EU EIP – C-ITS Workshop
Lessons learned from the pilots
SCOOP@F

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Connecting Europe Facility

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The SCOOP@F Project

- 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

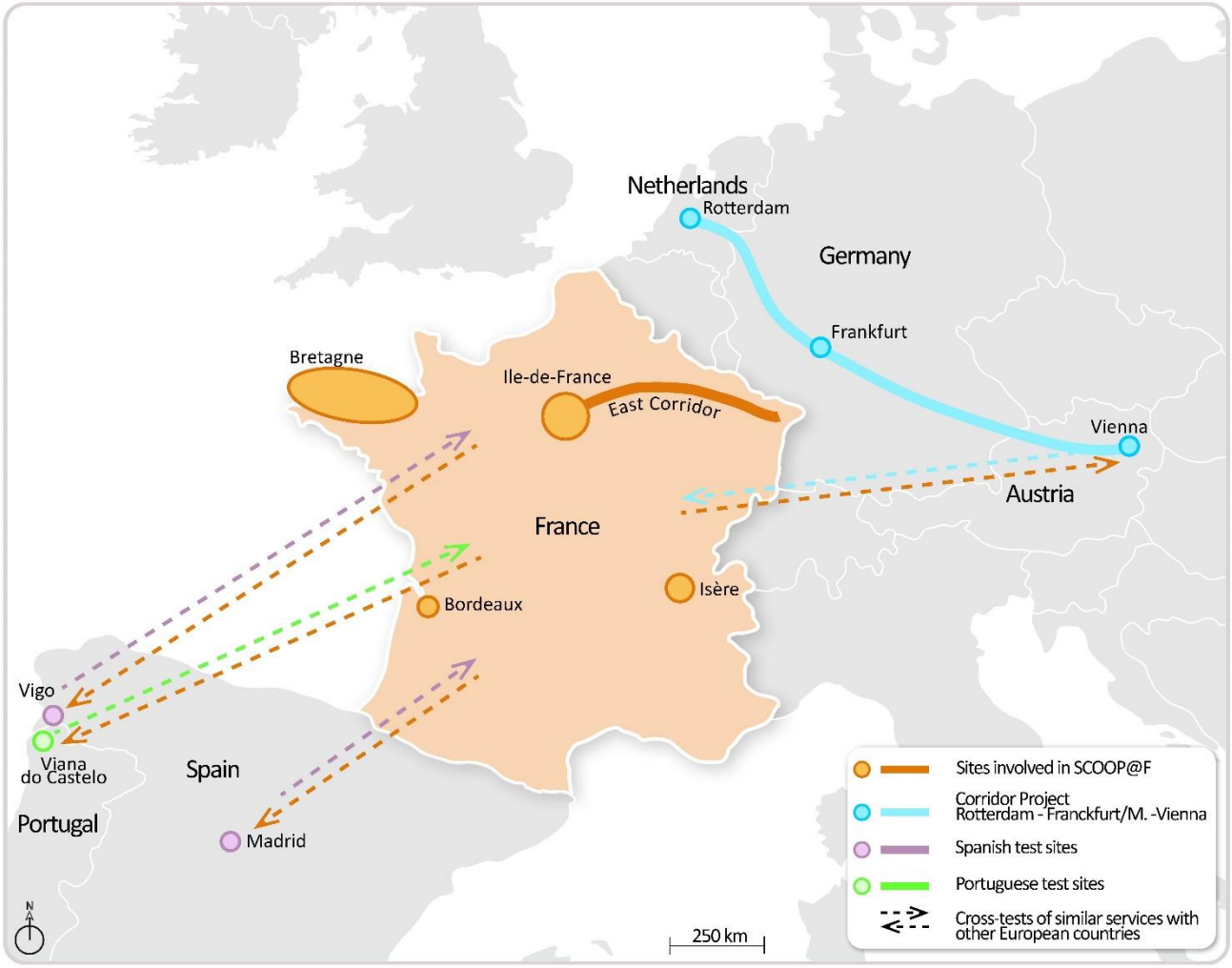
- French partners

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

The SCOOP@F Project

- Key achievements & lessons learn

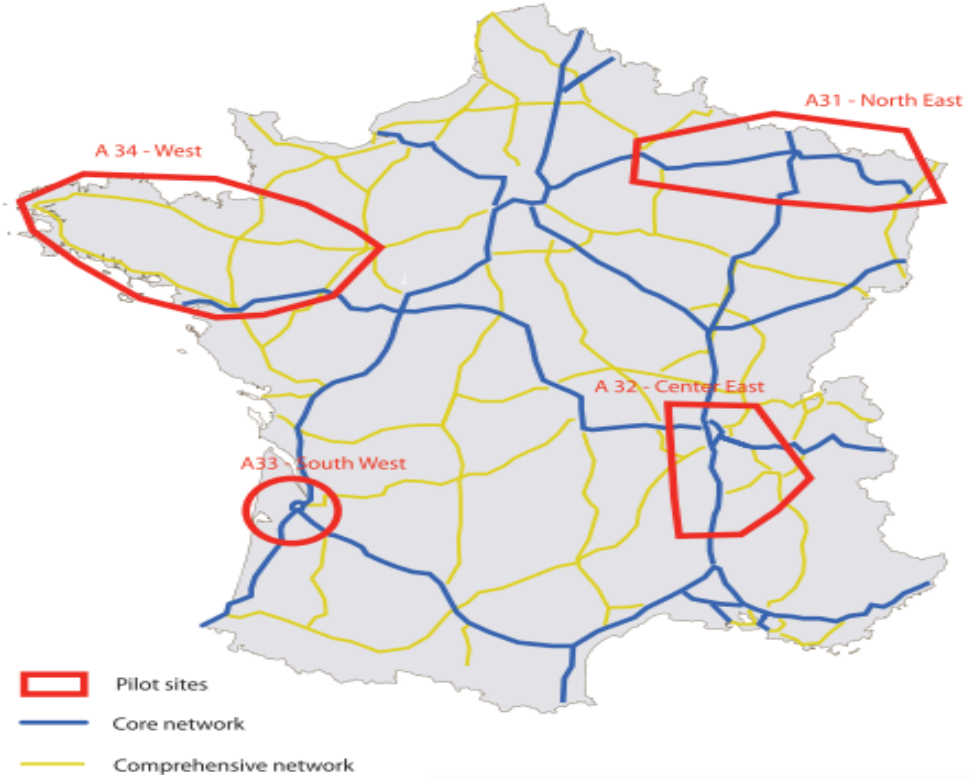
What is specific about SCOOP@F

- 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



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

- **List of uses cases in each category**

- **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 an user
  - F6 – Information on a parking space freed by an 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)

The French catalogue of C-ITS services

- **Detailed description based on a European template**

G3 – Traffic signal priority request by designated vehicles	
Type of road network	**Urban**
Type of vehicle	**Designated vehicles**
Use case introduction	
Summary	The service is to give priority to specific user at traffic lights. Level of priority depend on vehicle type asking and status on schedule.
Background	Today, in many cities, systems exist to give a level of priority to designated vehicle (emergency services, public transports, ...) at traffic light. It is based on several technologies (radio-communication, GPS positioning, remote control). In many other cities, authorized vehicle have to pass through a red light (police, ambulance,...).
Objective	• Enhance the smart routing • 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 Vr (vehicle requesting priority) => to => I (RSU on/around traffic light or before it)
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 are 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 applicated 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 vehicles (via OBU interface)
Standards	• DENM and/or CAM • NF P 99-105:1991: Traffic control – Traffic light junction controllers – Functional characteristics. Currently under review. • NF P99-071:2015:Regulation of road traffic by traffic lights – Specification of the standard dialogue of traffic control equipment – Diaser
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.

A complete set of specifications filling the gap of standards

- **Thoroughly tested and upgraded from experience and feedback from development and testing**
- **Most of them are open and available on our website**

2.4.1	Common set of functional and technical specifications for SCOOP
2.4.1_Bis	List of standards applicable for specifications and development
2.4.1_Annexe	Renewal of pseudonym certificates and upload of Logs (T-Logs and U-Logs)
2.4.1_Annexe	Appendix 1 - Renewal Of Pesudonym Certificates
2.4.1_Annexe	Appendix 2 - CAMI-Specification
2.4.1_Annexe	Appendix 3 - ITS-Container
2.4.1.2	Specifications of DENM fields
2.4.1.3	Catalogue of data to collect - Tlog
2.4.1.3	Catalogue Of Data Tlog To Collect
2.4.1.3	Specification of ASN.1 code for CM's Tlog
2.4.1.3	Specification of ASN.1 code for RO's Tlog
2.4.1.3	Catalogue Of Data Ulog To Collect
2.4.1.3	Specification of ASN.1 code for Ulog
2.4.1.3	Catalogue Of Data Tlog for Security To Collect
2.4.1.3	Specification of ASN.1 code for security Tlog
2.4.1.3_Bis	Technical specification for encoding data
2.4.1.4	Specifications of Datex II v2.3 messages in conjunction with CAMs and DENMs
2.4.1.4	Specification of DATEX II messages in conjunction with CAMs and DENMs
2.4.1.4	Appendix 1: DENM Structure and Datex II translation
2.4.1.4	Appendix 2: Simplification of Datex II Classes emitted by SAGT
2.4.1.5	Technical architecture for Road Operators' components
2.4.1.6	IPv6 Addressing over G5

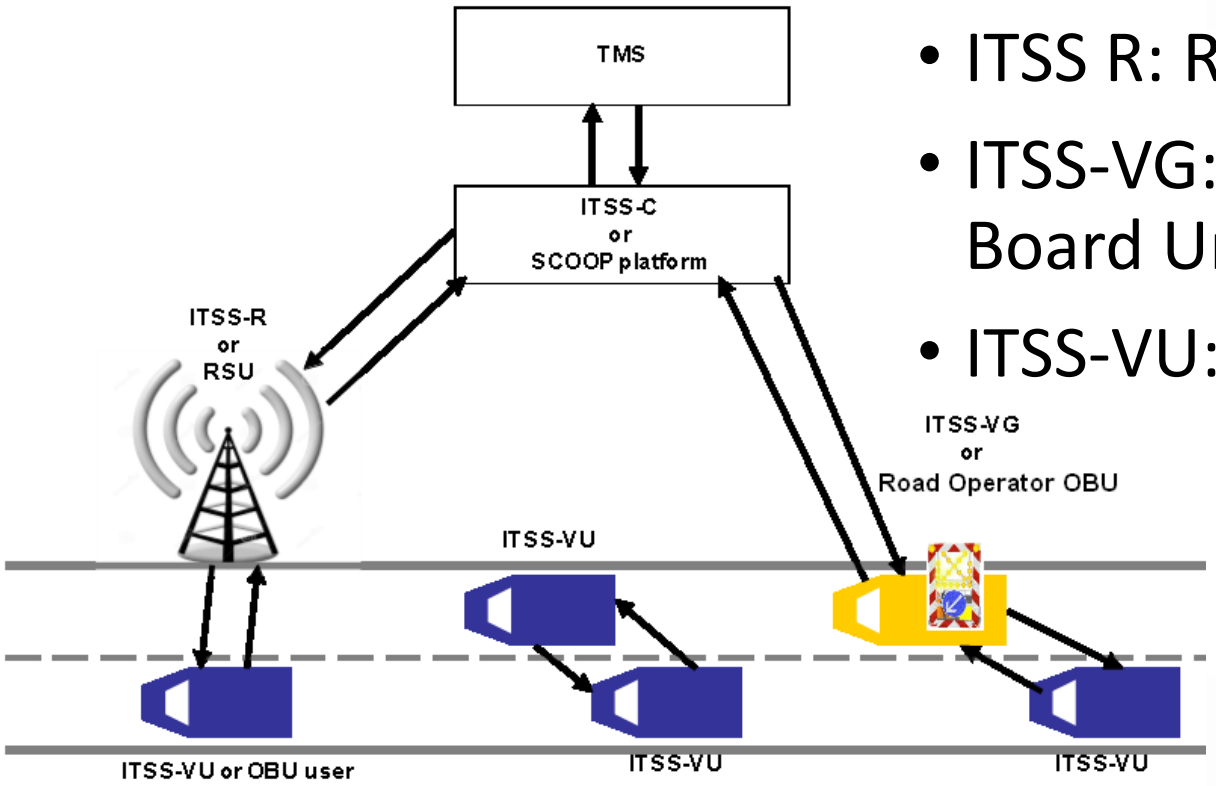
2.4.2.1	Functional and technical specifications of RSU
2.4.2.2	Functional and technical specifications of OBU for road operators
2.4.2.2_Bis	Specifications of Software for Road operators OBU
2.4.2.2_Ter	Specifications of Software for Road operators OBU
2.4.2.3_P	Functional and technical specifications of OBU for car manufacturer PSA
2.4.2.3_R	Functional and technical specifications of OBU for car manufacturer Renault
2.4.3.2	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 Solucom (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
2.4.4.6_App	Appendix_ASN.1
2.4.4.7	Strategies for changing pseudonyms and sizing the PKI traffic
2.4.4.8	SCOOP Security System: Integration Guide
2.4.4.9	Certification policy

A complete set of specifications filling the gap of standards

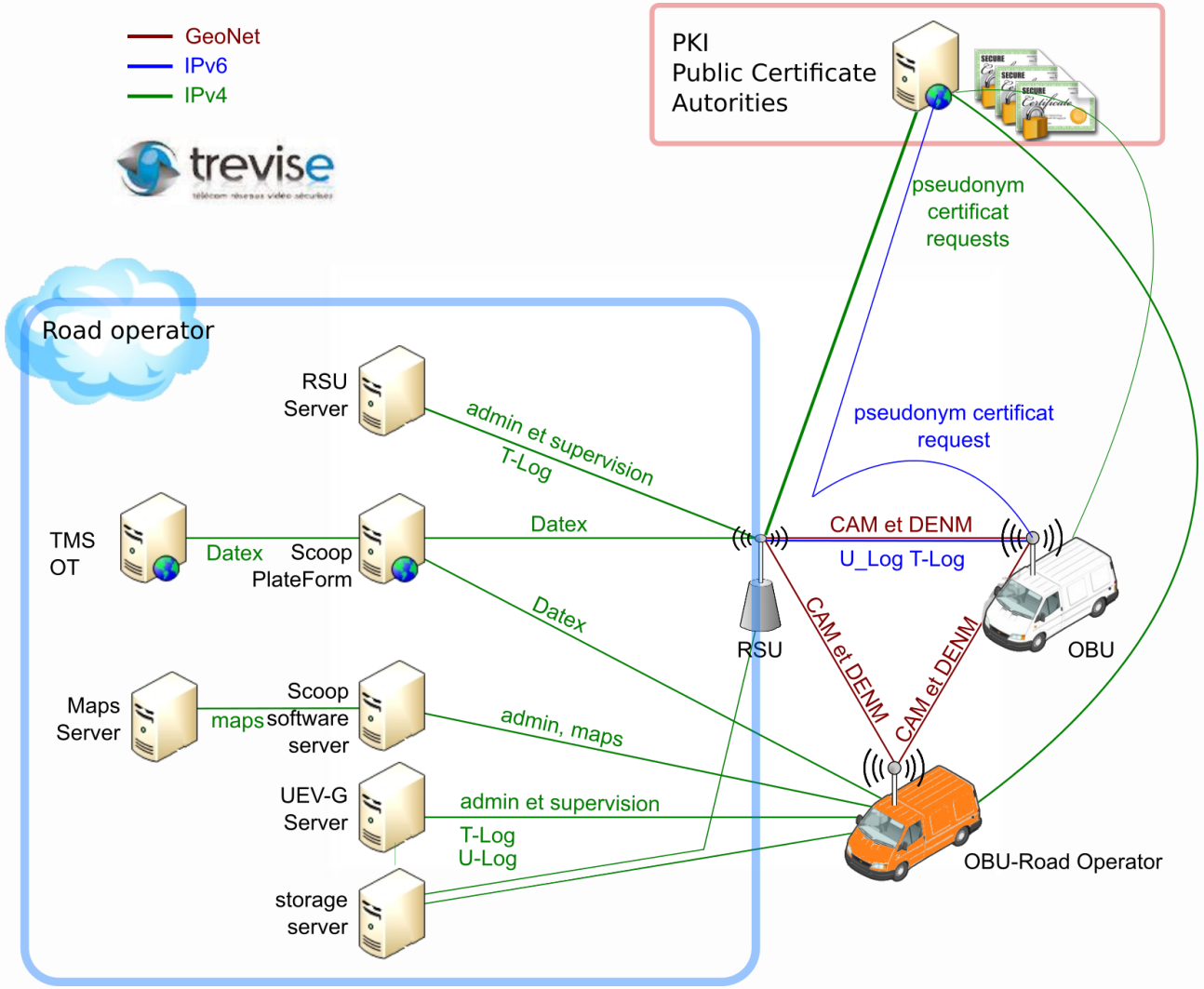
- RSU Specification + Installation and Validation Guidelines
- Road operator OBU Specification + Validation Guideline
- Road operator Information System Specifications
  (Datex II translation, Central Platform, …)
- Road operator organisational aspects
- Juridical aspect : Personal data protection, Road operator's responsibilities, Car manufacturers responsibilities, Road users responsibilities, …
- Recommendations for European interoperability

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

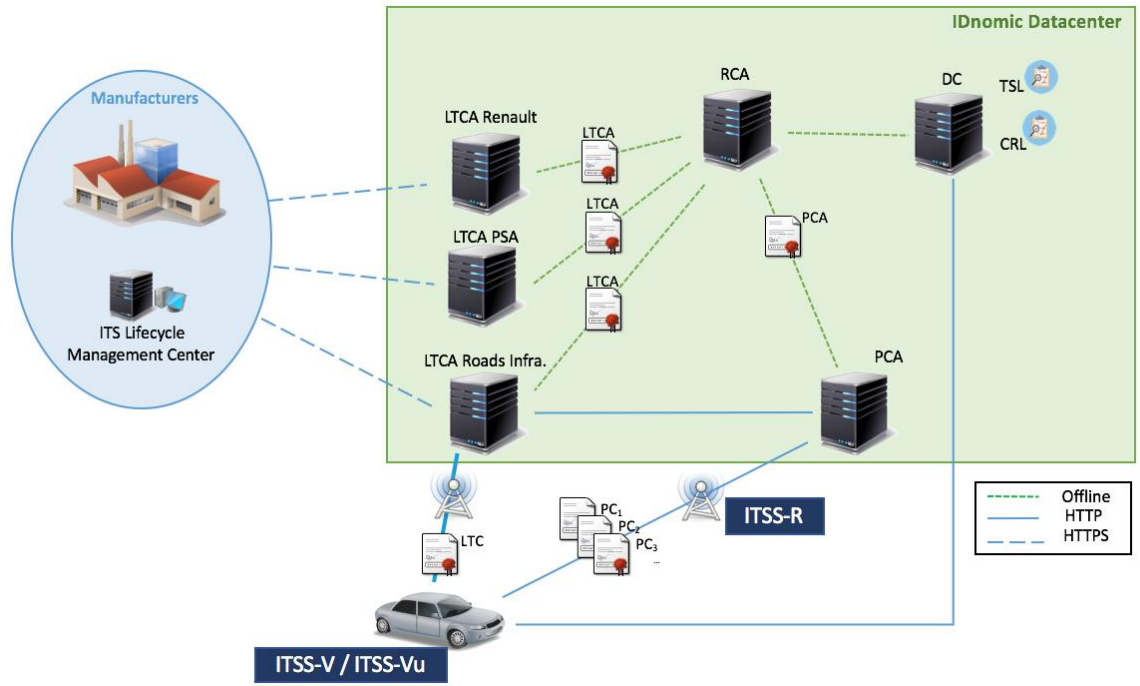


The SCOOP@F platform, a direct link between the driver and the road operator

- 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

- **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

1 RCA

3 LTCAs:

Renault, PSA, Roads Operators

A common PCA

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 acces 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?

Visit our website
www.scoop.developpement-durable.gouv.fr/en

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