Cooperative Intelligent Transport Systems (C-ITSs): application scenarios, use cases and enabling technologies

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Outline

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Following talk - Ing. Alessia Vennarini

Intelligent Transport Systems: …What?

ITS describe technology applied to transport and infrastructure to transfer information between systems for

1. improved safety,
2. traffic efficiency
3. and environmental performance.

This includes stand-alone applications such as:

- streamline the operation of vehicles;
- manage vehicle traffic;
- assist drivers with safety and other information;
- provisioning of convenience applications for passengers.

Intelligent Transport Systems …Why?

We depend heavily on transport in our everyday lives.
Yet continuously increasing road traffic generates **serious problems** in terms of:

- congestion,
- safety and
- environmental impact.

ITS improve existing and will lead to new services for the road users, which, in turn, will bring major **social and economic benefits** and lead to greater transport efficiency and increased safety.

→ *According to the World Health Organization, over 3 400 people die on the world's roads every day and tens of millions of people are injured or disabled every year.*
Land transport accidents are the leading cause of death in Italy among people aged 15–24 (www.instat.it).

Children, pedestrians, cyclists and older people are among the most vulnerable of road users.

Intelligent Transport Systems …When?

ITS Systems: a first example

The European Parliament made **eCall mandatory** for ALL new models of cars from **31 March 2018** onward.

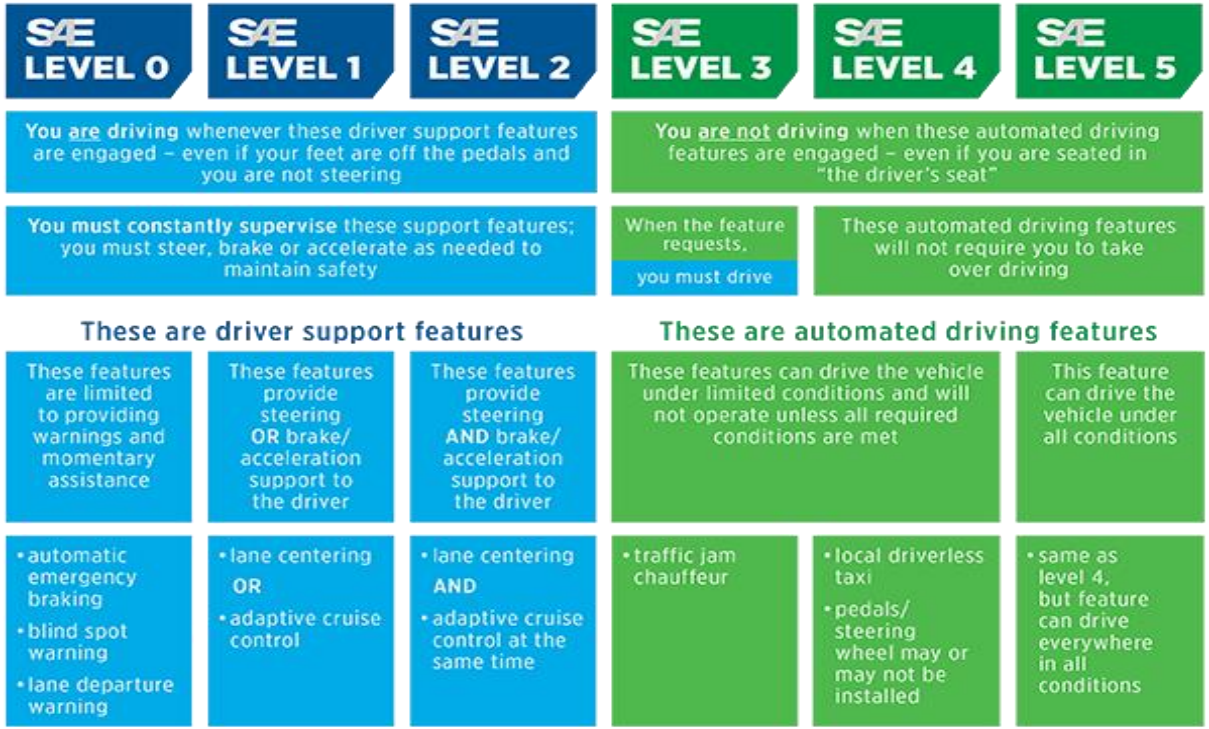
In case of a serious accident, even if the driver and passengers are unconscious, eCall automatically calls the emergency services.

Also, a Minimum Set of Data (MSD) of 140 bytes is transmitted as part of the call, containing:

1) The exact geographic location of the vehicle
2) The direction of travel
3) The time of the accident

Intelligent Transport Systems …How?

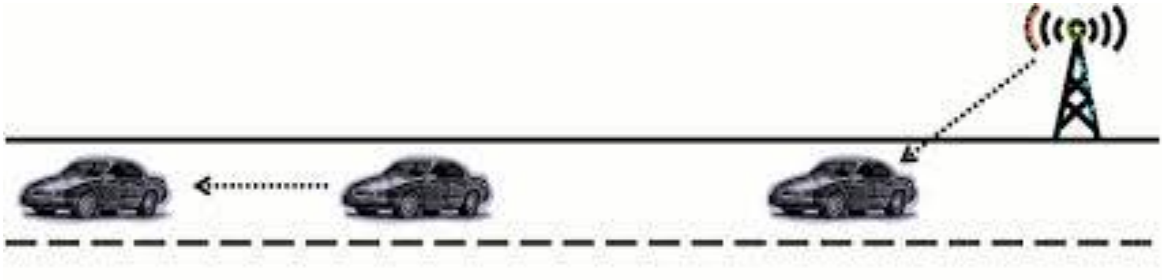
SAE's automation level



Source: sae.org – Society of Automotive Engineers

Intelligent vehicles are connected vehicles

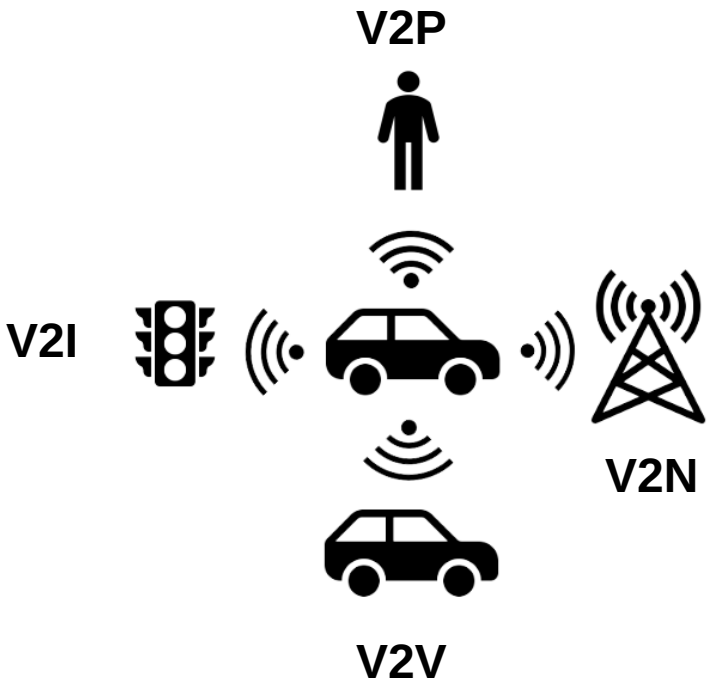
Vehicular Networks are emerging as a new class of wireless networks connecting moving vehicles to other vehicles and/or to fixed infrastructure nodes able to implement co-operative transport systems (C-ITS) where vehicles cooperate by exchanging messages.



Network nodes are equipped with wireless interfaces with different radio interface technologies employing short-range to medium-range communication systems

V2X Communications

V2X Communication modes



- **Vehicle-to-everything (V2X)**
- **Vehicle-to-vehicle (V2V)**
- **Vehicle-to-infrastructure (V2I),** e.g., communication with roadside units (RSUs), traffic lights, or, in the case of a cellular network, a base station
- **Vehicle-to-pedestrian (V2P)**
- **Vehicle-to-network (V2N),** where the vehicle connects to an entity within the network, e.g., a back-end server or a traffic information system

V2X Enabling Technologies

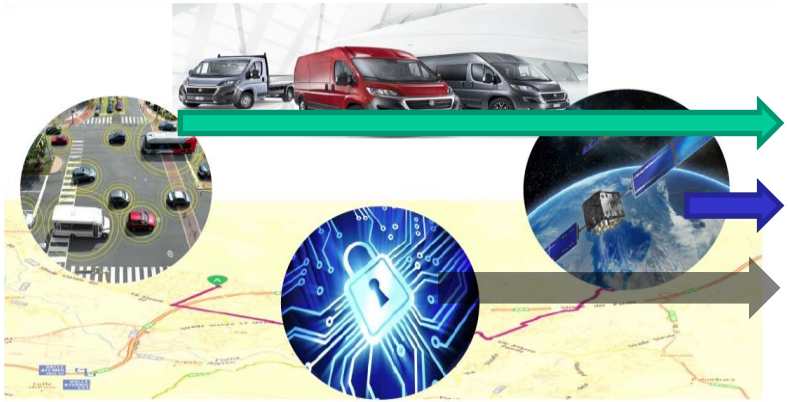
Short/medium-range communication technology such as

- IEEE 802.11-based V2X: it defines enhancements to basic 802.11 required to support Intelligent Transportation Systems (ITS) applications in the ITS band of 5.9 GHz (5.895-5.925 GHz);
- European ETSI ITS G5: mainly based on IEEE 802.11 for V2X, in the band of 5.875-5.925 GHz
- 700 MHz BAND INTELLIGENT TRANSPORT SYSTEMS defined in the ARIB-STD T109 Japanese standard

Cellular networks such as long-term evolution (LTE), 5G New Radio Cellular V2X (NR C-V2X)...

The EMERGE project

EMERGE – linked to a strategic Italian initiative - aims to design, prototype and verify on field the three core technology platforms of the connected and autonomous vehicles:



Partners: Radiolabs, University of L'Aquila, Telespazio, Leonardo, Elital

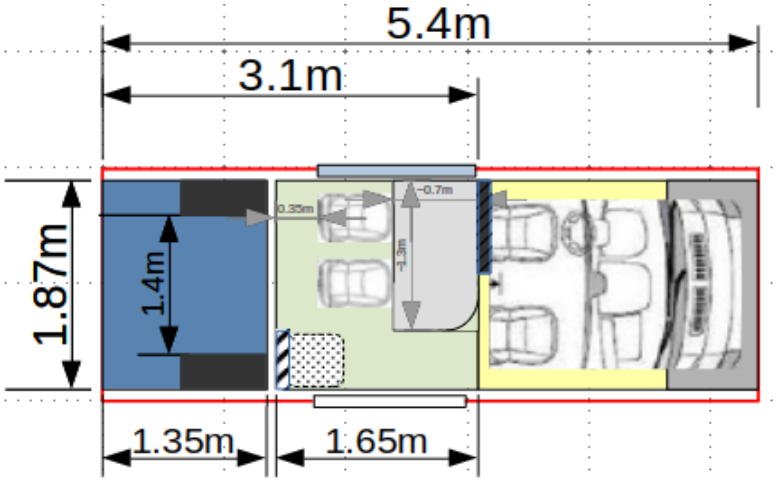
Unique features:

- Test Bed in urban environment with a 5G network; vehicles with SAE L3 automated driving systems;
- synergy with Rail automation stake-holders

Lab on wheels

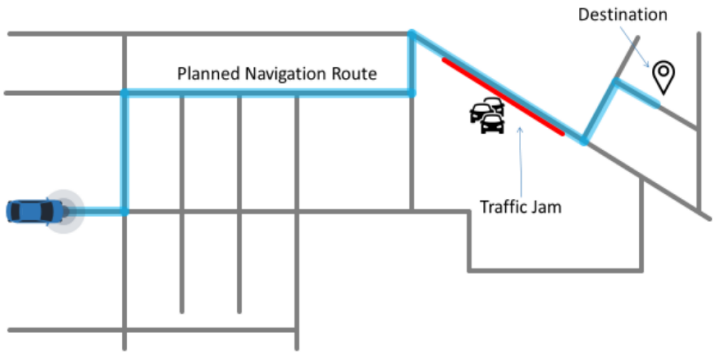
LIGHT COMMERCIAL VEHICLE

Examples



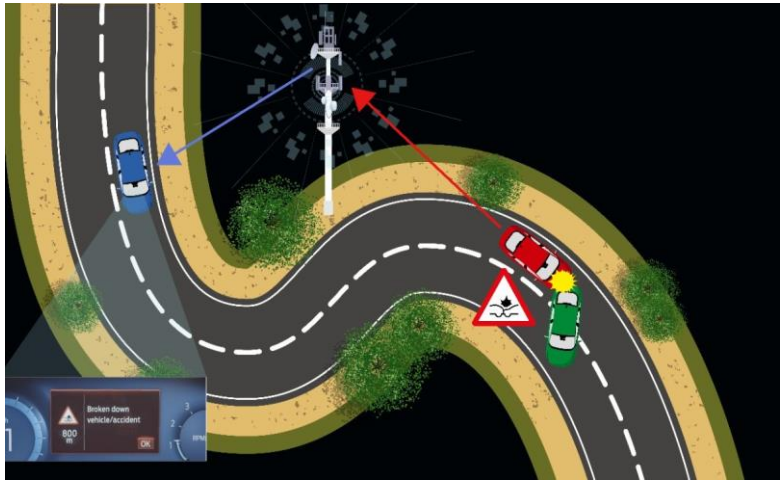
Connected vehicles for daily applications

Real rime monitoring of traffic conditions and massive information spreading for enhanced viability

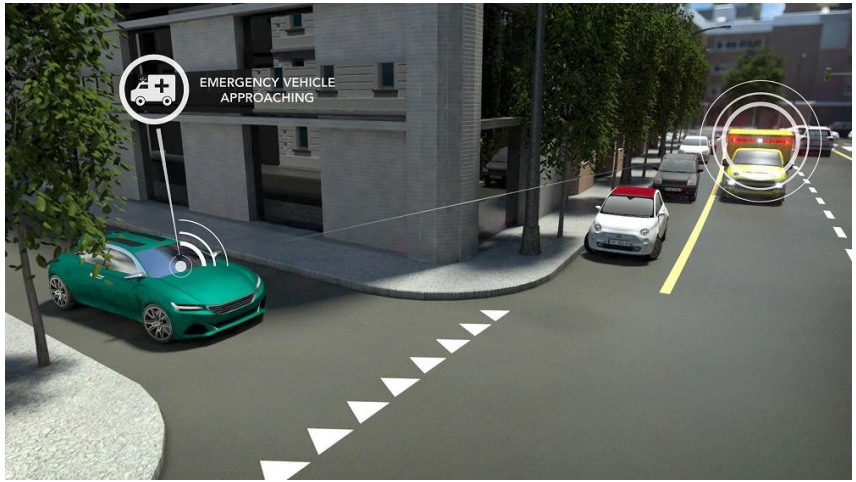


Cooperative and dynamic navigation

Connected vehicles for emergency applications



Critical event detection and dissemination of emergency information within the involved areas



Connected emergency vehicle to optimize the rescue operation

Region Abruzzo as technological hub

The P-CAR project

- P-CAR: Italian initiative supported by ESA to realize a PNT laboratory for testing and validation of **multi-sensor high integrity positioning solutions** for the connected car

Peculiarities of the project:

- the exploitation of GALILEO and 5G
- a novel approach based on a virtualized cloud-based platform to create a geo-distributed simulation and verification infrastructure

Questions?

…Thank you for your attention!

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