C-ITS pilot deployment in France
SCOOP@F key achievements

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Short presentation
Project SCOOP@F in a nutshell

- 2014-2018. Co-funded by the European Commission
- Intends to **connect 3,000 vehicles with 2,000 km of road network (various typologies)**
- 2 deployment waves:
  - **1st wave (2014-2017):**
    - ITS-G5
    - priority services
  - **2nd wave (2016-2018):**
    - hybrid cellular/ITS-G5
    - additional services
- Priority services focus on **improving road user and road operators safety** (data collection, road works warning, hazardous location notification)
## Project consortium
### French partners

| ROAD OPERATORS | − Ministry: public road operators (DIRs Ile-de-France, Atlantique, Ouest)  
|                | - SANEF  
|                | - LD38 |
| CAR MANUFACTURERS | − Renault  
|                | − PSA |
| RESEARCH INSTITUTES | − CEREMA  
|                | - IFSTTAR  
|                | - LAB  
|                | - ITS Bretagne |
| UNIVERSITIES AND HIGHER EDUCATION AND RESEARCH INSTITUTIONS | − Université de Reims Champagne-Ardennes  
|                | - Institut Mines Télécom (Telecom ParisTech) |
| SECURITY EXPERTS | − IDnomic |
| TELECOM EXPERTS | − Orange |

### Foreign partners
Spain: DGT, CTAG | Portugal: IMT, AENL | Austria: ASFINAG
Pilot sites and cross-tests
Priority services

- Data collection: position/speed/direction, events detected, events declared
- Road works warning:
  - Planned road works,
  - Slow moving maintenance, winter maintenance,
  - Road operator vehicle approaching, rescue and recovery work in progress
- Hazardous location notification:
  - Slippery road, bad visibility, extreme weather condition
  - Animal on the road, human presence on the road, obstacle on the road, unmanaged blockage of the road
  - Accident, emergency brake, stationary vehicle, end of queue
What is specific about SCOOP@F

- SCOOP@F system has been developed WITH the car manufacturers
  - It includes CAM emission (10/s) and automatic emission of DENMs based on the C2C-CC triggering conditions
  - It is embedded in the car manufacturer’s navigation system (ergonomy specialists involved in the development of the HMI)
  - It has gone through an industrial quality process, as a pre-series deployment (1000 vehicles/car manufacturer)
  - Multi-brand interoperability between PSA and Renault is ensured
What is specific about SCOOP@F

- SCOOP@F tackles the following aspects in **real life**
  - **Security**: a fully operational PKI, work with the national IT security agency ANSSI
  - **Privacy**: included in the design of the system, work with the national data protection authority CNIL (vehicles really sold to customers)
  - **Procurement**: all road operators have gone through standard procurement processes, common procurement also tested
  - **Industrial process**: the car manufacturers have worked with their usual suppliers and included it in their industrial process
  - **Compliance assessment**: a thorough validation process resulting in „stamps“ from the project has been defined
  - **Interoperability**: tested between pilot sites and with foreign countries
Son projects making the link with the C-ROADS Platform
Key achievements
The French catalogue of C-ITS services

A – Probe vehicle data
B – Road works warning
C – Signage applications
D – Hazardous location notifications
E – Traffic information and smart routing
F – Parking, park & ride, multimodality
G – Intersections
H – Traffic management
I – Vulnerable users
J – Logistics
The French catalogue of C-ITS services

F – Parking, park & ride, multimodality
   F1 – Information on parking lot location, availability and services
   F2 – Position and parking spots availability: break time indication
   F3 – Information on the schedule of the next PT after parking at the station
   F4 – Information on the schedule of the next PT when approaching a station
   F5 – Reservation of a parking space freed by a user
   F6 – Information on a parking space freed by a user
   F7 – Smart POI

G – Intersections
   G1 – Signal Violation Warning
   G2 – Signal Violation Prevention
   G3 – Traffic signal priority request by designated vehicles
   G4 – Green Light Optimal Speed Advisory (GLOSA)
G3 – Traffic signal priority request by designated vehicles

Type of road network | Urban
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Type of vehicle | Designated vehicles

Use case introduction

Summary
The service is to give priority to specific users at traffic lights. Level of priority depend on vehicle type and status on schedule.

Background
Today, in many cities, systems exist to give a level of priority to designated vehicles (emergency services, public transports, ...) at traffic light. It is based on several technologies (radio-communication, GPS positioning, remote control). In many other cities, authorized vehicles have to pass through a red light (police, ambulance, ...).

Objective
- Enhance the smart route
- Give priority to vehicles under logical considerations (transport policy included)
- Reduce the risk of collisions at traffic lights.

Desired behavior
Traffic light give priority to specific users.

Expected benefits
Smart routing, security, safety, enhanced travel time for requesting vehicle

Use case description

Situation
- Equipped traffic light
- Vehicles enabled to ask for priority could be (non-exhaustive list):
  - Emergency vehicles
  - Heavy goods vehicles
  - Public transport
  - High occupancy vehicles

Logic of transmission
V2I logic, Broadcast and/or Unicast

Actors and relations
- The sender is the vehicle asking for priority.
- The end-receiver is the infrastructure.

Scenario
1. A designated vehicle asks the priority to an equipped infrastructure.
2. The infrastructure decides if the priority is given and how different levels of priority can be applied, e.g. extension or termination of current phase to switch to the required phase.
3. Appropriate level of green priority may depend on the vehicle type (e.g. HGV (heavy goods vehicle) or emergency vehicle) and status (e.g. public transport vehicle on-time or behind schedule).
4. Driver of the requesting vehicle adapt his behavior in function of the decision made by infrastructure on the traffic lights. There is no confirmation message from infrastructure to the requesting vehicle.

Use Case Implementation
Implementation outlook
Example of implementation Helmond:
In case emergency vehicles have their light-bar activated, absolute priority request will be activated automatically at crossings, and the emergency vehicles get green light as soon as possible (taking into account minimal green times and evacuation time). Trucks equipped with this service have ‘light’ / ‘selective’ priority, meaning that when there are no emergency vehicles with light bar activated or other trucks in the vicinity, green light will be extended ( till the maximum green time) or red light will be shortened (when possible).

This implementation does not surely cover all needs of this use case (public transport, high occupancy vehicles, etc.). Triggering conditions and technology could be different. Calculations by infrastructure when several requests may be in scope.

Functional architecture

Display / alert principle
- Itinerary may be set into HMI so that the hold on appropriated traffic light will be replicated with an advanced phase or properly on complex route (itinerary to event or for public transport service).

Functional and non-functional requirements

Sources of information
Vehicle requesting priority with 3 possibilities to launch the UC:
- Automatic from equipment (triggering conditions analysis from equipment): usual CAM emitted by vehicles
- Automatic from vehicles (automatic requests with triggering conditions)
- Manual from vehicle (via OBU interface)

Standards
- DENH and/or CAM
- NF P99-071-2015: Regulation of road traffic by traffic lights – Specification of the standard dialogue of traffic control equipment – Diesel

Constraints / Dependencies
- If too many vehicles are taken priority on traffic lights, the overall traffic management will be disturbed.
- An application of this UC to roadworks temporary red lights is not excluded.
- This UC may be combined with D12 (emergency vehicle approaching).
- This UC may interact badly with G3 (GLOSA) because it changes phase of the red light.

Next step: List the different possible sub-UC behind this UC (emergency vs public transport, level of priority needs, their conditions depending vehicle and/or traffic management considerations, etc.), analyze and arbitrate them.

Detailed description based on a European template
A complete set of specifications filling the gap of standards

| 2.4.1 Common set of functional and technical specifications for SCOOP |
| 2.4.1.1 Functional and technical specifications of RSU |
| 2.4.1.2 Functional and technical specifications of CBU for road operators |
| 2.4.2.2.1 Specifications of Software for Road operators OBU |
| 2.4.2.2.2 Specifications of Software for Road operators OBU |
| 2.4.2.2.3 Functional and technical specifications of CBU for car manufacturer PSA |
| 2.4.2.2.4 Functional and technical specifications of CBU for car manufacturer Renault |
| 2.4.2.3 Detailed functional specifications of SCOOP platform |
| 2.4.4.1 Analysis of safety objectives |
| 2.4.4.2 Scoop@f risk analysis for safety |
| 2.4.4.2_bis Risk Analysis Safety Info Note |
| 2.4.4.3 Comparison between the risk analysis performed by Solucor (del. 2.4.4.2) and the risk analysis proposed in ETSI standard TR 102 893 (TVRA) |
| 2.4.4.4 State of the art of public key infrastructures for cooperative ITS |
| 2.4.4.5 PKI System Requirement Specifications |
| 2.4.4.6 PKI architecture and technical specifications |
| 2.4.4.6_bis Use case scenarios with security data |
| 2.4.4.8 SCOOP Security System: Integration Guide |
| 2.4.4.9 Certification policy |

Thoroughly tested and upgraded from experience and feedback from development and testing

Most of them are open and available on our website
A robust back-end architecture

- Traffic Management System
- ITS Central Station: SCOOP Platform
- ITSS R: Road Side Unit
- ITSS-VG: Road operator On Board Unit
- ITSS-VU: User On Board Unit
A robust back-end architecture
The SCOOP@F platform, a direct link between the driver and the road operator

- Is the interface with the Traffic Management System
- Works in Datex II
- Sends information to the operator’s ITS stations (roadside units and ITS stations in the operator’s vehicles) and receives data from them
- Performs a quality check of the inputs
- Aggregates multiple messages on the same event
- Conversion between TMS geographic reference and GPS coordinates
- Scalability
- Supervision: status of the RSU (Keepalive messages), of the servers, logs, configuration backups, ...
The SCOOP@F PKI, a fully operational security solution

1 RCA
3 LTCA: Renault, PSA, Roads Operators
A common PCA

Designed and implemented in a collaboration with ISE (IRT-SystemX)
Compliant to ETSI standards (TS 103 097, TS 102 941, ...)

RCA : Root Certificate Authority
LTCA: Long Term Certificate Authority
PCA : Pseudonym Certificate Authority
Efficient validation processes

Testing procedures applied for each equipment:
- Laboratory test
- Test-tracks test
- Open road tests

When all steps approved -> equipment ready for deployment

- ✔ ETSI conformance testing: As done during ETSI Plugtest
- ✔ SCOOP conformance testing: Checking SCOOP profile
- ✔ Technical/User log(tlog/ulog) generation checks: Each station is checked if it provides all SCOOP log files required for further evaluation
- ✔ Log file upload verification: The transfer of files to a dedicated server is analysed
- ✔ Secure message testing: Check the dynamic changes of pseudonyms
- ✔ PKI access verification: The remote access to PKI servers is verified
- ✔ Scalability check: The ability of an station to compute a high number of received messages
- ✔ DATEX translation into DENM: This step checks the communication between RSUs and C-ITS central station
Vehicles now ready for driving!

- Choice of the hardware
- Developments linked to the OBU: construction of automatically triggered messages, relay of messages, security and pertinence check of all in-coming messages, construction of LOG files, ...
- Developments linked to the HMI: prioritization of incoming messages (SCOOP and non-SCOOP), display of C-ITS alerts, triggering of manual messages,...
- Gone through an industrial validation process
- Mounting processes defined

- PSA will sell 1000 serial cars to mainly private customers
- RENAULT will sell 1000 serial cars to fleet customers
- You may experience them at our demonstrator and order them at scoop-participate@developpement-durable.gouv.fr
Thank you for your attention!
Any questions?

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