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Road to Vehicle Communications for Safety : AIDA and IVHW

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Road to vehicle communications

- **Road to vehicle communications via DSRC : AIDA**
  - **two way communications**
  - **safety related services, warnings**
  - **comfort information : travel times, motorway exits, rest areas, sevices available, etc.**
  - **traffic data collection, incident notification**

- **Electronic Toll Collection / DSRC : liber-t**

- **Vehicle to vehicle communication : IVHW**
  - **transmission of emergency signals between vehicles**
  - **extended to road – vehicle communications**

IVHW

Inter-Vehicle Hazard Warning

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An interoperable ETC system

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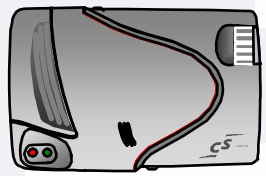
Information, safety, data collection

AIDA antennas



- Road information
- Safety messages
- Traffic and weather data collection
- Incidents detection

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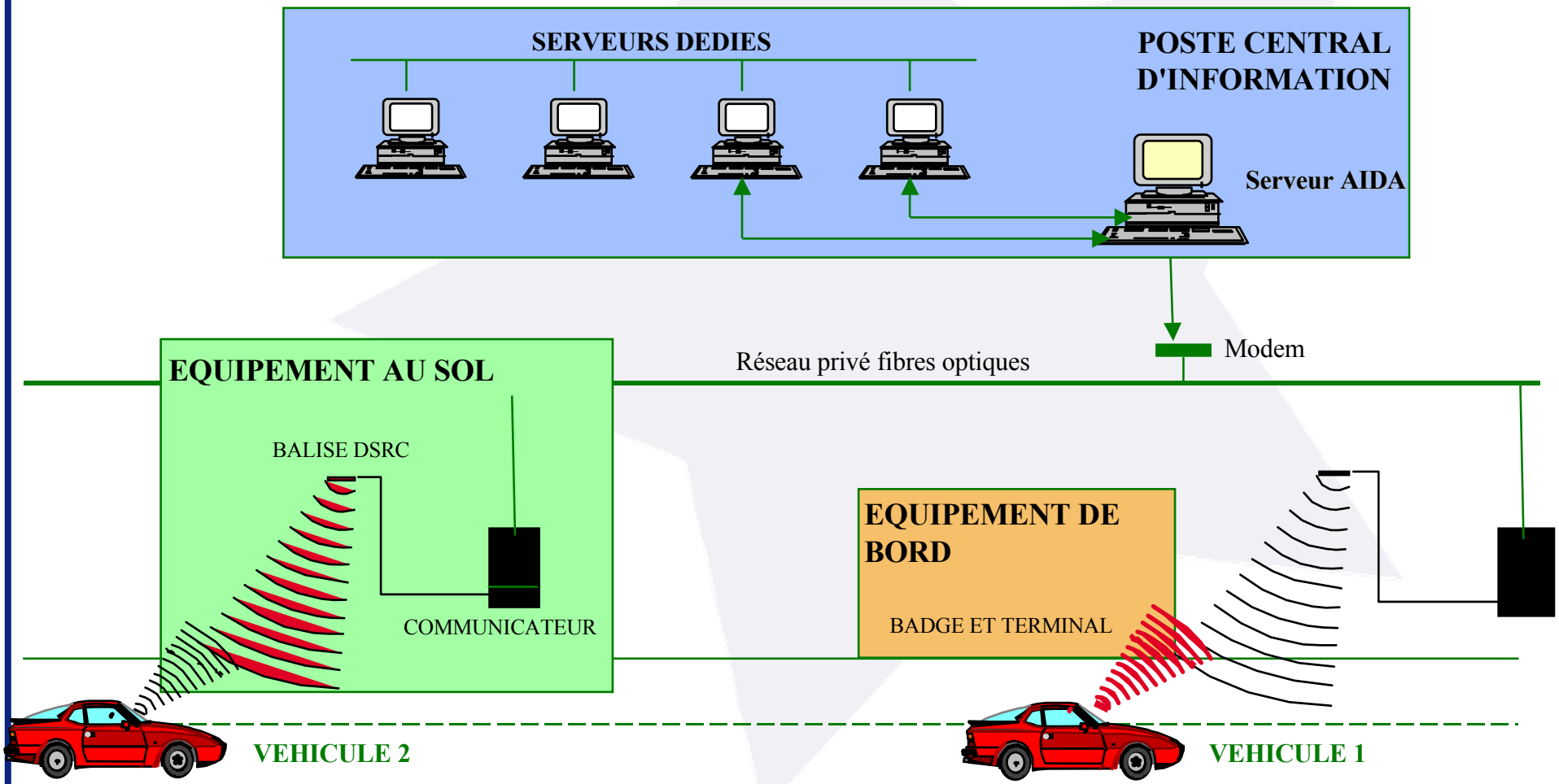
The communication architecture



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AIDA : principles of data transmission

Communication with the vehicles

Data processing and transmission to the vehicles

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The AIDA services

AIDA : an on-board system providing real time information dedicated to safe and comfortable highway driving

Traffic conditions
- accidents
- perturbances
- road works
- traffic jams

Road information
- sorties conseillées
- distance to next exits
- estimated time of arrival
- relief routes

Weather conditions
- fog
- low temperature
- heavy rain

Personalised traffic information
- tourist information
- petrol stations with brand and price
- service and rest areas

Interactive services
- incidents signalling

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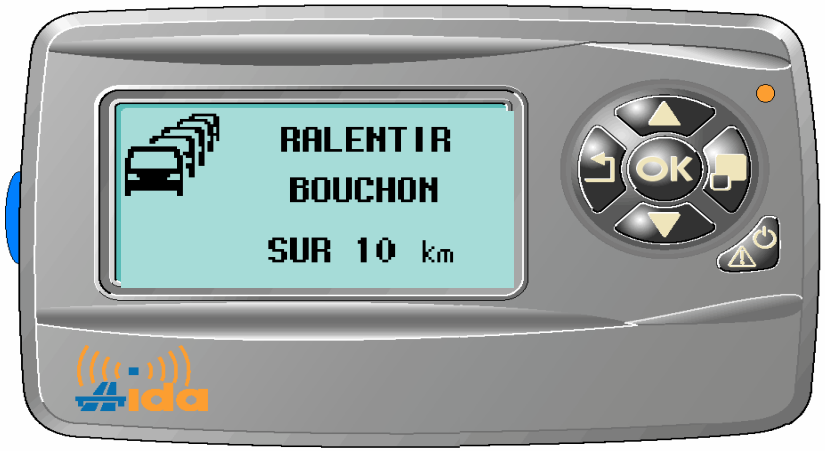
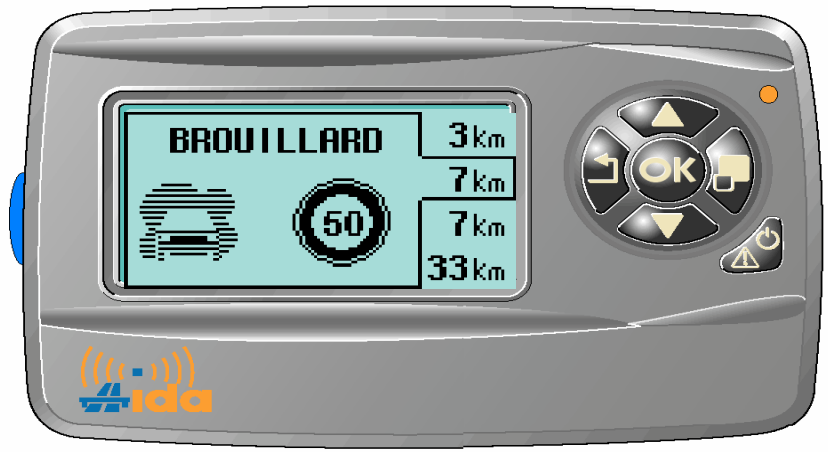
Display examples : safety services



Alert message corresponding to a traffic incident

Checking the list of incidents (here weather incident)



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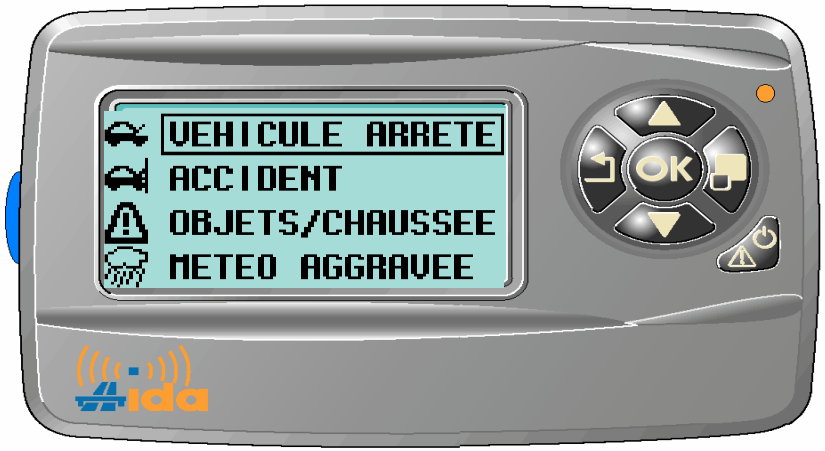
An “interactive” safety service



The interactive service…

… gives the possibility to inform the Traffic Information Centre of an incident that was seen on the motorway

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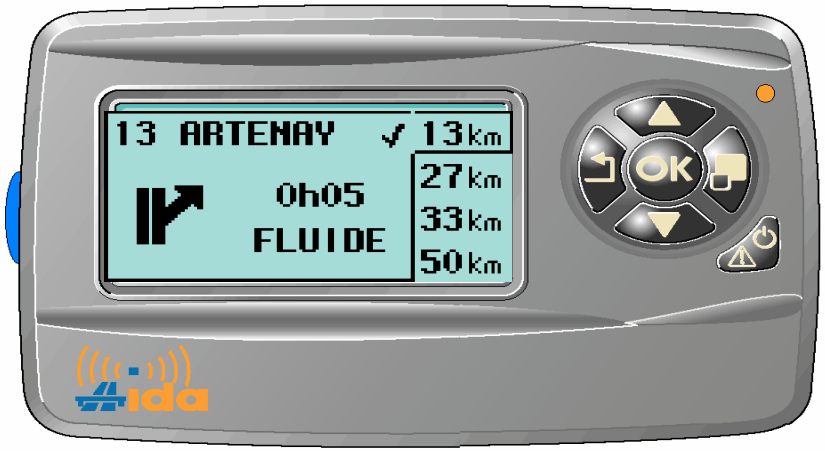
Display examples : comfort services

Distances to the exits, time to destination, traffic conditions

Information on rest and service areas



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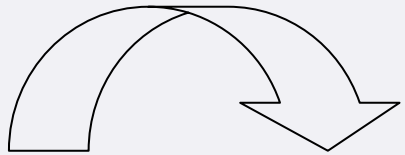
DELTA = integration in the vehicle

Objective : Integration of the DSRC as standard equipment in the vehicle



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The TRAVIATA project

- An attempt to perform a vehicle to vehicle communication using the same DSRC systems
  - emergency warnings between vehicles
- Results did not meet the expected level
  - good communication at 20 m
  - probability of good communication at 50 m if messages repeated 100 times
  - communication not possible at more than 100 m
- Vehicle equipment will remain too expensive for large market introduction

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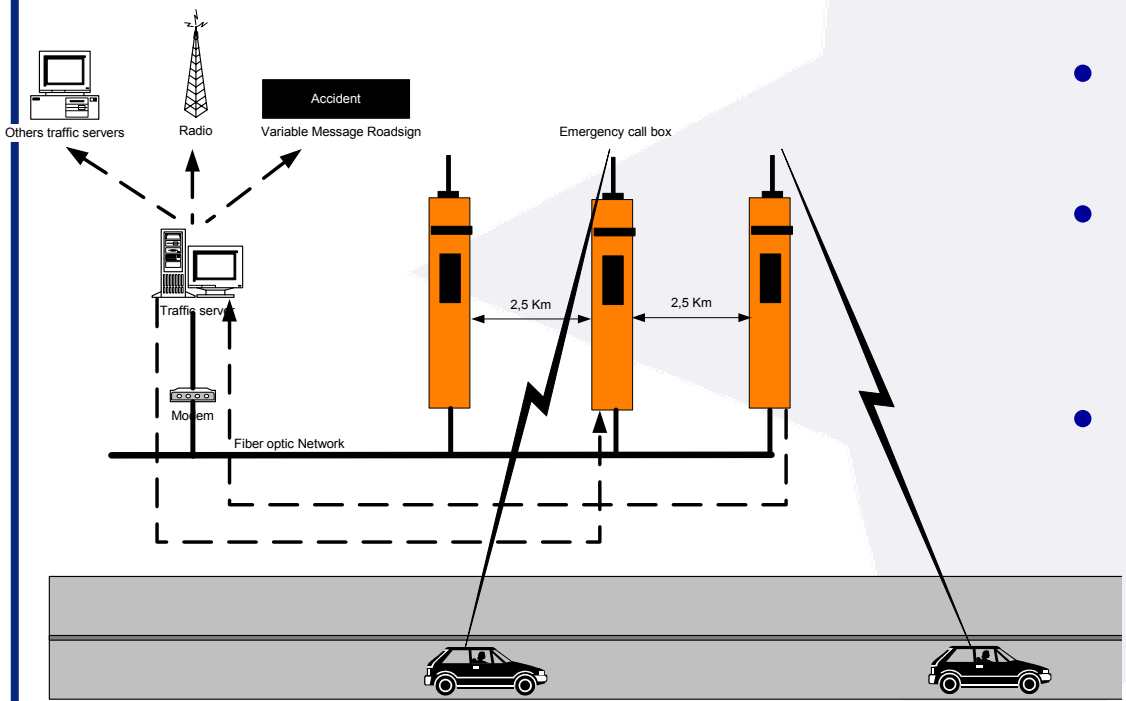
IVHW

IVHW

Inter-Vehicle Hazard Warning



- **Transmission of alerts between vehicles**
- **Communication : up to 1 km**
- **System activated manually or automatically in case of airbag release**
- **Alerts can be transmitted to / from the road operator, thanks to IVHW systems installed in the emergency call boxes**

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The context

- **Today's new opportunities:**
  - **Broad dissemination of GPS**
  - **Accuracy of GPS (no more scrambling for civil applications)**
  - **Market penetration of telematics platforms for:**
    - **navigation, electronic tolling, emergency call**
  - **Recent authorization of the use of a band in the 869 MHz allowing to reach the needed range of 1 Km**

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Without IVHW

- Vehicle-vehicle communication for hazard warning
  - radio « warning flashers »
  - accident
- Also vehicle- infrastructure communication

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Without IVHW

- Reasons : bad visibility or temporary loss of visibility due to obstacles or weather conditions
- Characteristics : pile-up accidents aren't statistically very numerous, but often very serious …
- That can be avoided in some situations if a warning message is delivered in time

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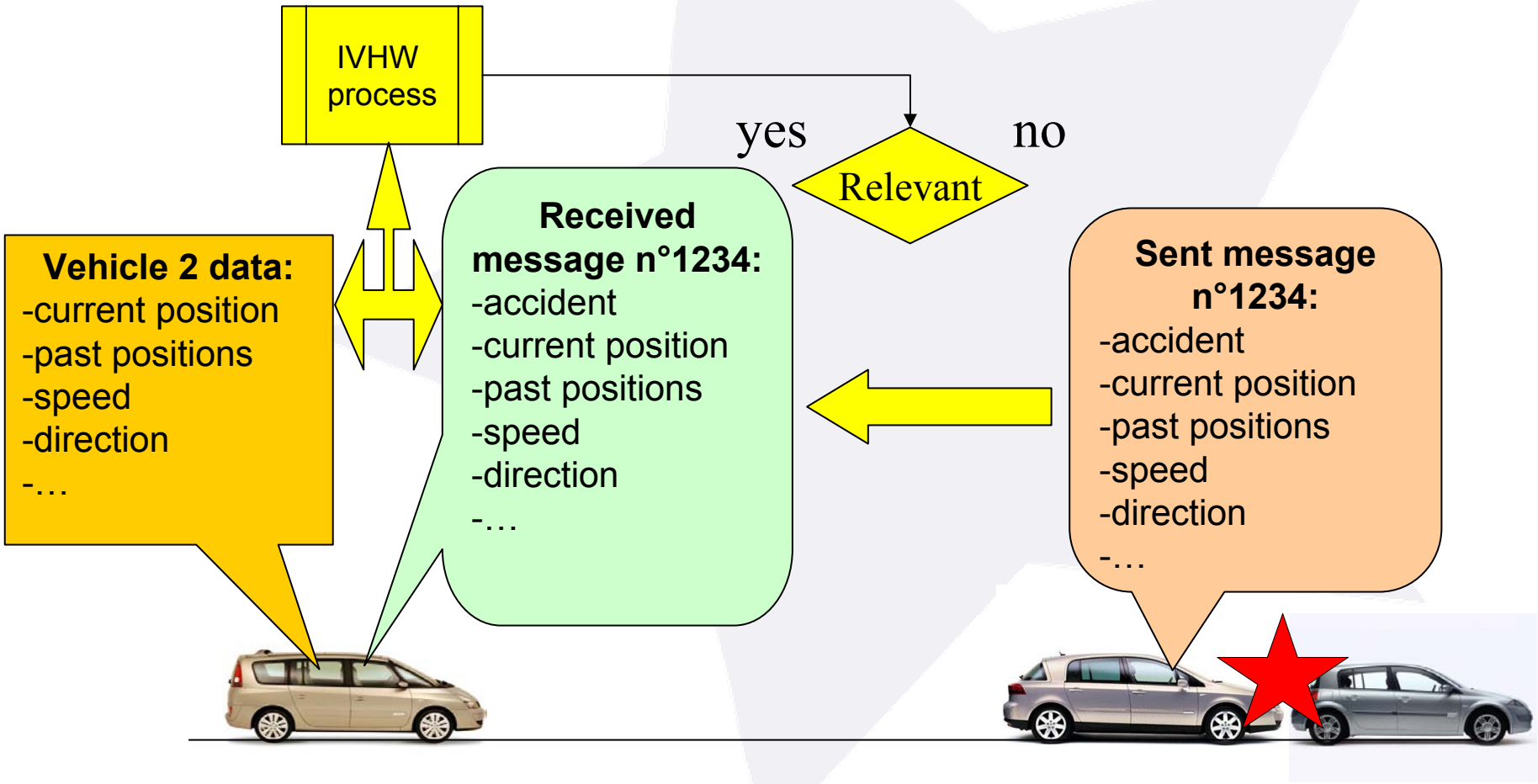
With IVHW



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Result message with an example of visual HMI

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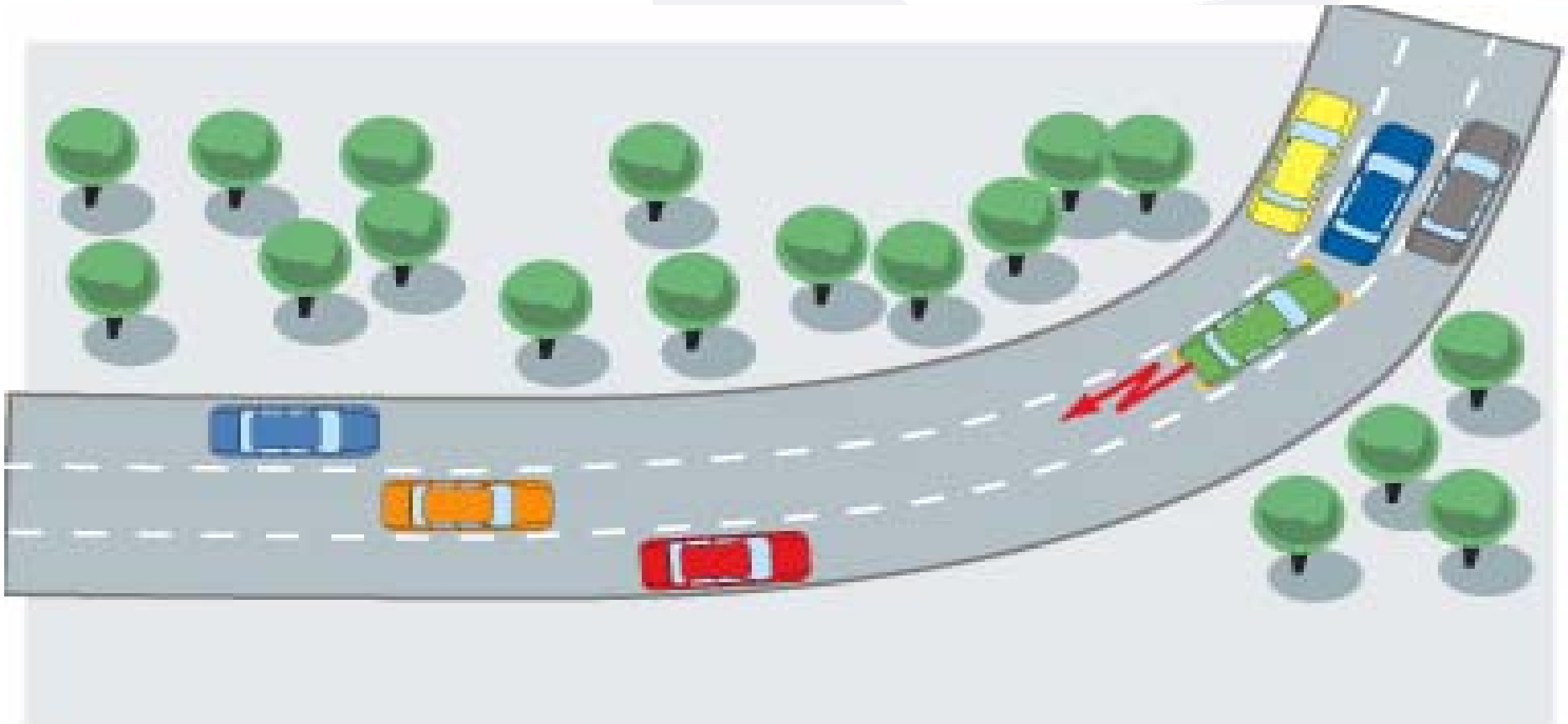
Risk of queue end collision



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Risk of queue end collision

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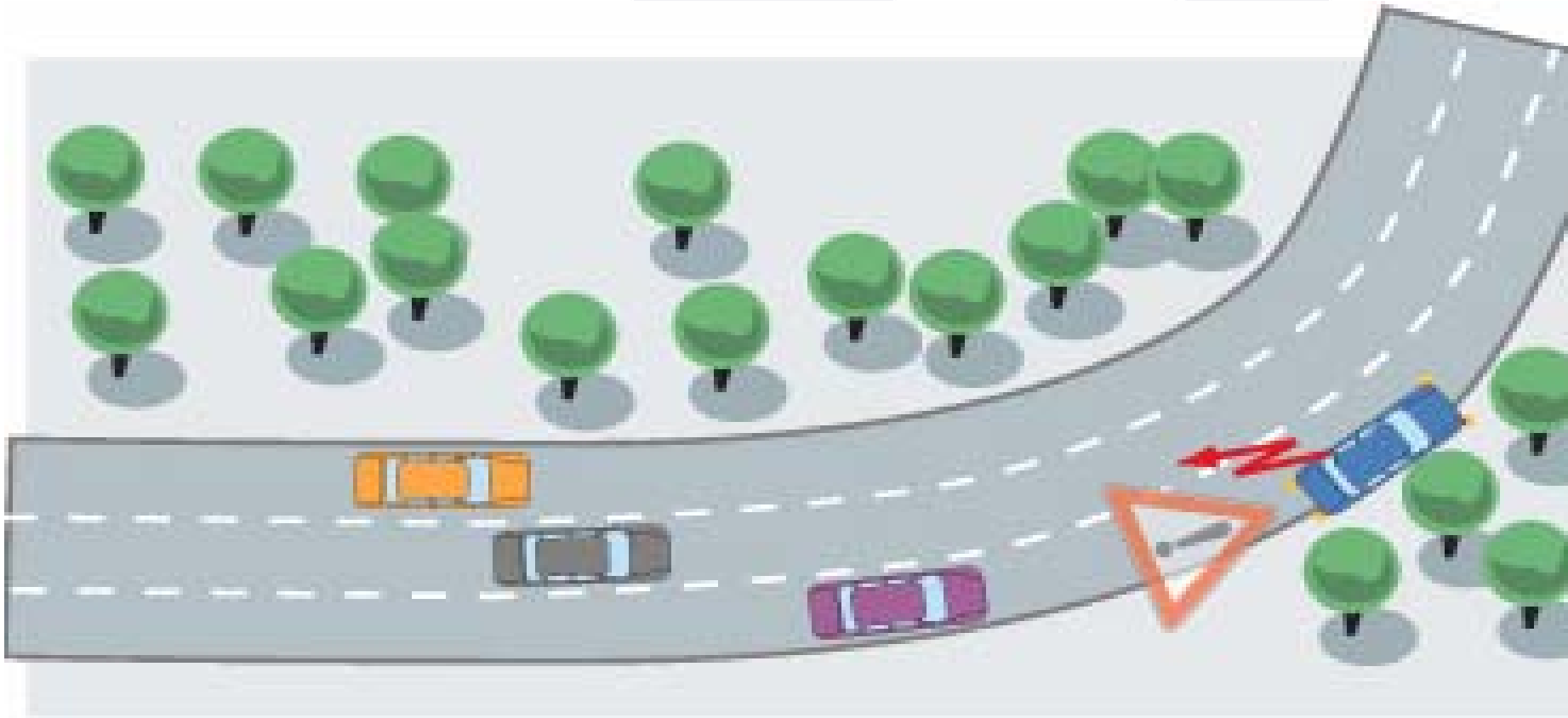
Vehicle breakdown



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Vehicle breakdown

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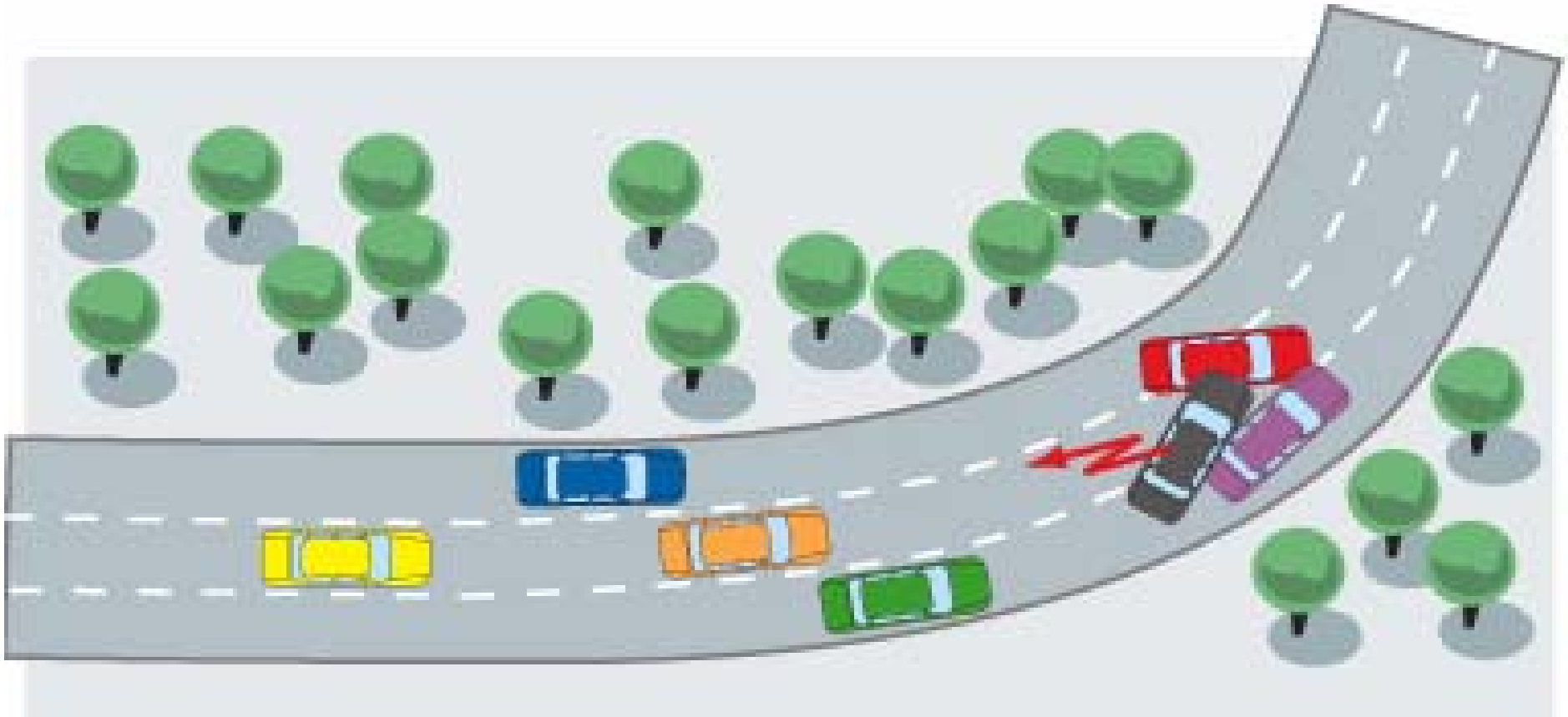
Airbag triggering



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Airbag triggering

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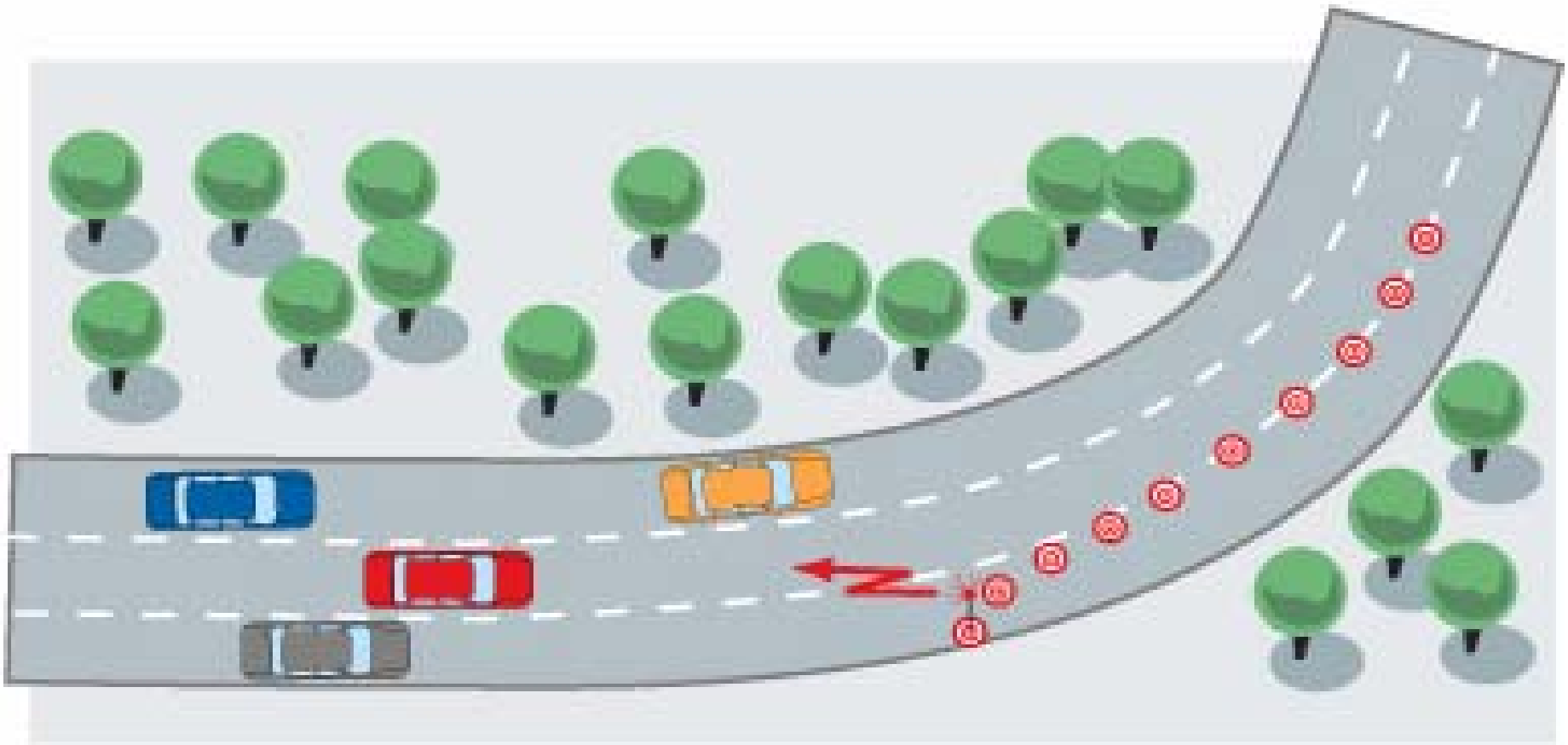
Warning from infrastructure



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Warning from infrastructure

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Core proposal synthesis

- A reduced set of messages:
  - from vehicles or infrastructure beacons



  - from infrastructure beacons only

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Extended proposal

- A proposed extended set of messages (all sent from infrastructure equipment only):

Traffic congestion

Very slippery road

Heavily reduced visibility

Vehicle on the wrong carriageway

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Message Content

Variable	Size (bit)
Header	8
Random-Message ID	9
Road type	3
Road ID	24
Hazard type	5
Current speed	5
Position and trace data	155
Total message size	**209**

No personal data !

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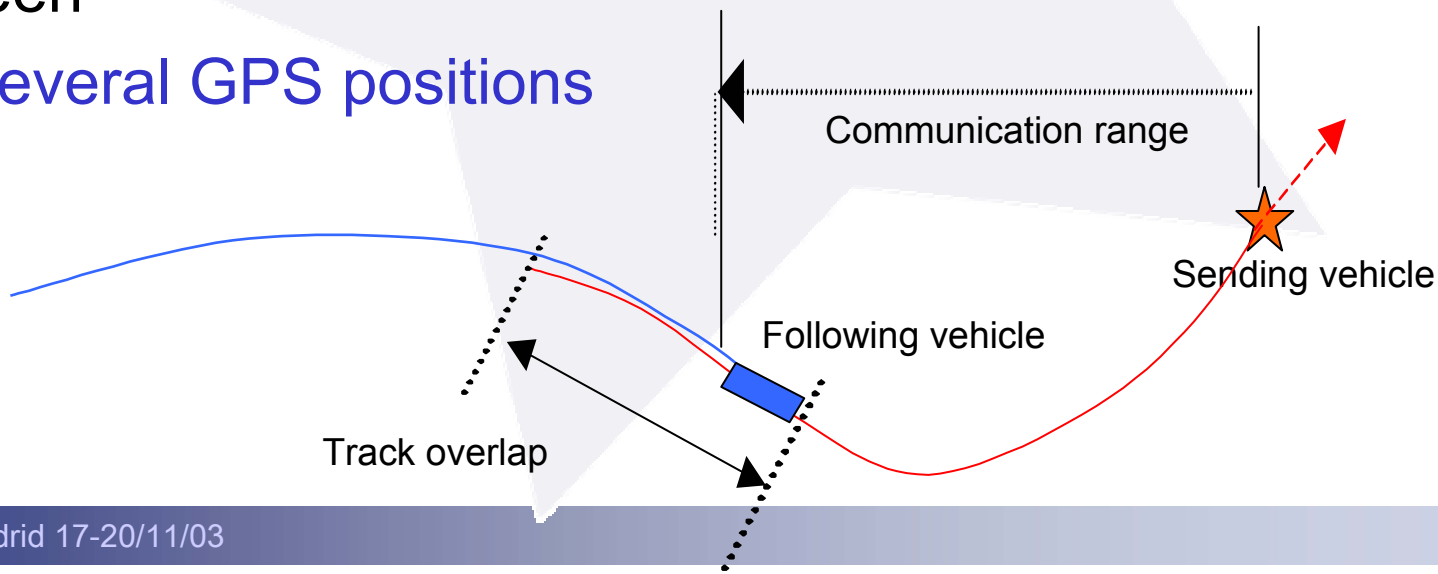
System characteristics

- Manual or automatic activation
  - generic warning, stopped vehicle, accident
- IVHW is coupled with the warning flashers
- Manual or automatic deactivation
  - In case of emission of the same message by several vehicles, automatic cancellation of useless messages is foreseen
- Use of several GPS positions



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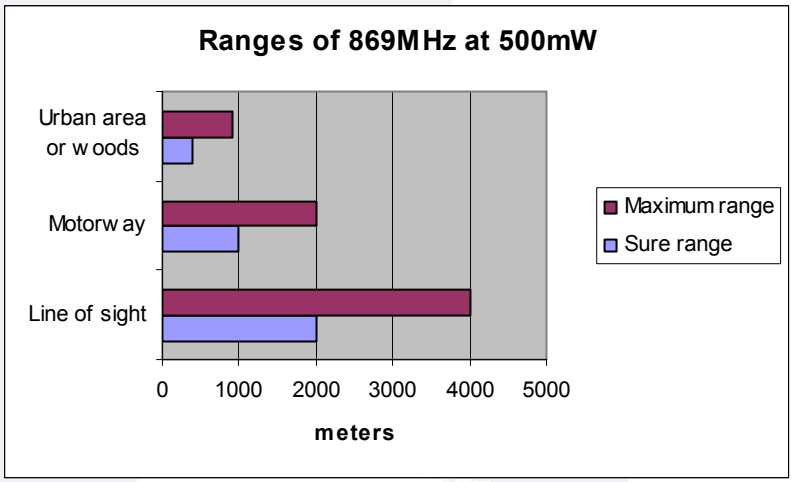
Communication technology

- choice of the 869.4 - 869.65 MHz frequency band
- for 1 Km nominal communication distance
- omni directional broadcast
- relevancy discrimination by the receiver



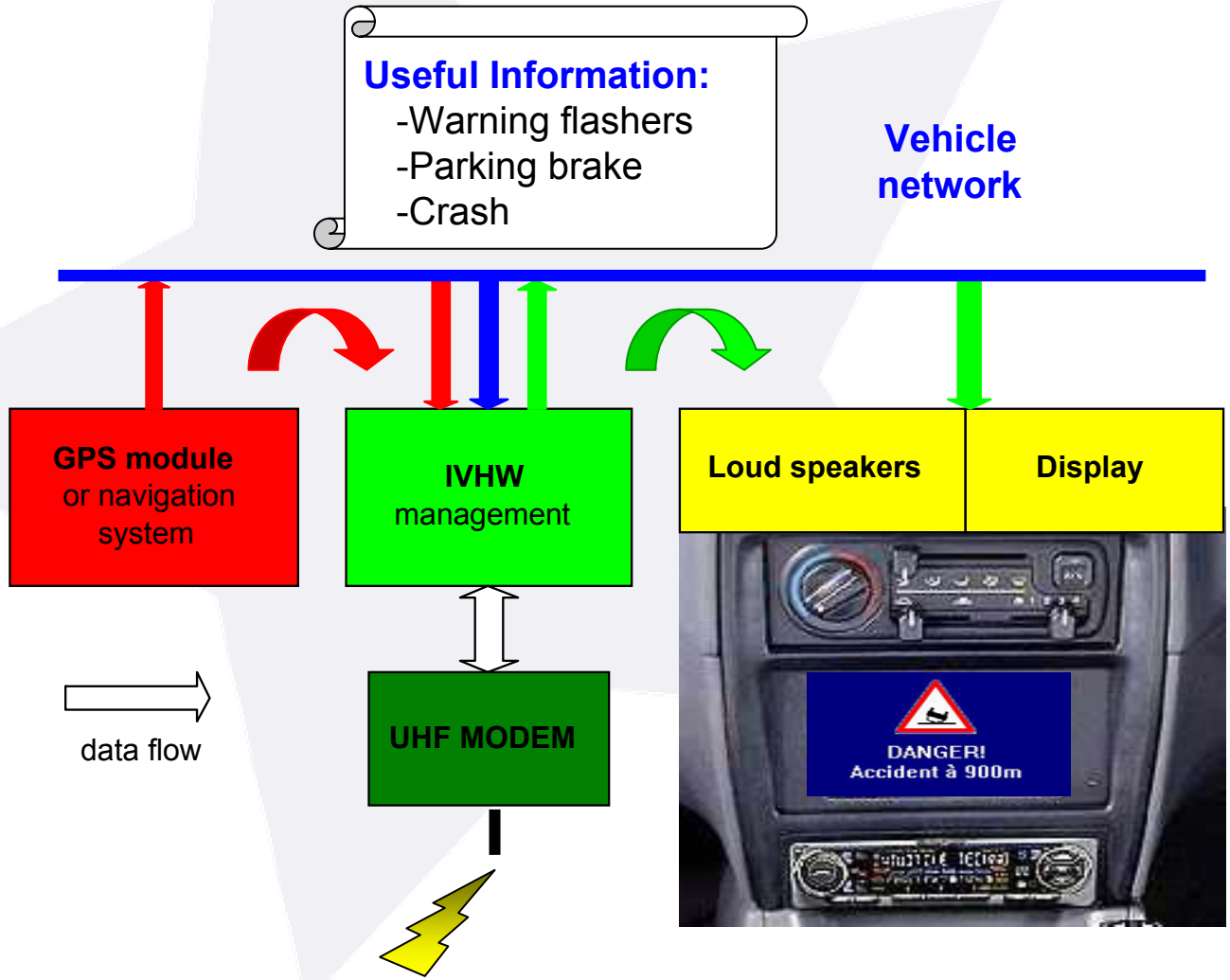
System characteristics

Minimum:

- GPS module
- UHF modem
- HMI interface

Optional:

- Navigation system



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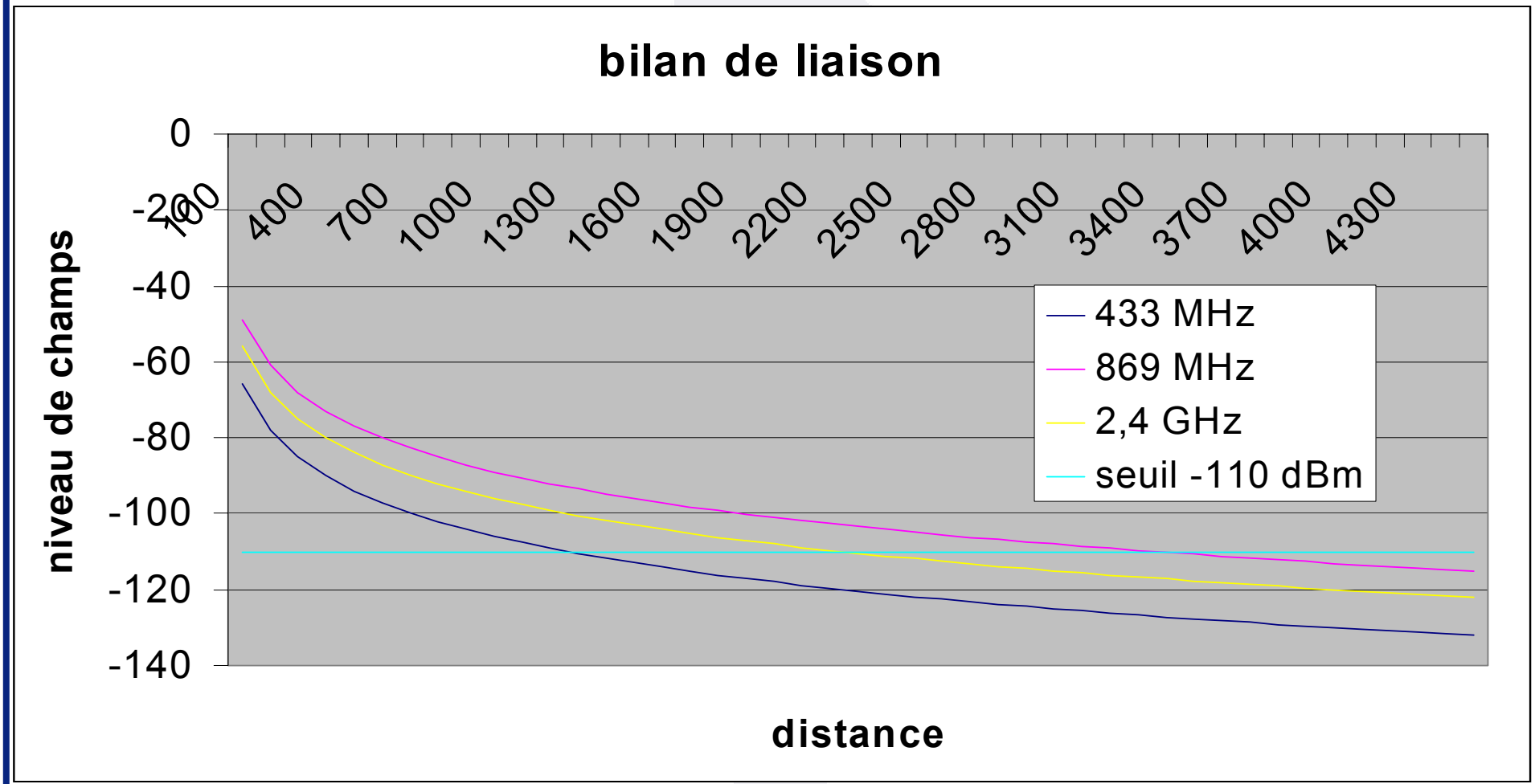
Frequency bands



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Market introduction

1
- **Standardisation: the prerequisite**
  - **work within EUCAR, the European manufacturers' research framework in order to achieve consensus among car makers**
  - **Item to be proposed to TC278**

2
- **Equipment of rescue and security vehicles**
- **Use of mobile infrastructure beacons**
- **Equipment of buses and commercial vehicles**

3
- **Equipment of passenger cars**

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A new R&D project

- A new initiative : SAAV (Savoir avant de voir – To know before to see)
- A combination of AIDA and IVHW
  - 2 communication channels
  - emergency signals between vehicles and infrastructure
  - safety and comfort services
- Main advantages
  - low cost equipment
  - higher communication zones (around 1 Km)
  - integration in the vehicles
  - using motorway infrastructure (emergency call boxes, communication network)

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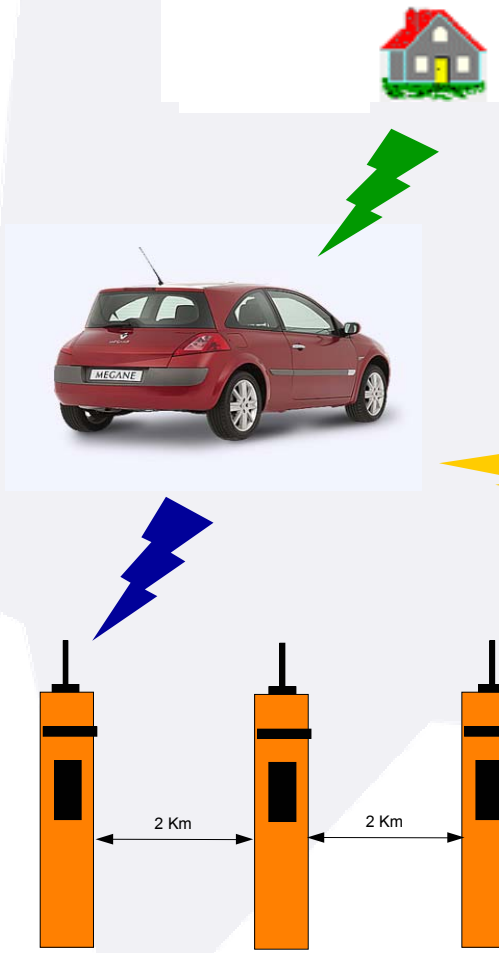
New developments

- To lower the costs and improve the market penetration, the SAAV project will try to develop a radio communication system allowing several applications to coexist on the same frequency band



1. IVHW
2. traffic and travel inf
3. secure black spots
4. gate control
5. door opening?
6. tire pressure control?

.Motorways emergency call boxes
.Mobile beacons
.Black spot beacons