

Pervasive Networked Technologies for Automotive Application

From RFID to the Internet of Things

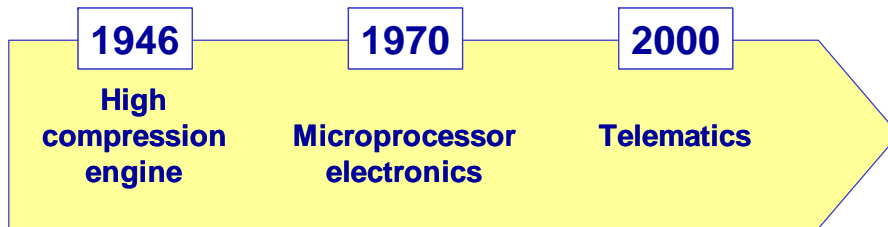
Brussels 6th March 2006

- ✓ **Pervasive networked technologies** represent the **innovative key factors** for improving application and services, productivity processes and product management in the automotive sector

- ✓ **Pervasive networking** for the automotive sector to:
 - **innovate** the in-vehicle and telematic system architectures;
 - **enhance** the application and services offered to the end users;
 - **improve** the efficiency of the manufacturing processes.

Technological trigger

Major waves of vehicle technology



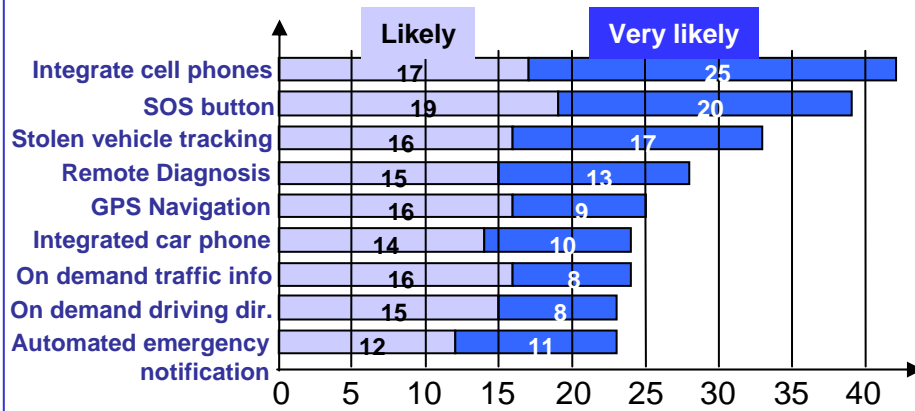
Source: RocSearch Ltd, Telematics and automotive communications, 2004

Added value for the vehicle

Not only connection but also safety, mobility and security



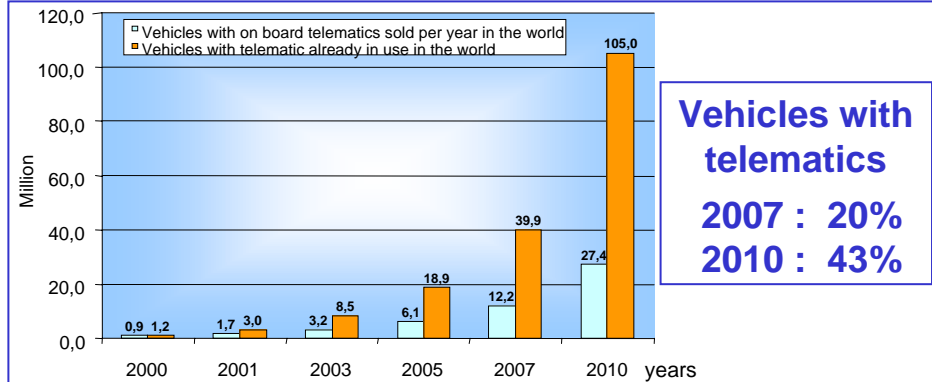
Competitive factor



Consumer likelihood to get telematics in next new vehicle (% of respondents)

Source : GartnerG2, 2002

Growing market

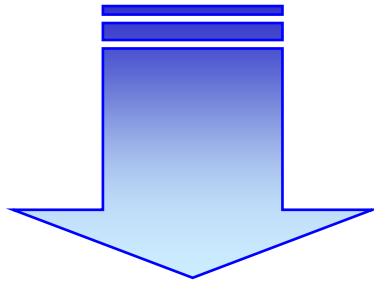


Vehicles with telematics
2007 : 20%
2010 : 43%

The introduction of new normative can further facilitate market penetration

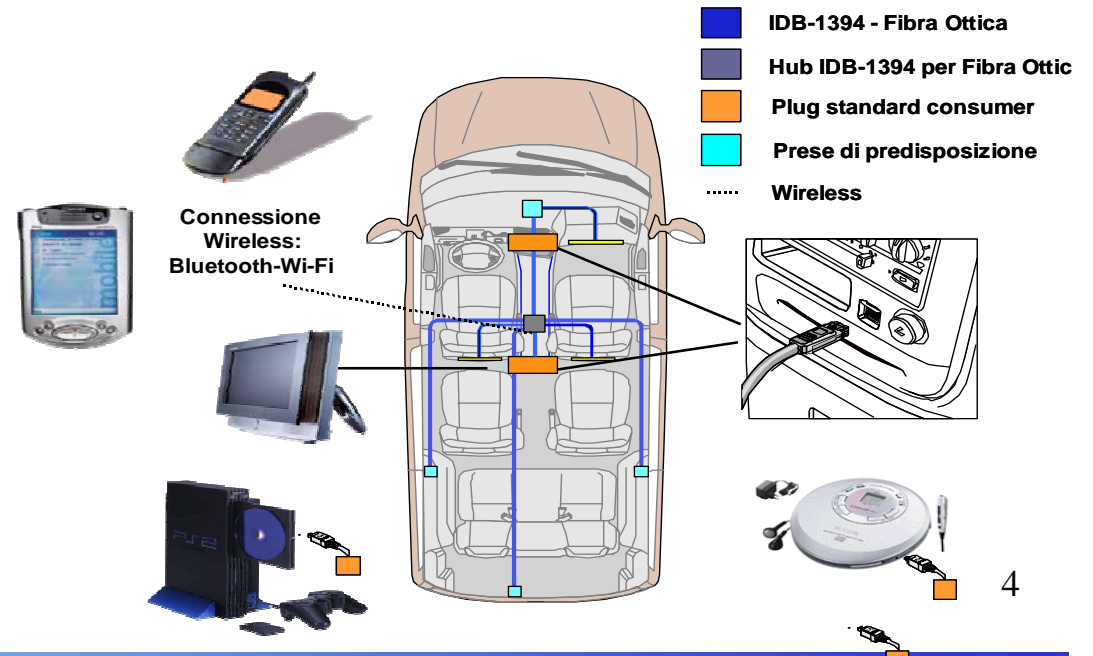
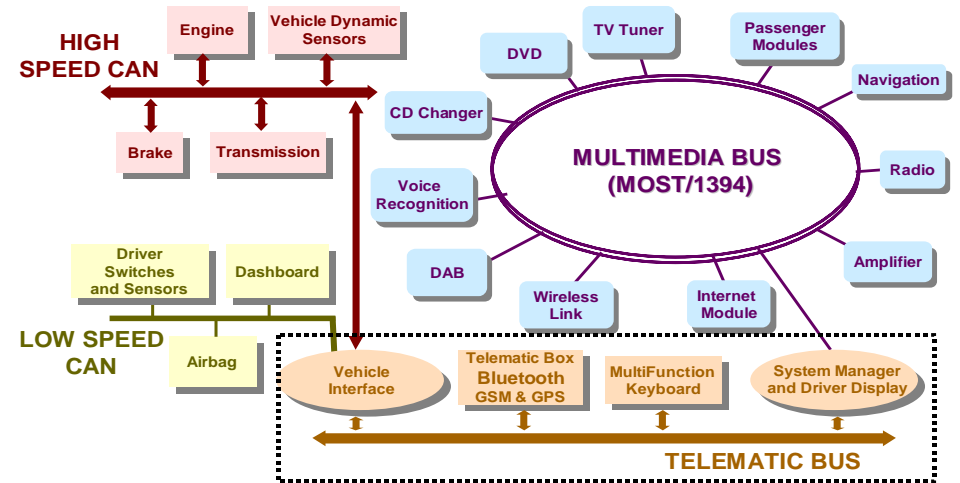
Source : Telematic Research Group

✓ development of **in-vehicle architecture** for connecting vehicle control unit, telematic modules and multimedia devices

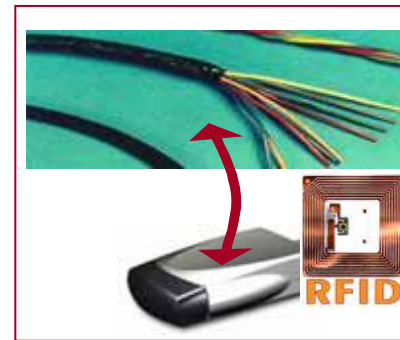


✓ integration of **pervasive networking**:

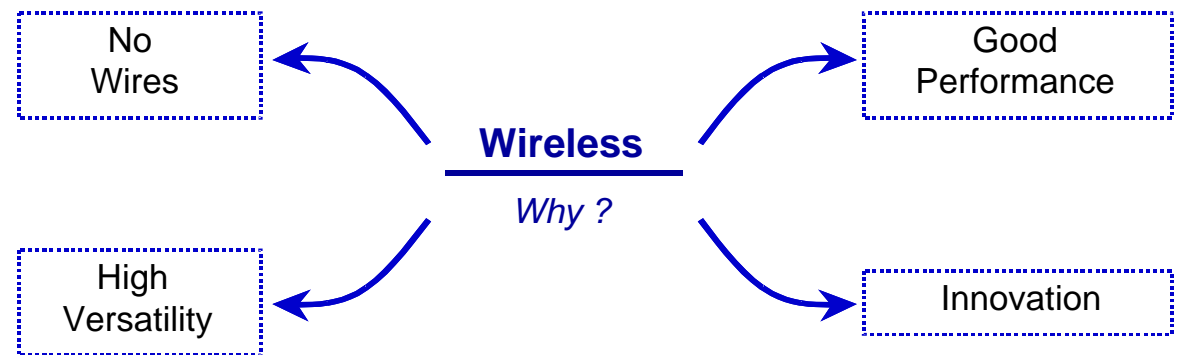
- to develop optimal architecture taking into account **costs, performances** and **customer needs**
- to use product/service **personalization and consumer product** interface (cellular phone, PDA)
- to assure system **security & safety** (electro magnetic compatibility, etc.)



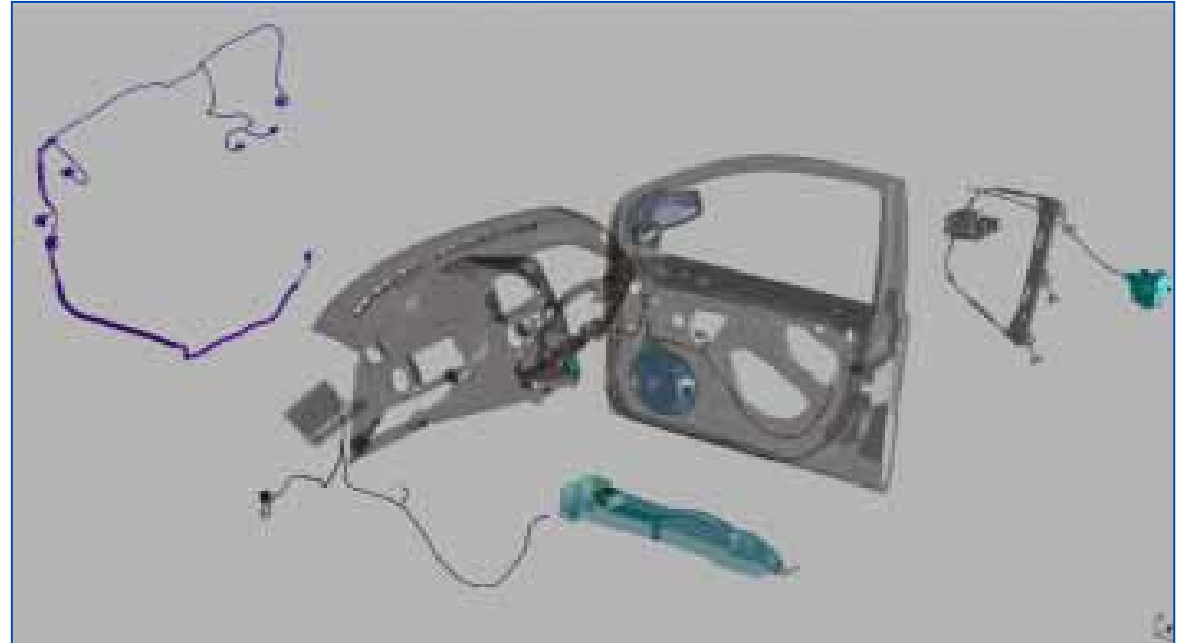
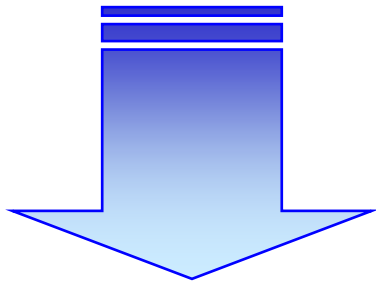
✓ Wireless communication technologies offer reliable solutions to the in-vehicle connection about **linking, controlling** and **commanding** electronic devices.



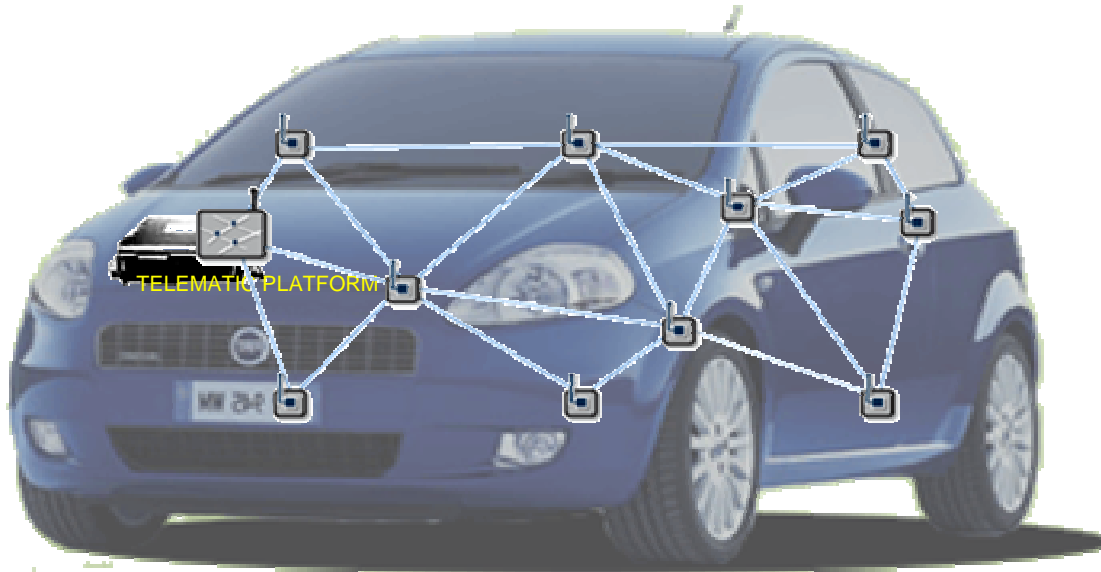
✓ **Innovation** in the automotive market pass through the application of **wireless technologies** for improving the **performances** and increasing the **versatility** of the in-vehicle connections.



- ✓ Nowadays wires and cables are needed for controlling most of the in-vehicle devices.
- ✓ Numbers of configuration, bill of materials, maintenance management are some of the relevant disadvantages



- ✓ Integration of pervasive wireless networking re-designing the in-vehicle network for:
 - reduction of cables
 - reduction of configuration
 - reduction of time and cost assembling
 - increase the degrees of liberty

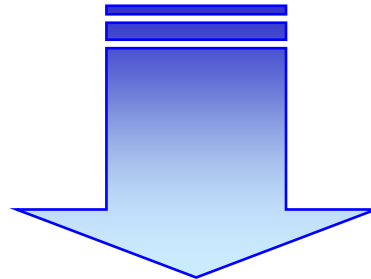


✓ REQUIREMENTS

- Low consumption nodes
- Self forming mesh networks

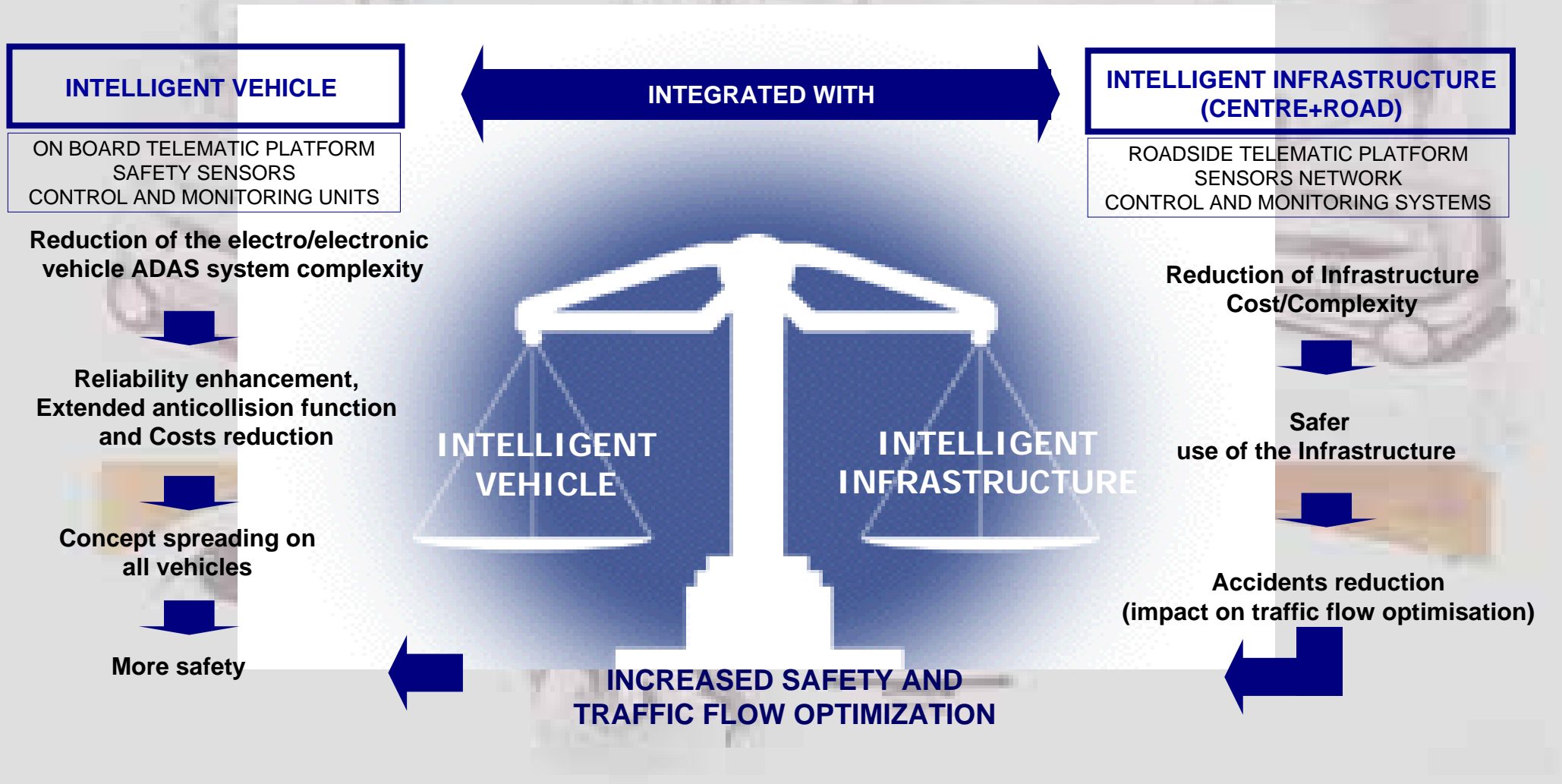
✓ APPLICATION

- Tyre pressure monitoring;
- Brake temperature control;
- Rain Sensor;
- Road status sensor;
- ...

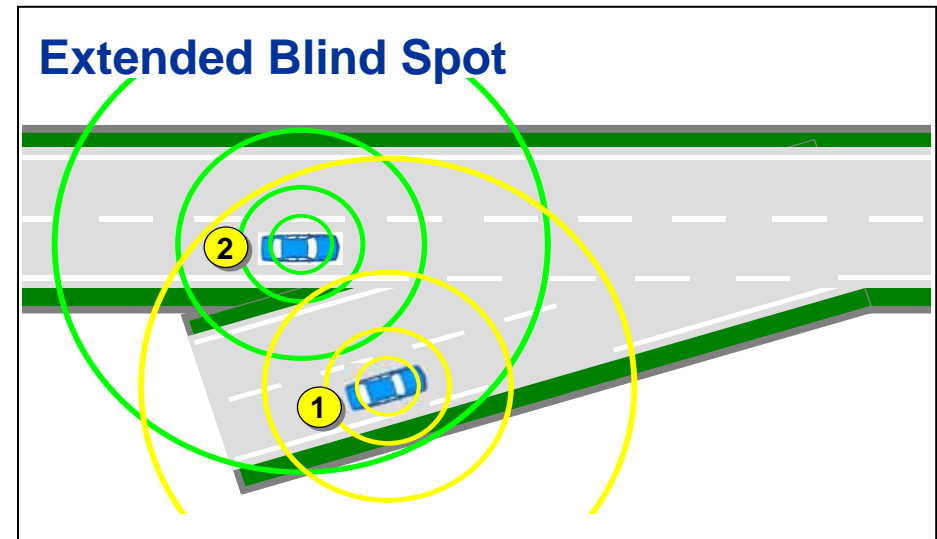
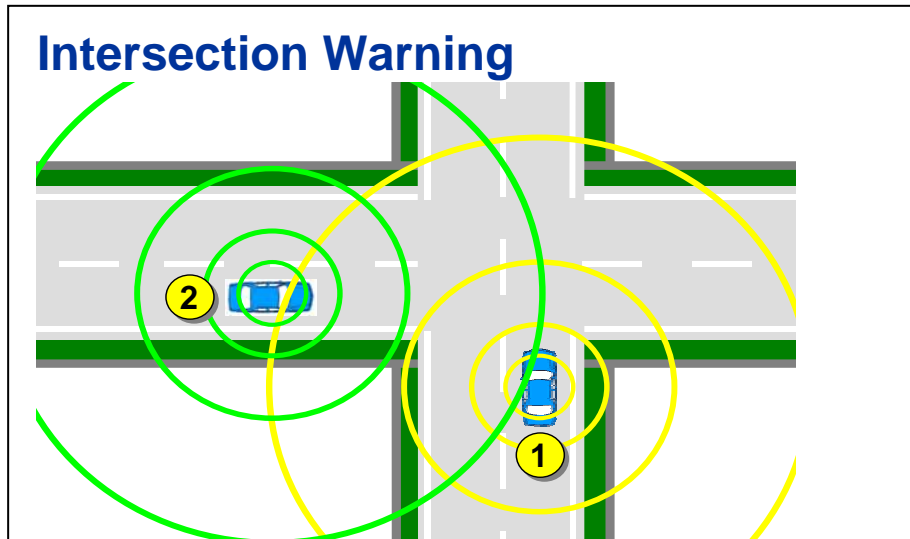
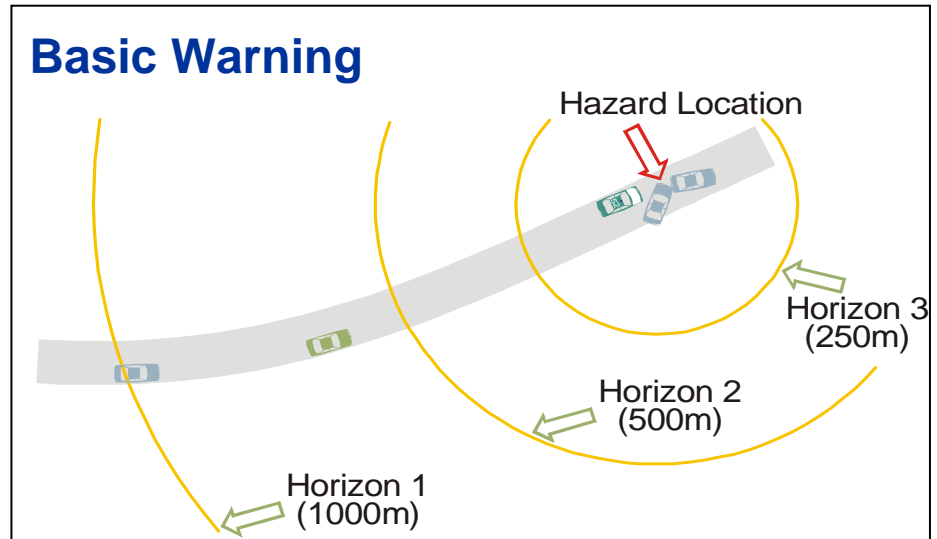


- ✓ Specific cable is not required (neither data or power);
- ✓ Low cost for the application;
- ✓ Ideal for the after market application;
- ✓ Wireless data collected by the master node (telematic platform) to remote monitored parameters or user interface information.

OPTIMAL BALANCE OF INVESTMENTS TOWARDS COOPERATIVE INTELLIGENT SYSTEM



- ✓ Wireless long range communication enhances the capabilities of in-vehicle application (e.g. warnings to the drivers)
- ✓ Application could be enhanced by dispatching information to the drivers particularly in those scenarios where other technologies (e.g. radar sensors) could not be efficiently.

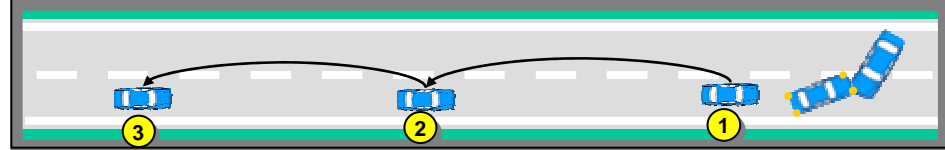


✓ Wireless short range communication enable pervasive networking in which the vehicles become its nodes

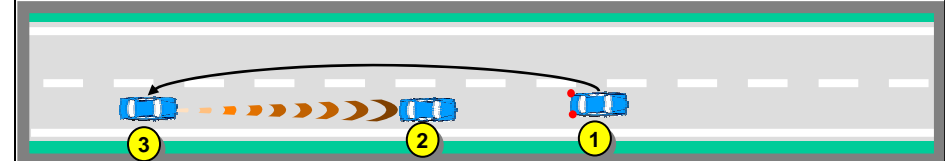
✓ Vehicles self form networks in different road scenario (e.g. multilane roads) and configuration of the traffic flow (queues or merge of vehicles)

✓ Sharing information among vehicles prevents those road dangerous situation not detectable by the traditional in-vehicle sensors.

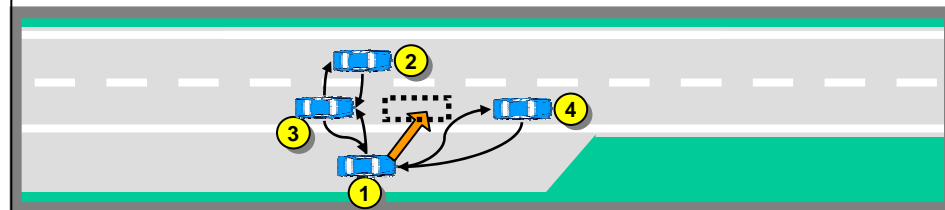
Information and Warning Functions



Communication-Based Longitudinal Control



Co-Operative Driver Assistance





CAR 2 CAR
COMMUNICATION CONSORTIUM

Car makers consortium members



OPEL

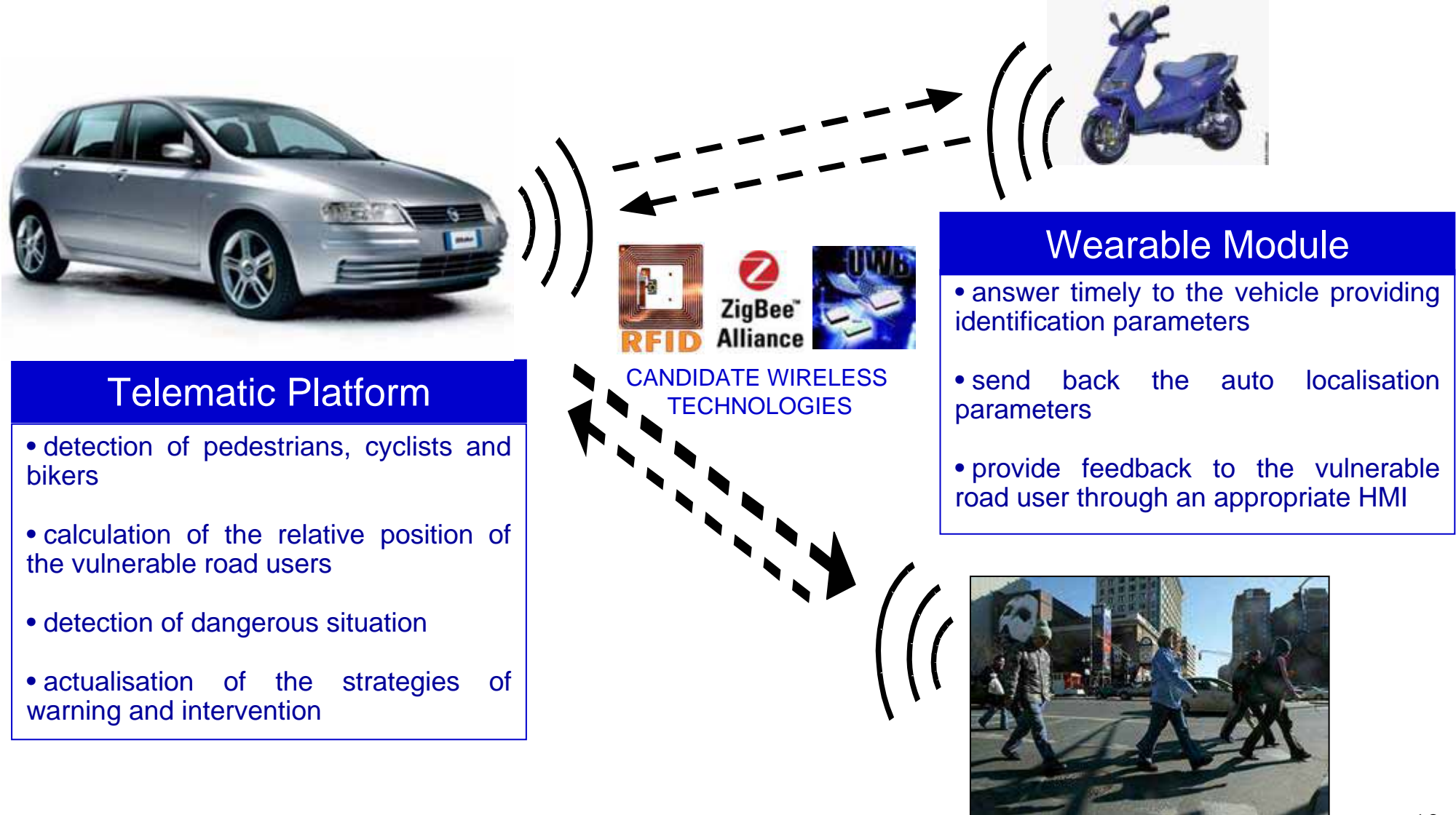
DAIMLERCHRYSLER



RENAULT



<http://www.car-2-car.org>



✓ On-Board Telematic services for a sustainable and efficient mobility

✓ Vehicle as a further dynamic component of the infrastructure network for:

- probing the traffic flow data
- using information related to traffic congestion.

✓ Telematic platform integrates wireless short range communication for connecting the vehicle with the roadside infrastructure

Traffic information from beacon



Traffic Light Management

Parking booking and tooling



**PERVASIVE
NETWORKING**



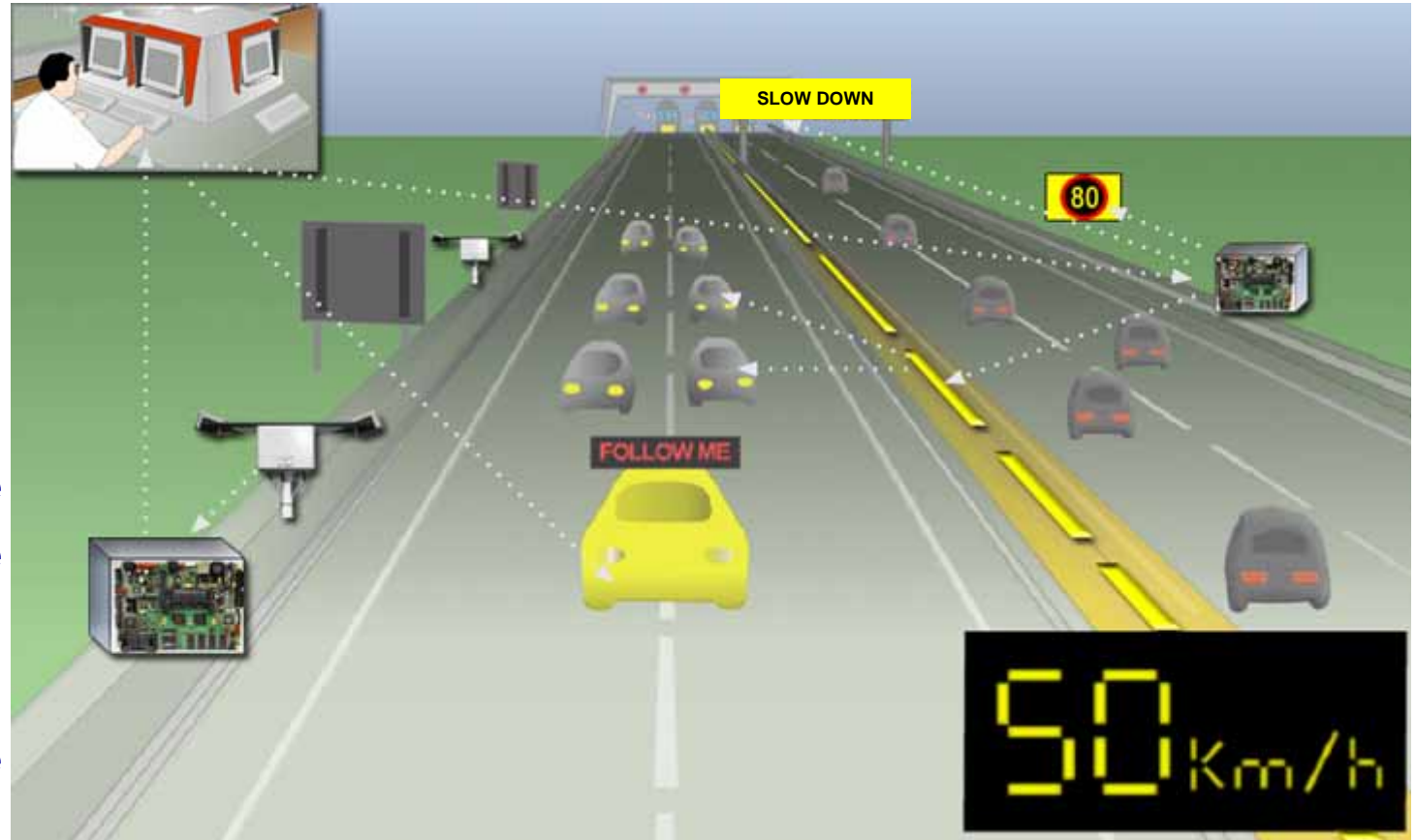
Remote dynamic navigation

Floating car data



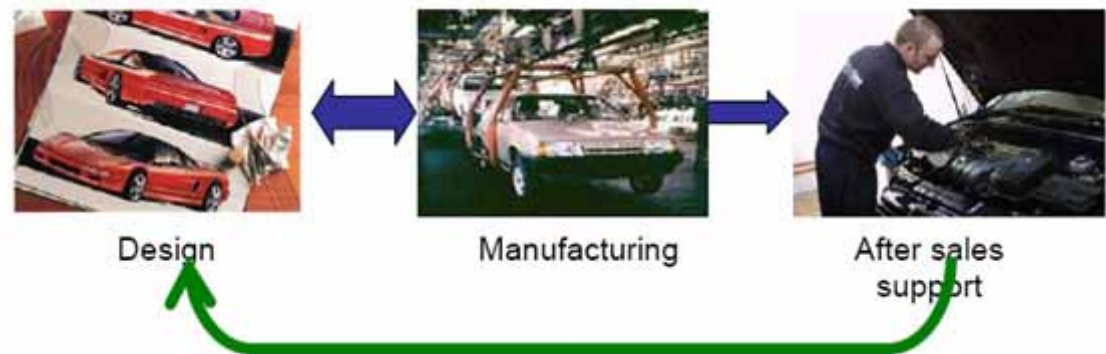
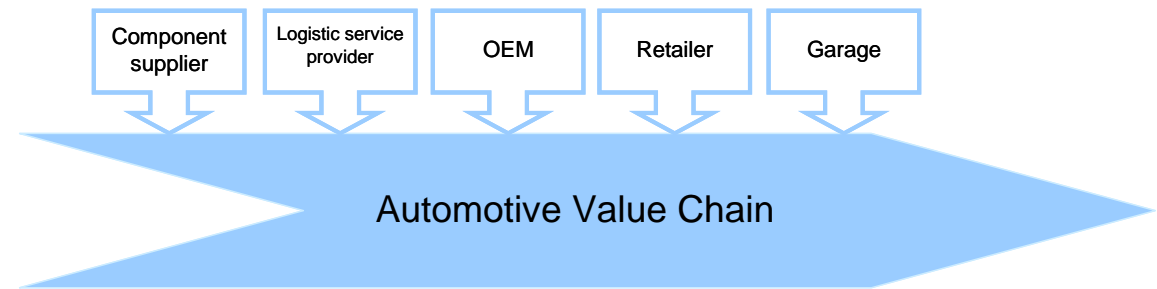
**From the
intelligent
vehicle...**

**....to the integrated
and cooperative
safety, based on the
dialogue among
vehicles and
infrastructure**



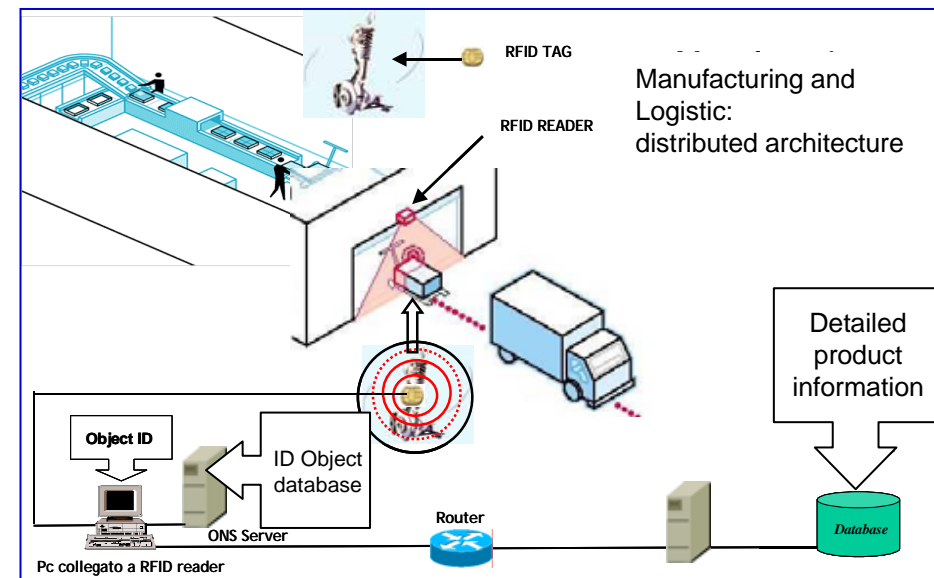
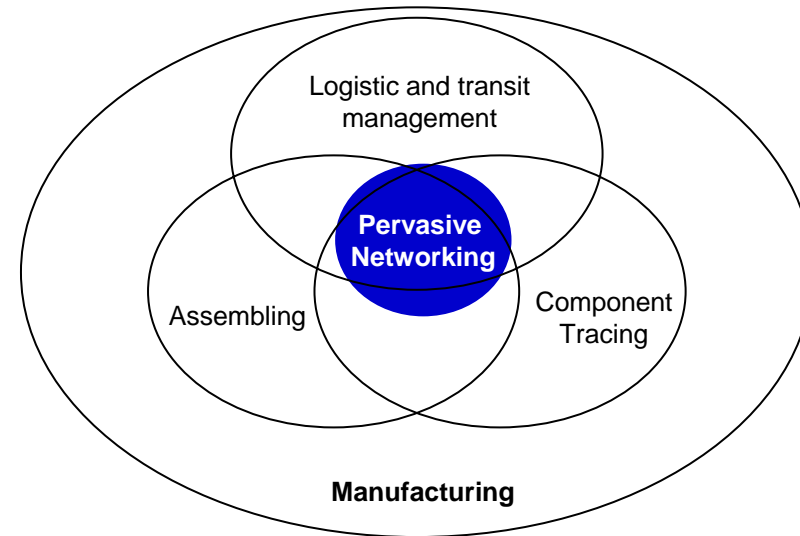
✓ Pervasive networked technologies in the automotive sector will concern not only in-vehicle architecture and telematic and safety application but also the complete automotive value chain

✓ Telematic network will allow to collect data on the field and centralise the product information along its life cycle (design, manufacturing and after sales);



✓ Availability of information allow interconnection among different processes (logistic, assembling and tracing) and increase the efficiency of the entire manufacturing process;

✓ Component tracing during the transportation and the assembling processes allows easy inquiry and identification of missing/incorrect products, and possible recovery actions.

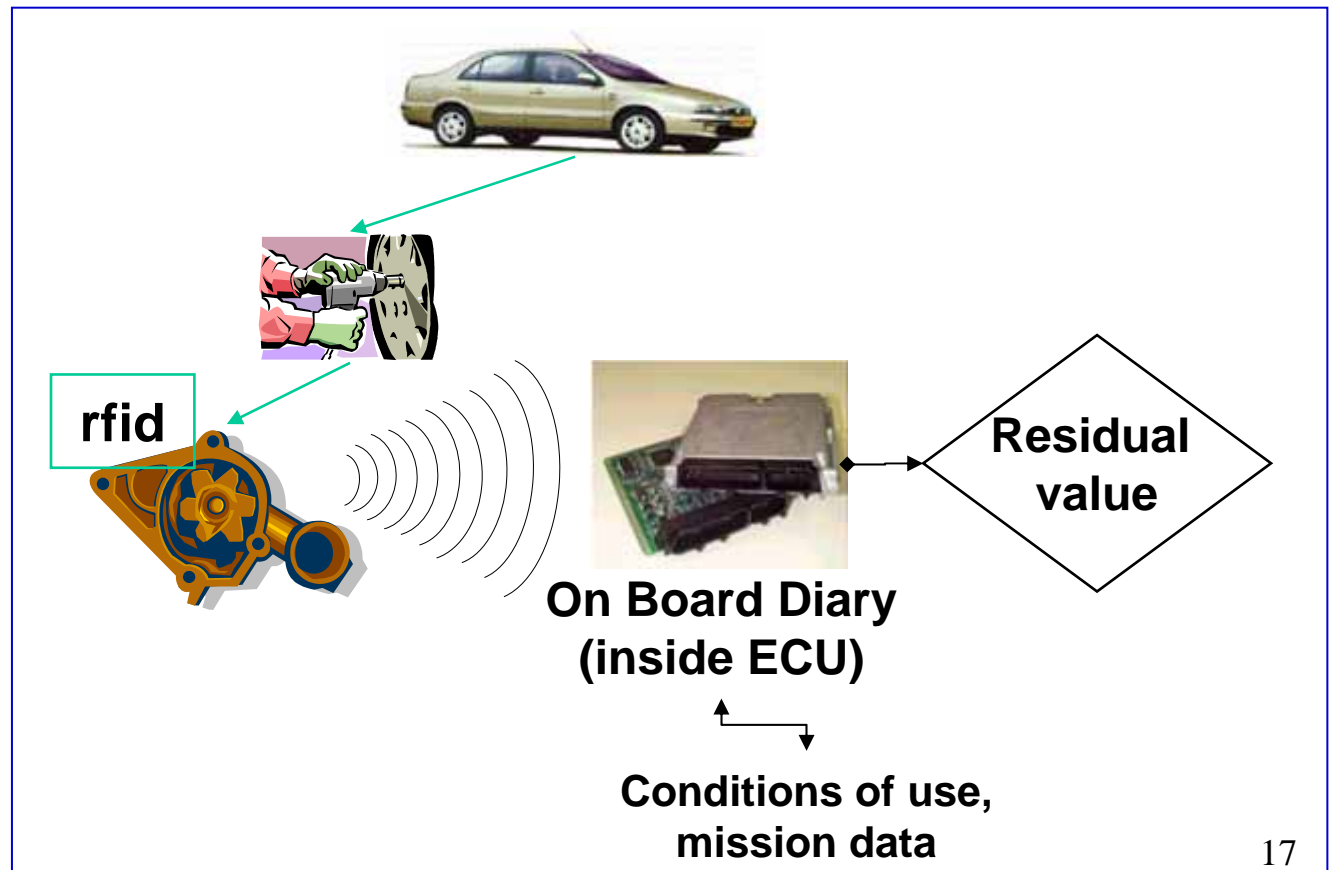


✓ End Life Vehicle (EVL) Directive 2000/53/EC aims at increasing the recycling content of vehicles manufactured and sold in the European Union.

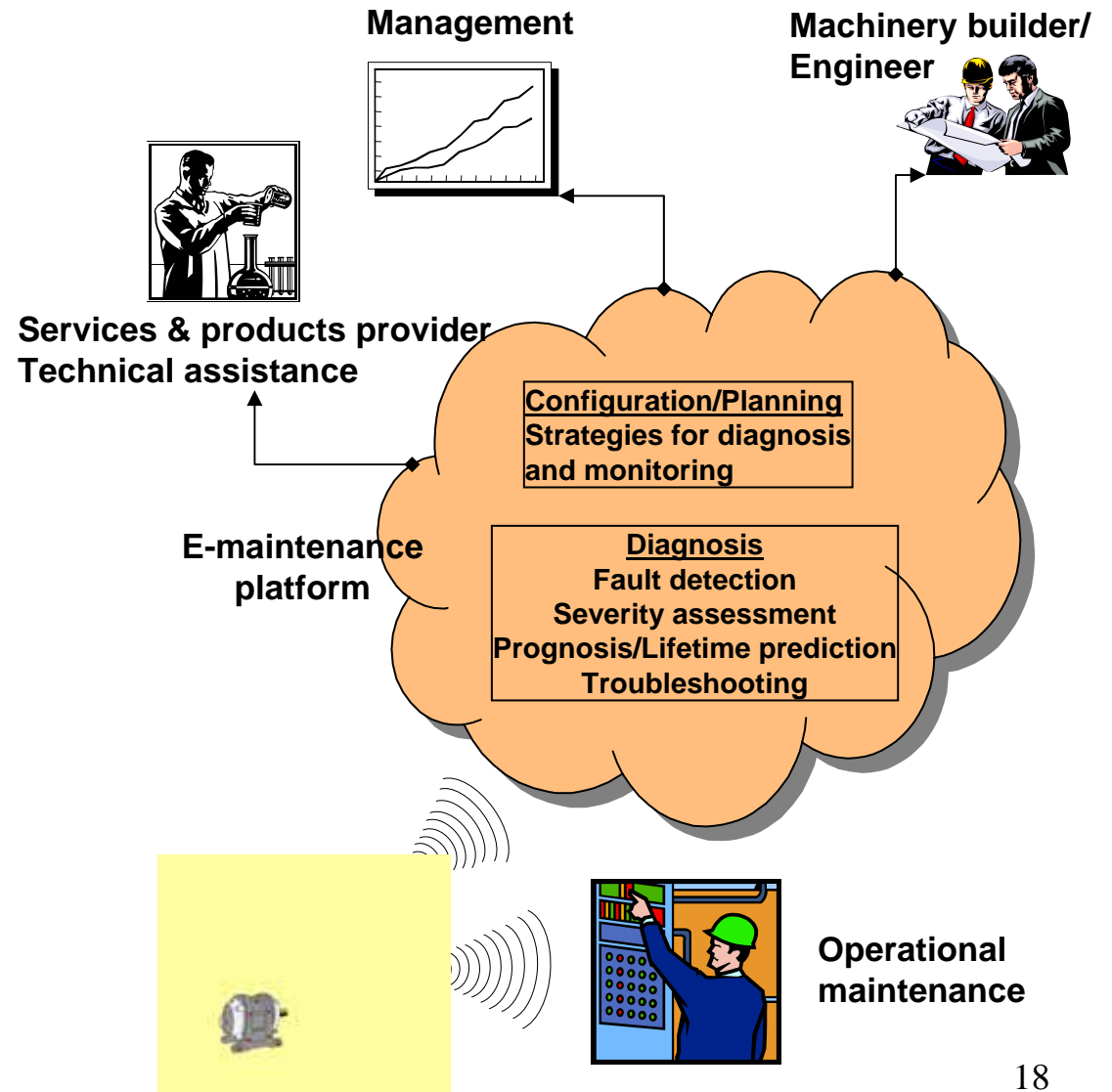
It only applies to automotive vehicles and took effect July 1, 2003. The directive details complete restriction or limits the use of lead, mercury, cadmium and hexavalent chromium

✓ Identification of each component and the knowledge of its treatment, using wireless transmission technologies and a PLM (Product Life-cycle Management) system, will facilitate the achievement of the Directive objectives.

✓ Wireless transmission technology has to guarantee the universal and security access to the information as well as their integrity along the entire product life.



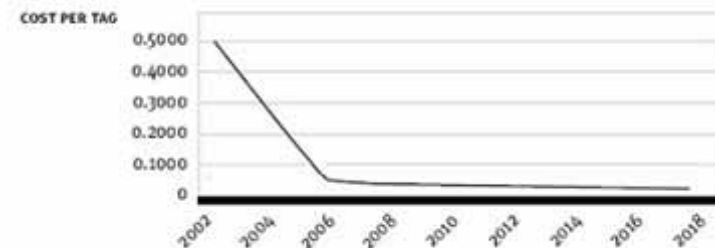
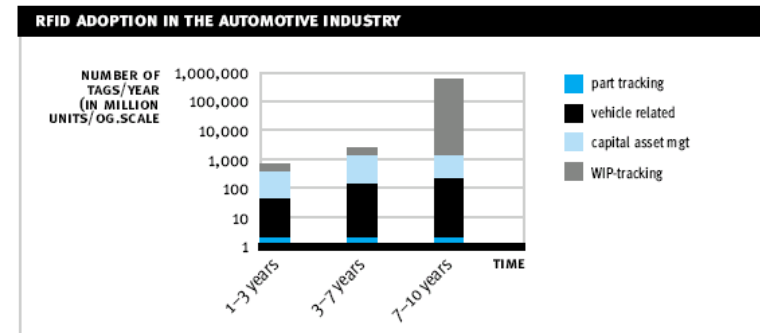
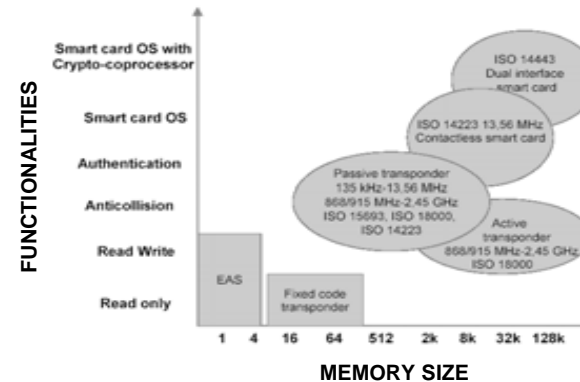
- ✓ Industries today face the challenge of managing their maintenance resources as efficiently and cost effectively as possible. The timely coordination of personnel, parts, equipment, tools, etc, of these resources is key to success.
- ✓ A network of smart tags (sensors, RFIDs, Zigbee) embedded in the machine tools will communicate to the e-maintenance platform critical information on conditions of use and performance degradation.
- ✓ Users of such technology will have immediate access to information including machinery data, sensor identification, audit trails of maintenance activities, spare part information, use of maintenance tools.



✓ RFID is a good candidate technology for covering some of the aspect in the automotive sector (in-vehicle architecture, telematic and safety application, product value chain). Different functionalities and memory size are available at different operational frequency.

✓ The trend of the RFID technology application by the automotive industries is positive. In particular the annual grow increases for vehicle related application.

✓ The tag costs is decreasing per year. This allow the feasibility of its application in the automotive industry in terms of infrastructure investments and product quality return.



- ✓ **Future prospective:** enlarge the spectrum of application of pervasive networking (logistics, transport, manufacturing, distribution, safety, enforcement, ...)
- ✓ **Future requirements:** storage, processing, sensing capabilities, physical dimension
- ✓ **Enhance the system architecture and wireless networking:** infrastructure means and devices for flexibility, adaptation, security, interoperability,...
- ✓ **Innovation of the protocol layers** for mac, network, application, ... toward low power consumption
- ✓ **Economic impact** of pervasive networked technologies on automotive products and processes