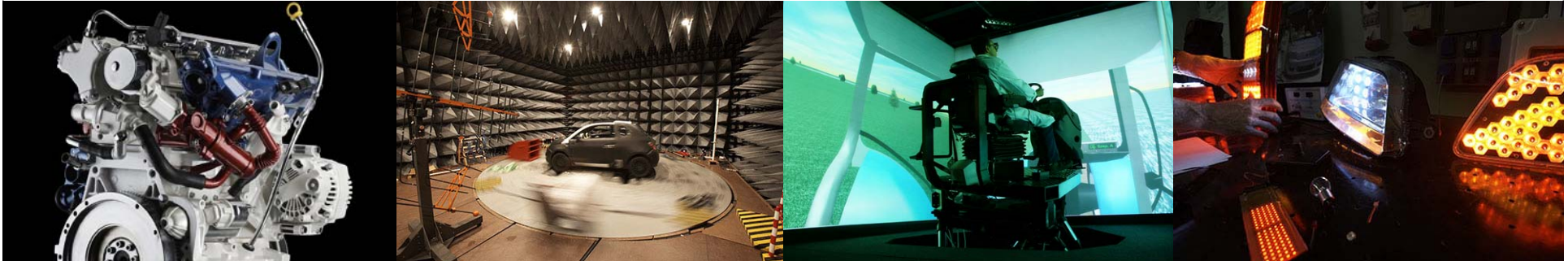# Cooperative systems for a safe and efficient mobility

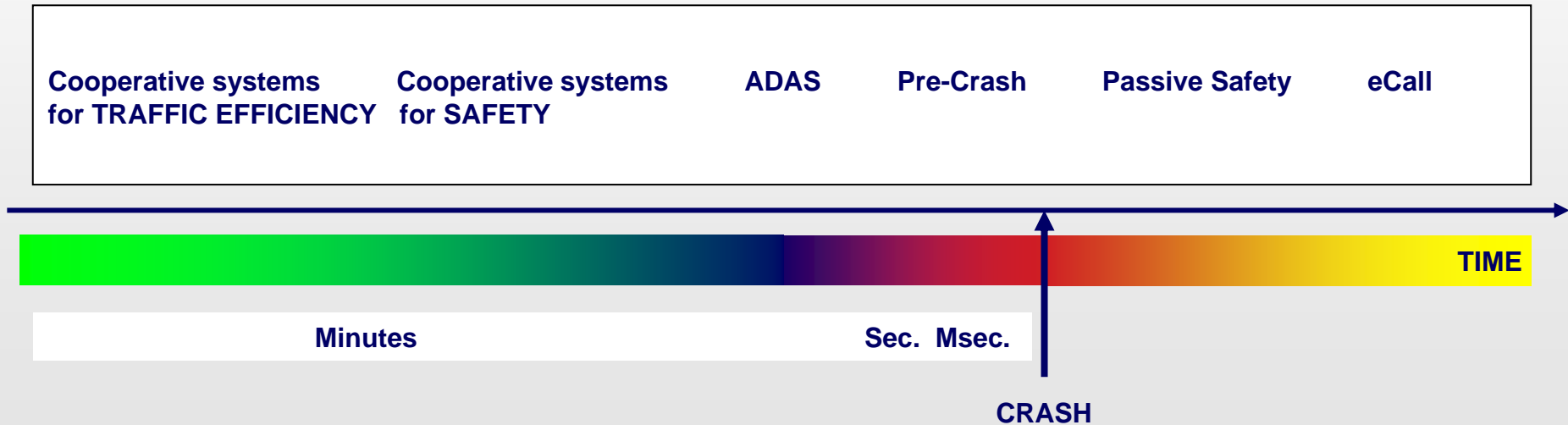**SMART VEHICLES ON SMART ROADS**
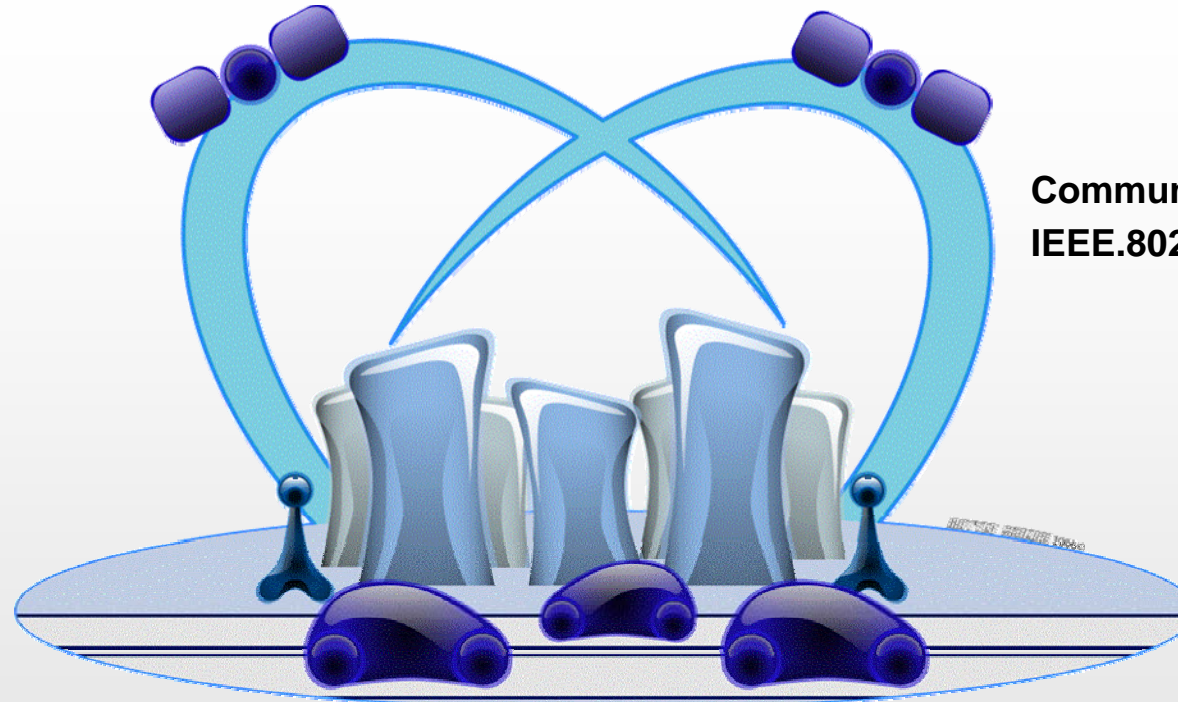
Luisa Andreone

Centro Ricerche FIAT (Italy)

**Cooperative systems based on vehicle to vehicle
and on vehicle to infrastructure communication**

complement to:

infrastructure and vehicle based systems

Cooperative systems for TRAFFIC EFFICIENCY	Cooperative systems for SAFETY	ADAS	Pre-Crash	Passive Safety	eCall

TIME

Minutes   Sec.   Msec.

CRASH

Concept of cooperative systems for road safety

Communication channel IEEE.802.11p

SAFESPOT Integrated Project co-funded by EC-INFSO, coordinated by CRF.

51 partners: OEMs, automotive and technology suppliers, road operators, research centers and universities.

Cooperative system applications for road safety

**STATIC BLACK SPOTS or "static risky conditions"**

typically addressed by V2I applications, the information will also be propagated via V2V multi-hop communication to extend the safety margin to all incoming vehicles.

DYNAMIC BLACK SPOTS or "dynamic risky conditions"

both addressed by V2V and by V2I based applications.
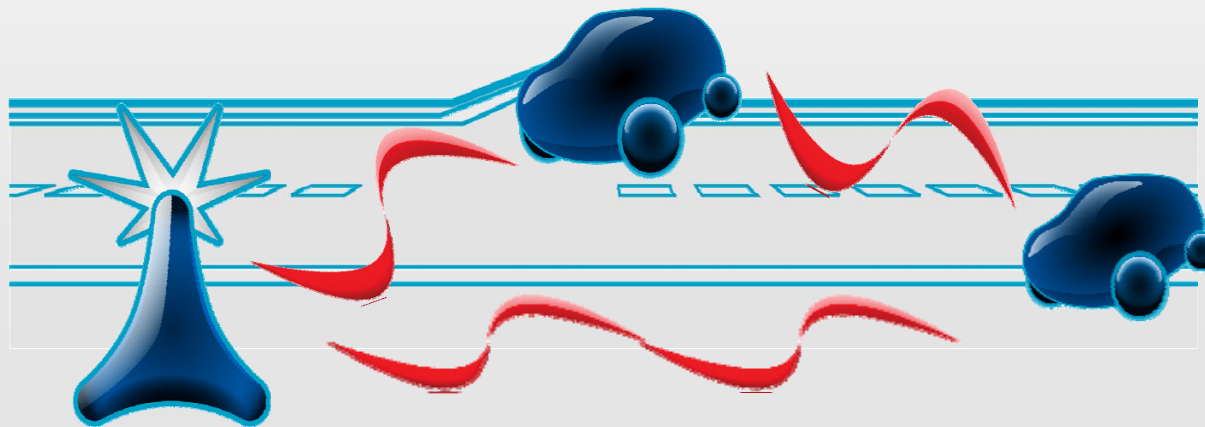
Concept of cooperative systems for efficient mobility

Cooperative system applications for efficient mobility
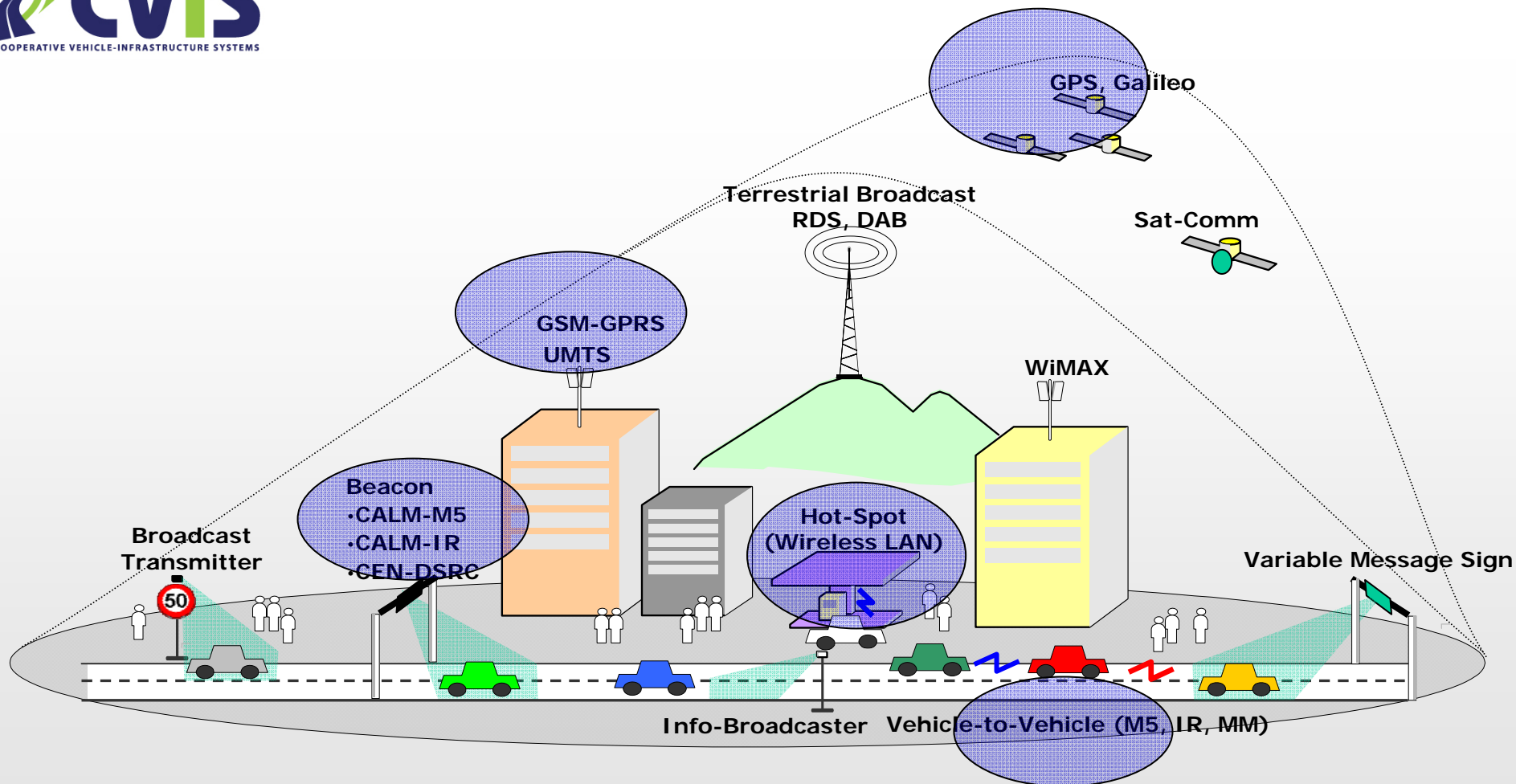
REFERENCE APPLICATIONS

- Cooperative network management
- Cooperative area routing
- Cooperative local traffic control
- Dynamic bus lanes
- Cooperative travelers' assistance
- Enhanced driver awareness
- Cooperative freight & fleet
- Dangerous goods
- Book and monitor parking zones
- Vehicle access to restricted zones

CVIS Integrated Project co-funded by EC-INFSO, coordinated by ERTICO. 60 partners: OEMs, suppliers and other industries, universities, research institutes, national road administrations and representative organizations from the European member states.

Cooperative Systems' time-critical safety messages

Key requirement to communicate time-critical safety messages among vehicles, infrastructure and traffic centers is to ensure that vehicles promptly receive the messages.

How?

- Reducing latency in transmitting messages

- Limiting the lenght of data exchange / optimising the communication protocol

Time critical safety messages have stringent requirements.

Cooperative Systems' time-critical safety messages

Cooperative Systems' primary mechanism to dispatch time-critical safety messages is:

- V2V communications to other nearby vehicles
- V2I messages to any in-range land-based roadside units

The selected communication technology is IEEE 802.11p as defined by the C2C Consortium.

Cooperative Systems' time-critical safety messages

Cooperative systems' time-critical safety messages addresses the integration of vehicle-infrastructure-vehicle communication:

- a vehicle detects a dangerous condition
- it first attempts to use the C2C communication link to vehicles in the vicinity and to any available beacons
- if the message cannot be sent to a vehicle or to a roadside unit, the vehicle selects an available communication channel to send the safety message to a traffic centre

The traffic centre dispatches the message to other vehicles that are approaching the dangerous area.

Towards a common European architecture for communication

CALM
Support of ITS and Internet Services based on continuous communication over 802.11, GSM, UMTS, IR, IPv6, etc.

Car2Car protocol

For V2V and V2I communication, based on geo-aware multi-hop routing
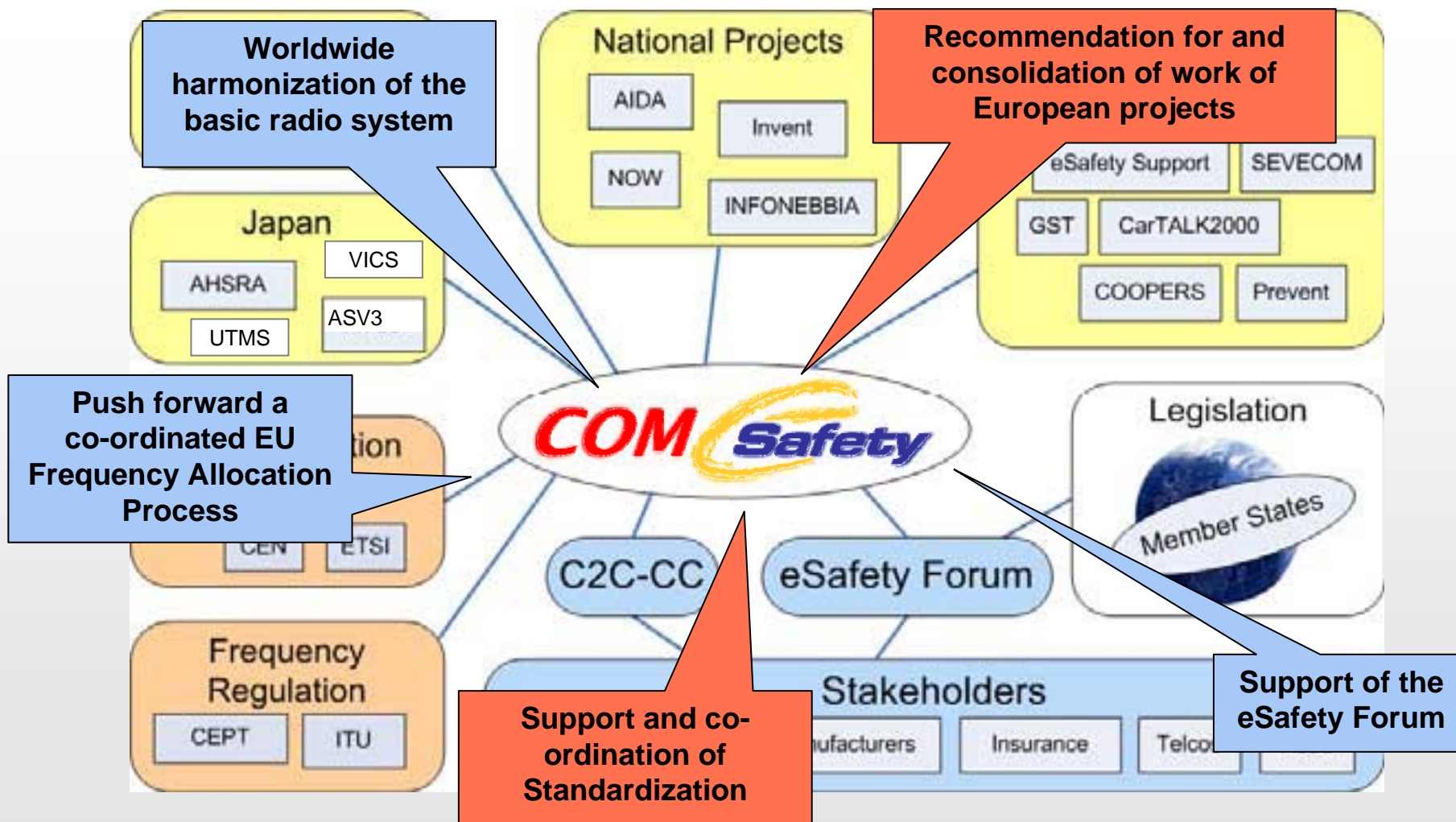
Comm. technology: IEEE 802.11p

Dedicated frequency band in the 5.9 GHz. range

V2V and V2I communication for road safety and traffic efficiency applications using Car2Car and CALM like technologies

ACTIONS
Towards a common architecture for cooperative systems

Worldwide harmonization of the basic radio system

Recommendation for and consolidation of work of European projects

Push forward a co-ordinated EU Frequency Allocation Process

Support and co-ordination of Standardization

Support of the eSafety Forum

ACTIONS
Towards a common architecture for cooperative systems

- The **COMeSafety Support Action** is drafting the architecture framework with consolidated protocols and interfaces.

  Co-funded by the EC-INFSO. Coordinated by BMW, includes 7 partners.

- The **PRE-DRIVE C2X project** (starting June 08) will establish a pan European architecture framework for cooperative systems ensuring interoperability of all different applications of vehicle to vehicle and to infrastructure communications for safety and mobility.

  Co-funded by the EC-INFSO. Coordinated by Daimler AG, includes 24 partners.

ACTIONS
Towards a common architecture for cooperative systems

- Projects like **SAFESPOT** are implementing a local high speed ad hoc network as defined by C2C-CC based on the IEEE.802.11p protocol.

- Other projects (e.g. the **COOPERS** Integrated Project, coordinated by AustriaTech) are actively contributing to create a common architecture.

- The network will be shared by road safety and traffic efficiency applications and is expected to be integrated with a CALM like architecture (as developed in the **CVIS** project)

- The integration in an overall architecture will also enable the use of different communication bearers for non-time-critical safety and for other applications (e.g. DSRC, infrared, GSM, ...).

Cooperative systems for a safe and sustainable mobility will be nothing without a **common architecture**.

Cooperative systems will be tested

in **field operational tests** held at European level

to enable an effective future deployment on a vast scale.

REFERENCE

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RELEVANT Project Links

SAFESPOT Integrated Project www.safespot-eu.org

CVIS Integrated Project www.cvisproject.org

COOPERS Integrated Project www.coopers-ip.eu

COMeSAFETY Support Action www.comesafety.org

PRE-DRIVE C2X Project, Matthias Schulze, Daimler AG

(web site available soon)