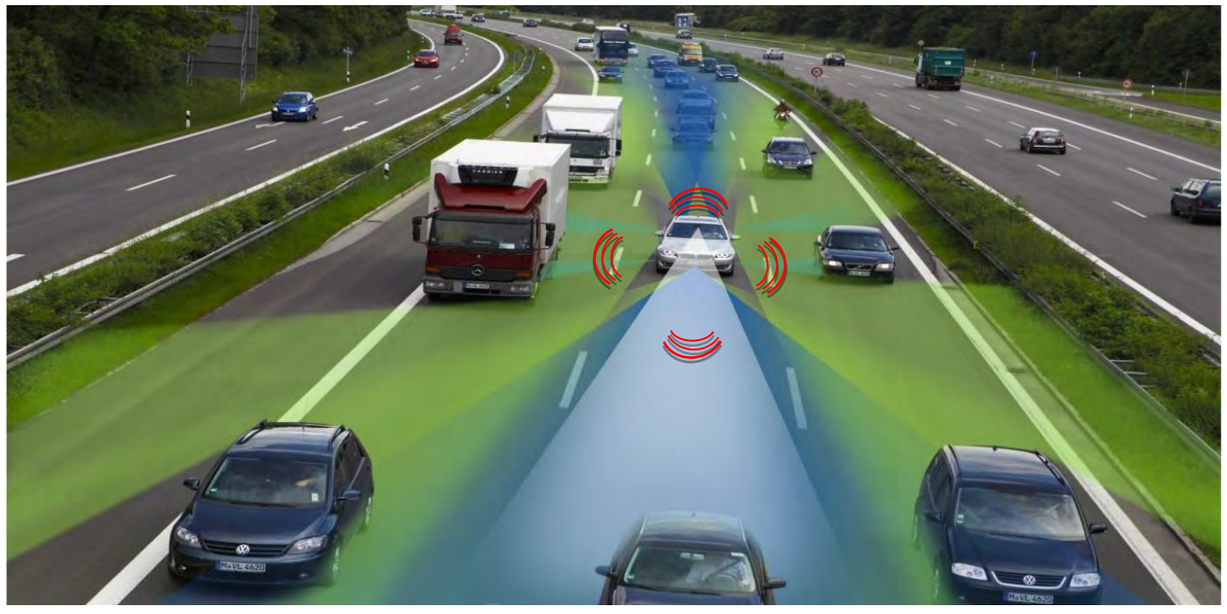
Experimental Vehicle



- Sensors, NEC platform for the C2X communication
- HMI platform, Navigation platform
- NAVTEQ/NOKIA ADASRP platform supporting Navigation, C2X communication

2. ECO DRIVING TO REDUCE CO2 EMISSIONS

Environmental View

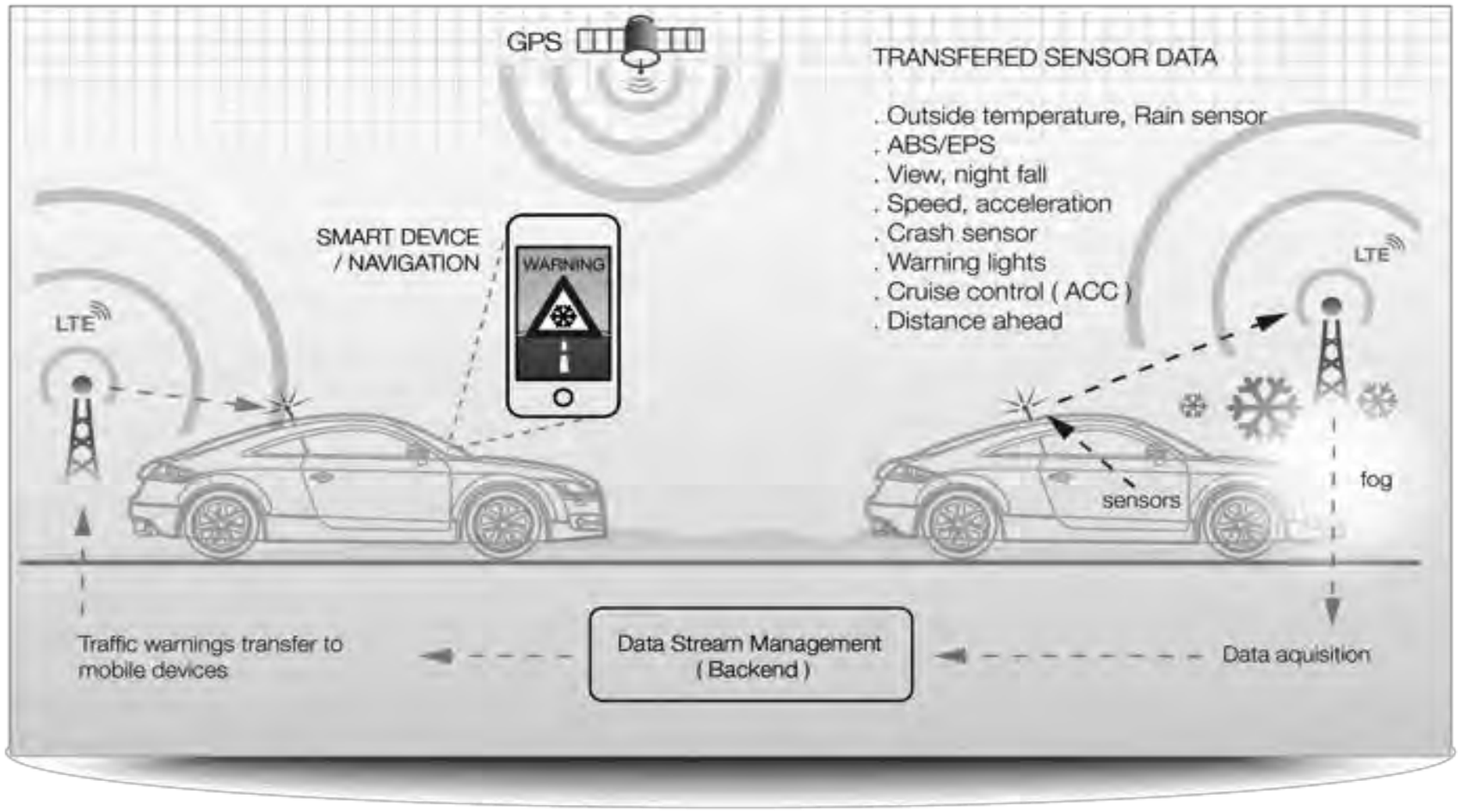


- Vehicles Sensor View while driving on a road/lane
- C2X communication active

- Laser Scanner
- Radar
- Camera
- Ultrasonic

2. ECO DRIVING TO REDUCE CO2 EMISSIONS

Vehicle act's as a member of a mobile sensor network

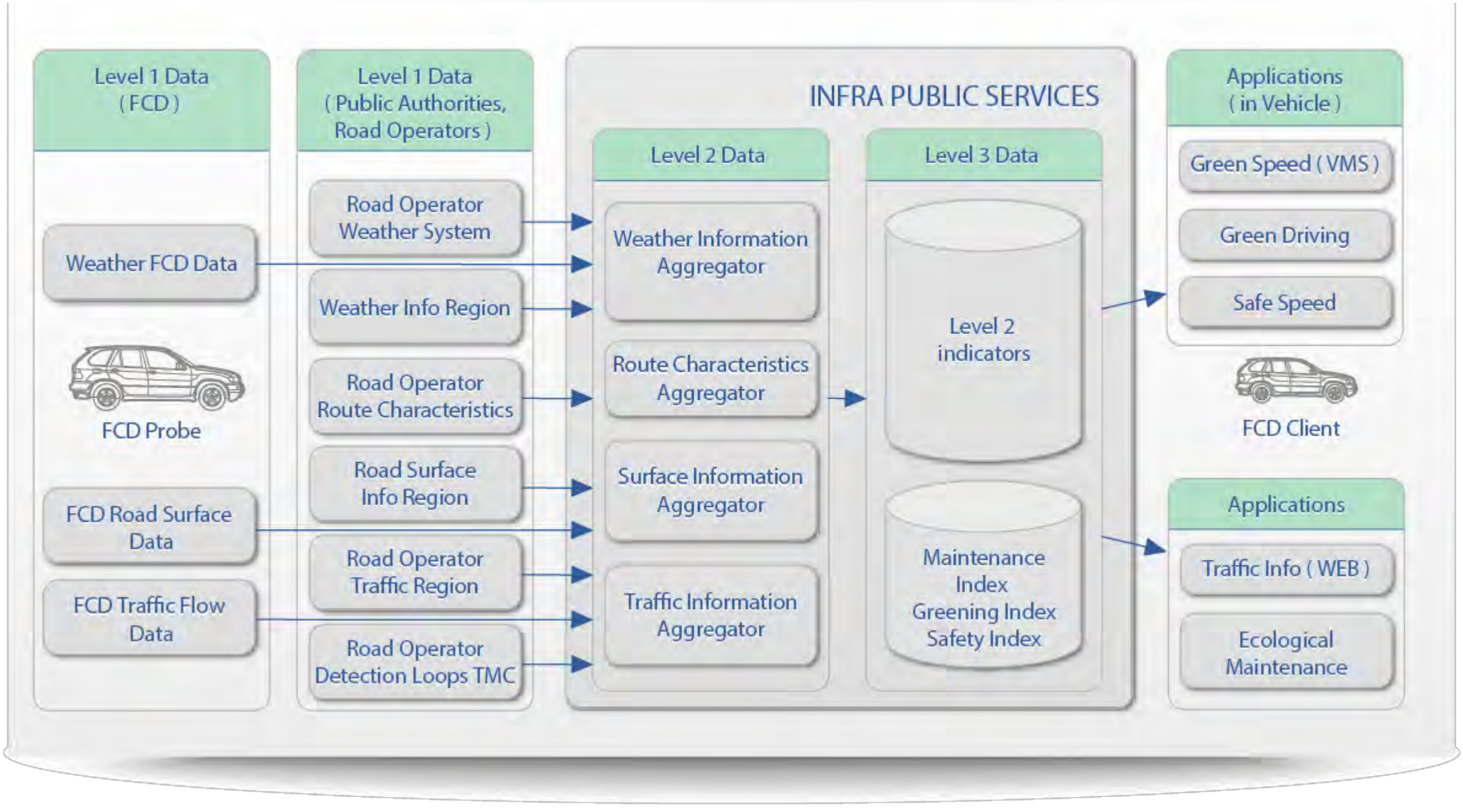


3. THE ARCHITECTURE AND FUNCTION OF THE WEATHER ASSISTANT

Requirements

- Cars acting as probes and Sensors and delivering Floating Car Data (FCD)
- Public Authorities and Road Operators delivering their local information
- Backend is consolidating the incoming data in real time
- Applications are available (OBU, Smartphones) delivering services to end users

3. THE ARCHITECTURE AND FUNCTION OF THE WEATHER ASSISTANT

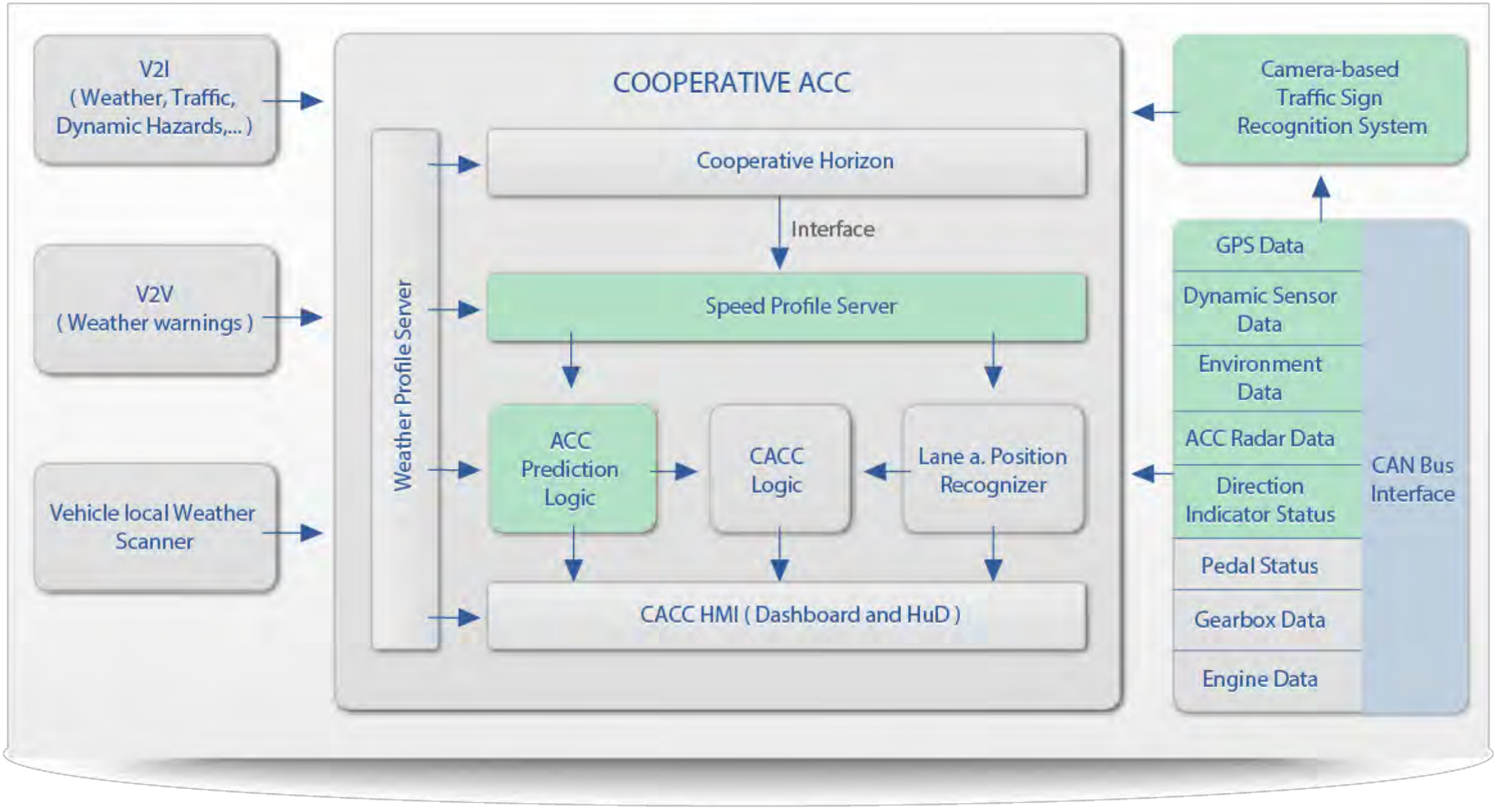


4. CO2 REDUCTION THROUGH WEATHER ASSISTANT WITH CACC

Preconditions

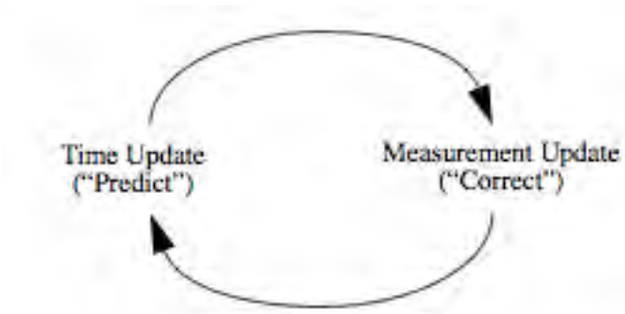
- V2I – Weather Data known by Infrastructure
- V2V – Collaborative Weather Data exchanged in the local environment
- Local Weather Scanner within the vehicle

4. CO2 REDUCTION THROUGH WEATHER ASSISTANT WITH CACC



4. CO2 REDUCTION THROUGH WEATHER ASSISTANT WITH CACC

CACC Prediction Logic is using Kalman Filters



Time Update ("Predict")

(1) Project the state ahead

$$\hat{x}_k^- = A\hat{x}_{k-1} + Bu_{k-1}$$

(2) Project the error covariance ahead

$$P_k^- = AP_{k-1}A^T + Q$$

Measurement Update ("Correct")

(1) Compute the Kalman gain

$$K_k = P_k^- H^T (HP_k^- H^T + R)^{-1}$$

(2) Update estimate with measurement z_k

$$\hat{x}_k = \hat{x}_k^- + K_k(z_k - H\hat{x}_k^-)$$

(3) Update the error covariance

$$P_k = (I - K_k H)P_k^-$$

Initial estimates for $\hat{x}_{k-1}$ and P_{k-1}

4. CO2 REDUCTION THROUGH WEATHER ASSISTANT WITH CACC

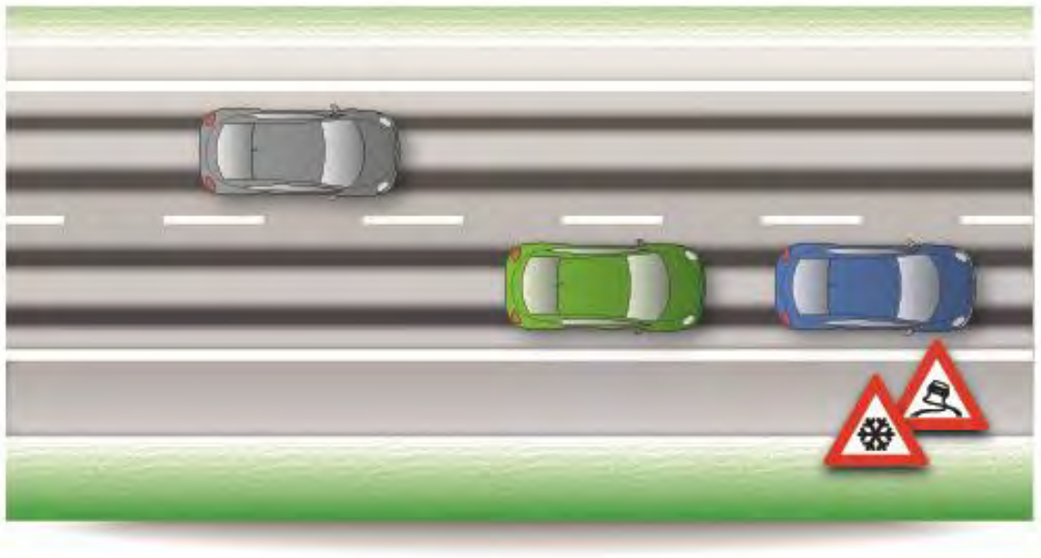
Results will end up in EfficientDynamics and ConnectedDrive Strategy

- Engine start stop function and intelligent energy management
- Brake energy regeneration and gear shift indicator
- Improved engines and power train
- Learning electronic horizon
- Predictive efficiency driving strategies with optimized longitudinal control
- Multimodal and perspective HMI functionalities
- Intelligent ACC with special control strategies and Car2X communication
- Weather information connected to the Navigation device

5. IMPLEMENTATION DETAILS AND THEIR HMI

Visualization via HuD

- Warning, Alert (Type)
- Navigational Actions
- Limits (Speed, Restrictions, ...)



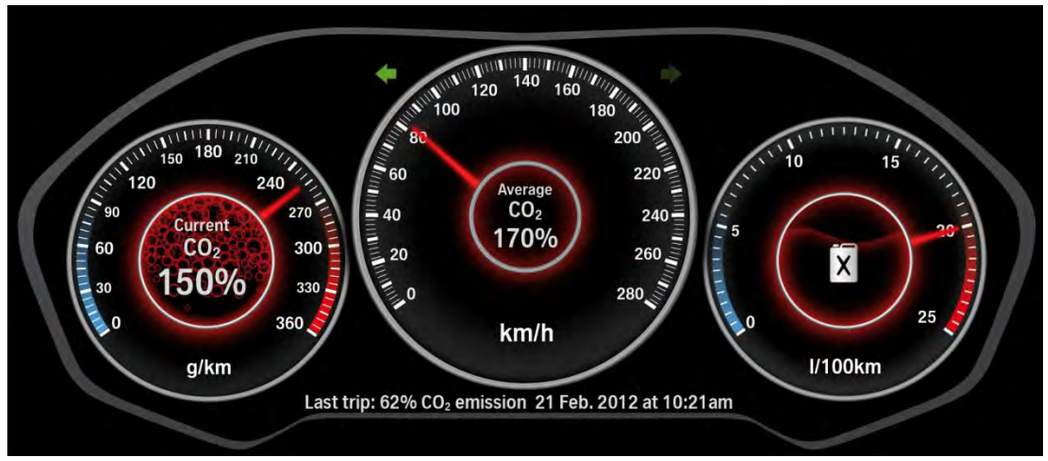
Environmental View

- Position
- Surrounding traffic
- Alert type

5. IMPLEMENTATION DETAILS AND THEIR HMI

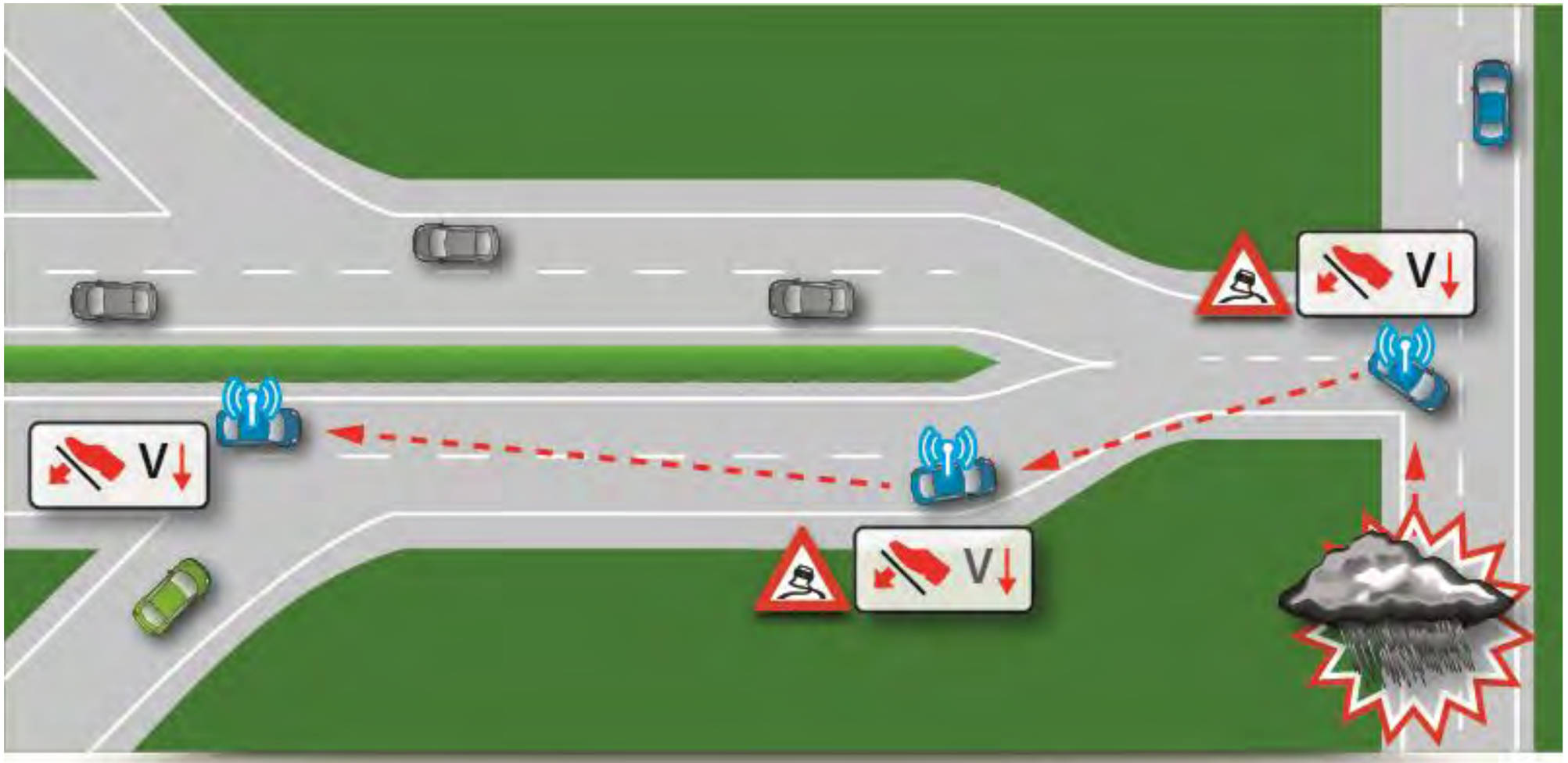
Visualization via Dashboard

- CO2 – Eco Drive
- CACC Status



- CO2 – Eco not efficient
- CACC Off

5. IMPLEMENTATION DETAILS AND THEIR HMI



6. Summary and Outlook

- Technology allows to deal with a wide range of physical parameters within traffic systems
- Comprehensive view of the vehicles local and mid term environment
- LIDAR, optical and ultrasonic systems are playing an important role
- Cooperation and Collaboration are key enablers for CO2 reduction and a wide range of new upcoming eco-friendly apps
- Key benefits are eco- and safe- driving

7. Questions

Thank you