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Seminar – 20th and 21st November 2019

Projet SCOOP
véhicules et routes connectés
connected vehicles and roads

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INTRODUCTION

Project SCOOP

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Connected vehicles and Cooperative ITS

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- Intelligent Transport System (ITS) : any use of information and communication technologies in the field of transport

- Cooperative : based on the exchange of information between vehicles and between vehicle and infrastructure. Also called V2X communication

- **NB : there are other types of connected vehicles beside V2X communications (multimedia platform of the car manufacturer, eCall, Pay As You Drive insurance…)**

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The 3 ways of cooperative ITS (C-ITS)

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- V2V : sensors embedded in the vehicles gather information and transmit them automatically to vehicles behind

- V2I : idem, but the information is received by the traffic management center of the road operator

- I2V : the road operator sends information which is displayed in vehicles driving near the site

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Stakes of C-ITS deployment

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- To enhance **road safety**
- To enhance **safety of road workers**
- To optimize **traffic information**
- To develop **new services**
- **To prepare the vehicles of tomorrow**

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C-ITS and automation

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- C-ITS are considered as a solution to make automated vehicles :
  - Cope with critical situations they could not cope with otherwise (ex. toll gate, road works)
  - Anticipate on sensor detection for better comfort of the driver (ex. end of queue)

- **To reach automation level 4 (no possibility to take over manually) will probably, C-ITS will probably be needed**

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ITS G5 technology

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- A wifi technology adapted to high speed vehicles. Operating in the 5.9 GHz band
- Allowing V2X exchanges with **very low latency**, which is needed for road safety use cases (slippery road, end of queue)
- **No communication costs**
- Communication with infrastructure through Road Side Units
- **Mature** : standardized years ago, several Field Operational Tests including SCORE@F in France
- Can be hybridated with existing cellular networks (3G/4G) for latency non-critical services

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Project SCOOP

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- Funded 50% by the European Commission, in two parts (2014-2015 and 2016-2018)

- SCOOP (or SCOOP@F) is a pilot deployment of cooperative ITS
  - Deployment : large-scale (hundreds of vehicles on 2000 km of roads)
  - Pilot : includes ex ante and ex post evaluation

IMPORTANT : the project does not involve any automation, messages are received by the driver

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Project partners

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- **French Ministry of Transport** (Transport Infrastructure Directorate)
- **Local authorities**
  - Département de l'Isère
  - ITS Bretagne with Départements des Côtes d'Armor, du Finistère, d'Ille et Vilaine, Région Bretagne, Saint-Brieuc Agglomération)
- **TEN-T road operators** (3 DIRs, SANEF)
- **Car manufacturers** (PSA, Renault)
- **Universities and research centers** (Cerema, IFSTTAR, GIE RE PSA-Renault, Université de Reims Champagne-Ardenne, Institut Mines-Télécom).
- A **telecommunication** operator : Orange
- A provider of **trust services** : IDNomic
- **Spanish** partners (DGT, CTAG)
- **Portuguese** partners (DGAE)
- **Austrian** partners (ASFINAG)

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Five pilot sites

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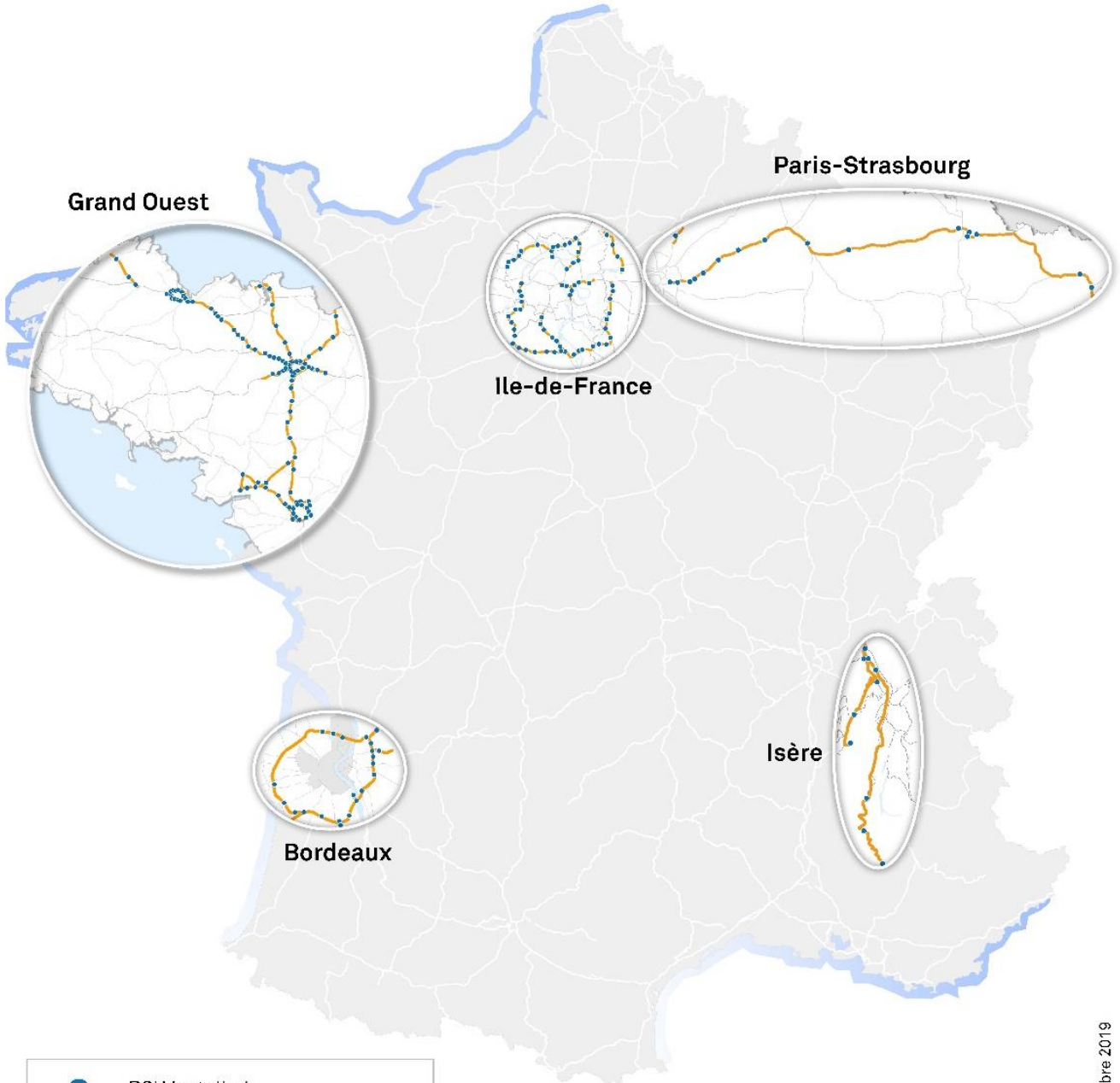

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Two car manufacturers

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The specificity of SCOOP

- SCOOP 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
  - Multi-brand interoperability between PSA and Renault is ensured

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The specificity of SCOOP

- SCOOP 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

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The second wave of SCOOP

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- A proof of concept (a few prototypes, HMI not embedded)
- Hybrid : cellular / ITS G5 communications
- Whole cellular architecture deployed, including a national cellular node
- Fully compliant with C-ITS standards
- Secured through a PKI
- Additional services

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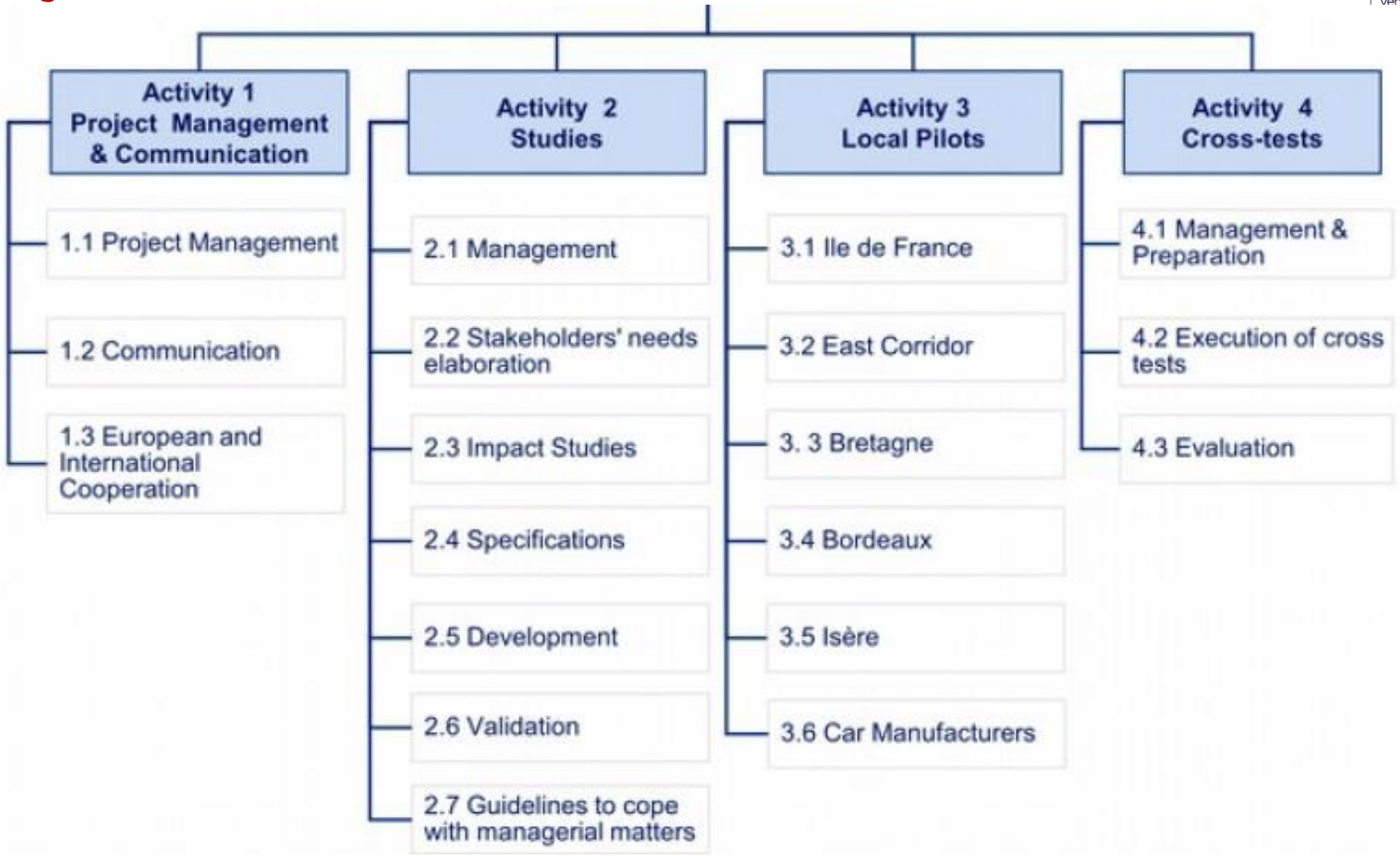
Project structure



Projet SCOOP
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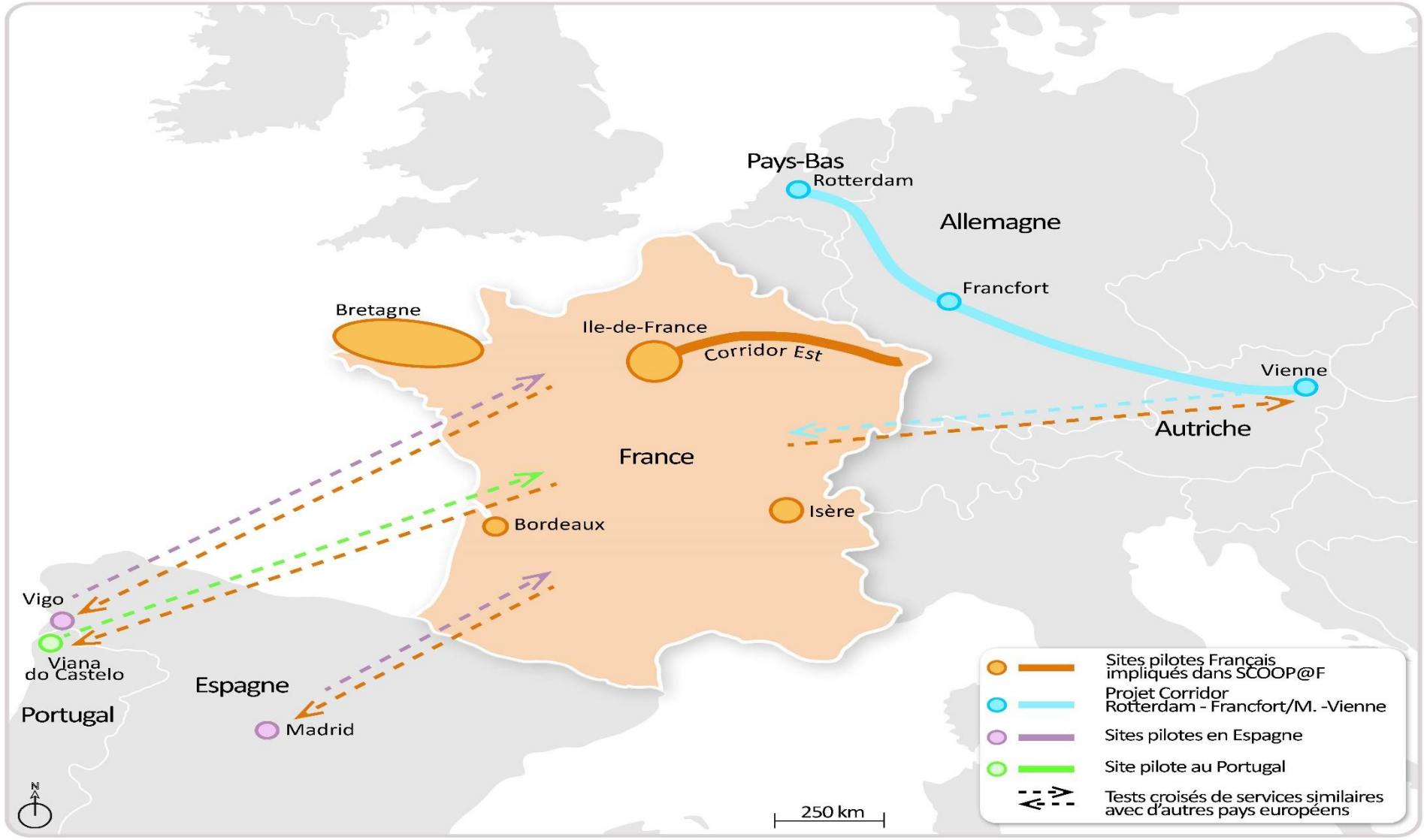
SCOOP in Europe

Projet SCOOP
véhicules et routes connectés
connected vehicles and roads



Projet SCOOP
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connected vehicles and roads

Questions / answers

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Agenda of the seminar

20 November

- 10h00-11h00 The SCOOP system
  - Architecture and components
  - Security
- 11h00-11h15 Movie : moments of SCOOP
- 11h15-12h10 The SCOOP method
  - Specifications
  - Developments
  - Validation
- 12h10-13h40 Lunch

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Agenda of the seminar

20 November

- 13h40-15h00 Evaluation results 1/2
  - Health impacts
  - Acceptability
  - Organizational impacts
  - Legal aspects
- 15h00-15h30 Live link-up demonstration
- 15h30-15h45 Coffee break

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Agenda of the seminar

20 November

- 15h45-17h00 Evaluation results 2/2
  - Road safety impacts
  - Traffic impacts
  - Cost-benefit analysis and business models
  - Technical evaluation
- 17h-18h Cross-tests with foreign partners and European harmonization
  - Cross-tests
  - The C-Roads Platform

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Agenda of the seminar

- Gala dinner: 19h at château Grattequina, including tasting of Bordeaux wine

  - Departure by bus 18h30
  - Return by bus to Bordeaux city center and L'Agora

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Agenda of the seminar

21 November

- 8h30-9h Registration - coffee
- 9h-10h15 Beyond SCOOP 1/2
  - Panorama of projects
  - Logistics services
  - Connected railway level crossing
  - Urban services
  - The smartphone app
- 10h15-10h30 Coffee break

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Agenda of the seminar

21 November

- 10h30-11h15 Round table « C-ITS for local authorities »
- 11h15-12h15 Beyond SCOOP 2/2
  - Even more security
  - New technologies
  - Connectivity for automated driving
- 12h15-12h30 Conclusion by the European Commission

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Questions / answers

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THE SCOOP SYSTEM

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Architecture and components

Marie-Christine ESPOSITO
(French Ministry of Transport)
(Former) SCOOP@F Technical project manager

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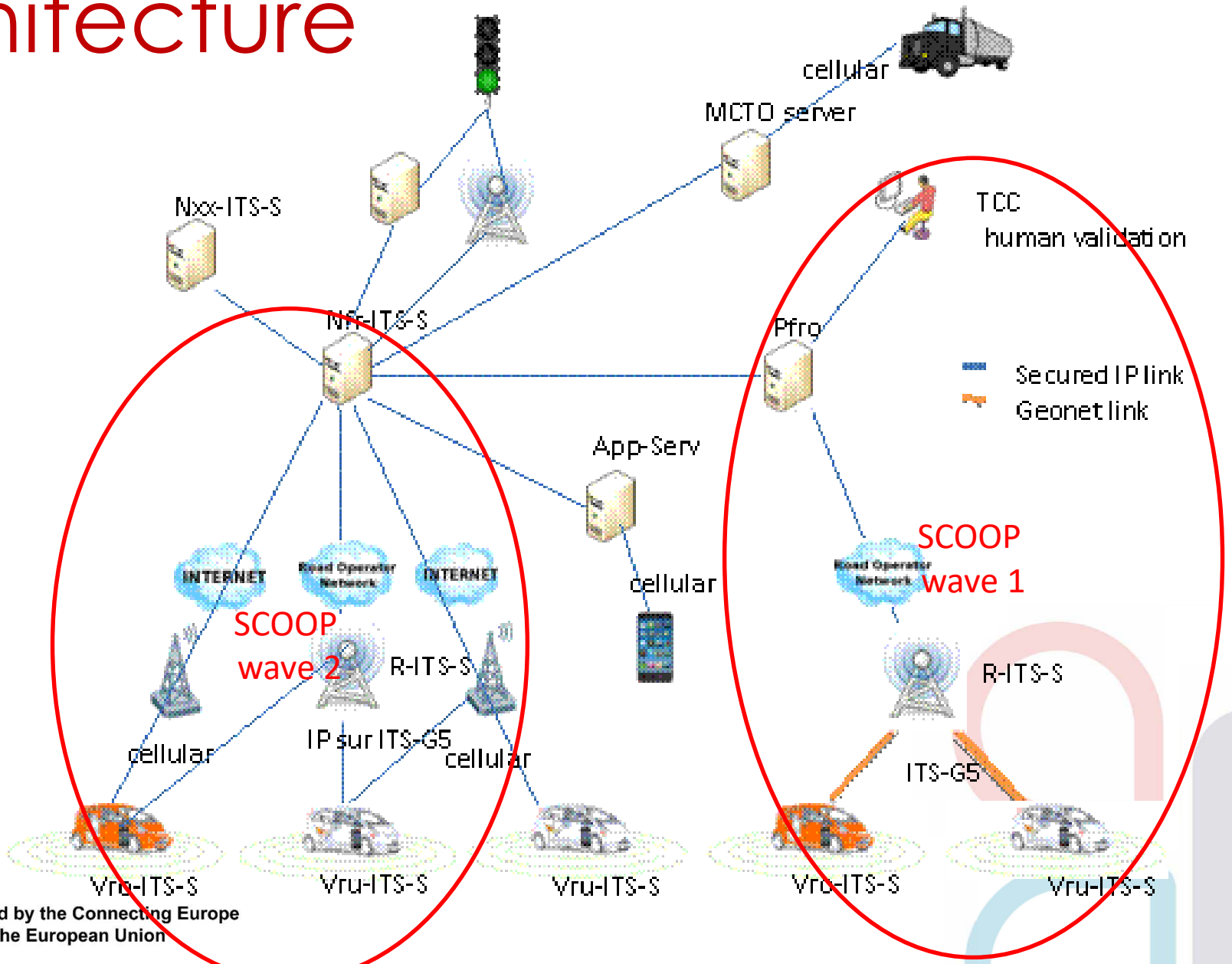
Architecture



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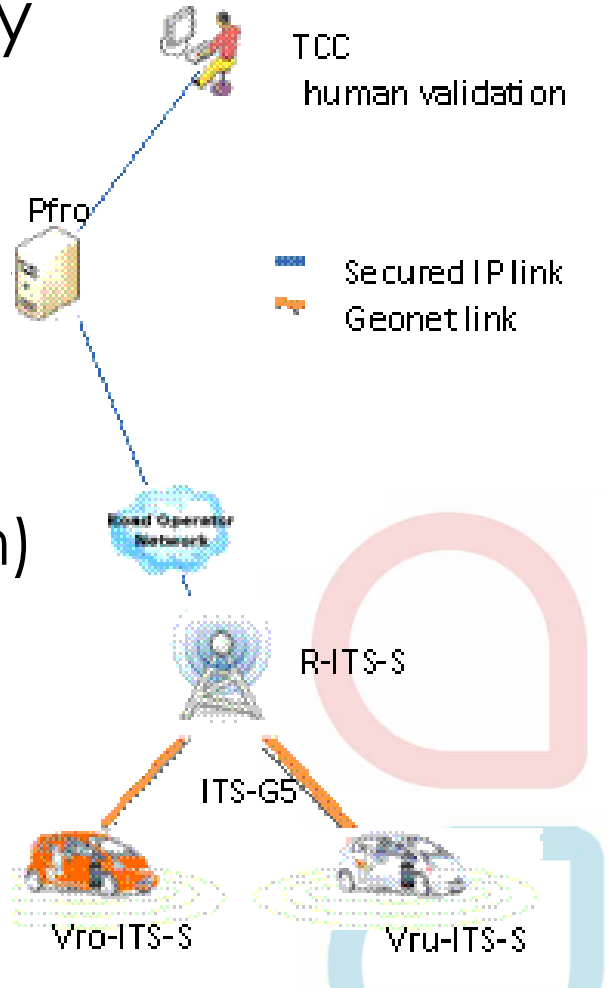
Architecture ITS-G5 (wave 1)

- Goal: transmit messages locally
- Components
  - Vru-ITS-S
  - Vro-ITS-S
  - R-ITS-S
  - Pfro
  - TMS (Traffic Management System)



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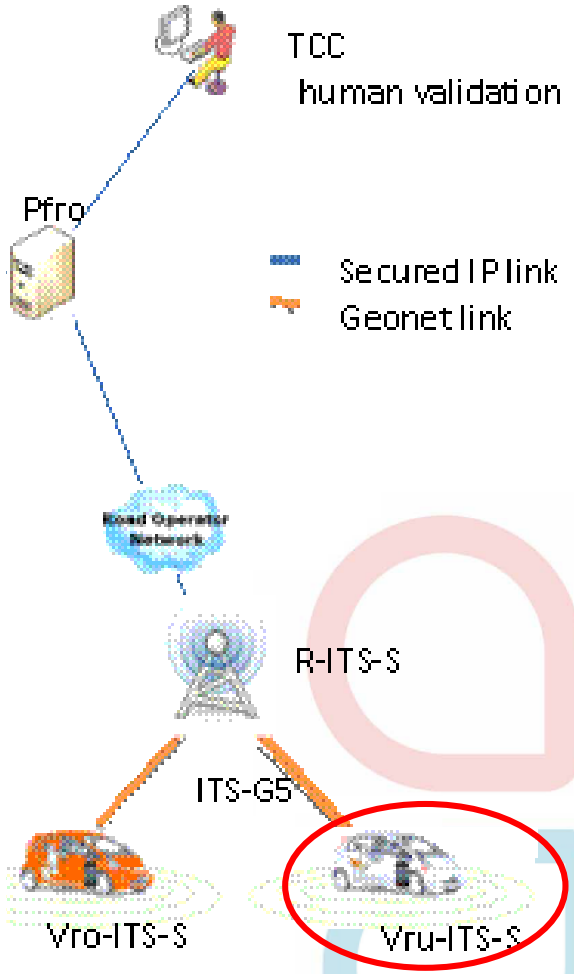
Architecture wave 1

- Vru-ITS-S main functionalities
  - Transmits CAM and DENM messages (from defined Triggering Conditions)
  - Receives and displays to the driver events sent by other vehicles and road operators
  - Forwards messages on ITS-G5 channel



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Architecture wave 1 : Vru-ITS-S

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Architecture wave 1 : Vru-ITS-S

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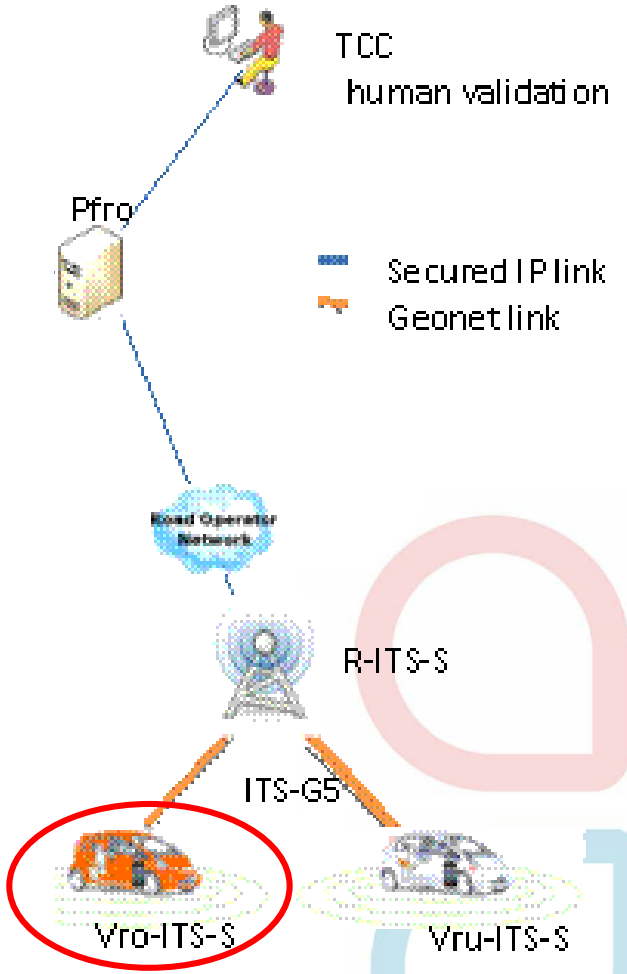
Architecture wave 1

- Vro-ITS-S main functionalities
  - Transmits CAM and DENM messages (from defined Triggering Conditions) as a Vru-ITS-S
  - Receives and displays to the driver events sent by other vehicles and road operators
  - Forwards messages on ITS-G5 channel
  - Acts as a mobile RSU (connected through the Pfro to the TCC)
  - Operator mode: transmits specific DENM about road operator activities (wintry viability, intervention, patrol, roadworks, etc)



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Architecture wave 1 : Vro-ITS-S

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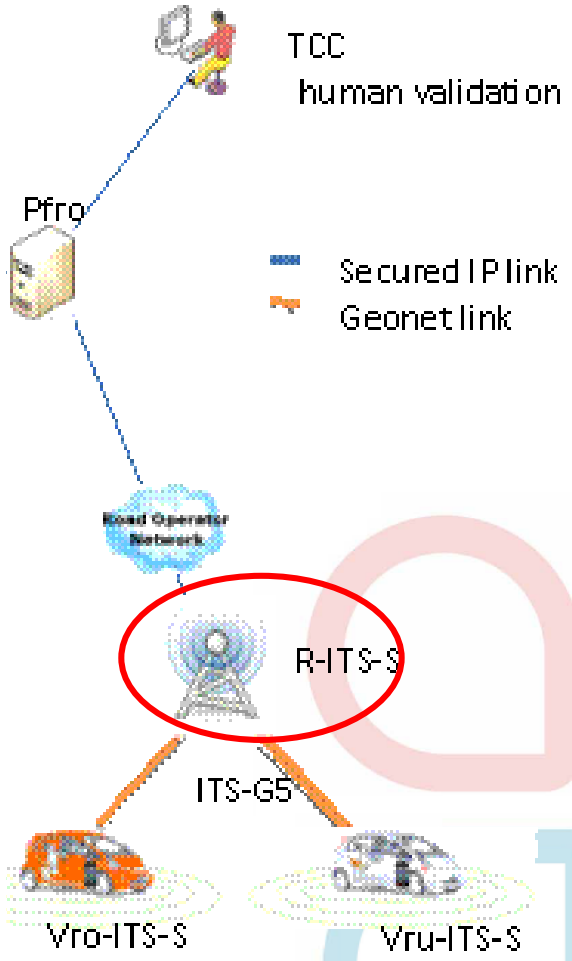
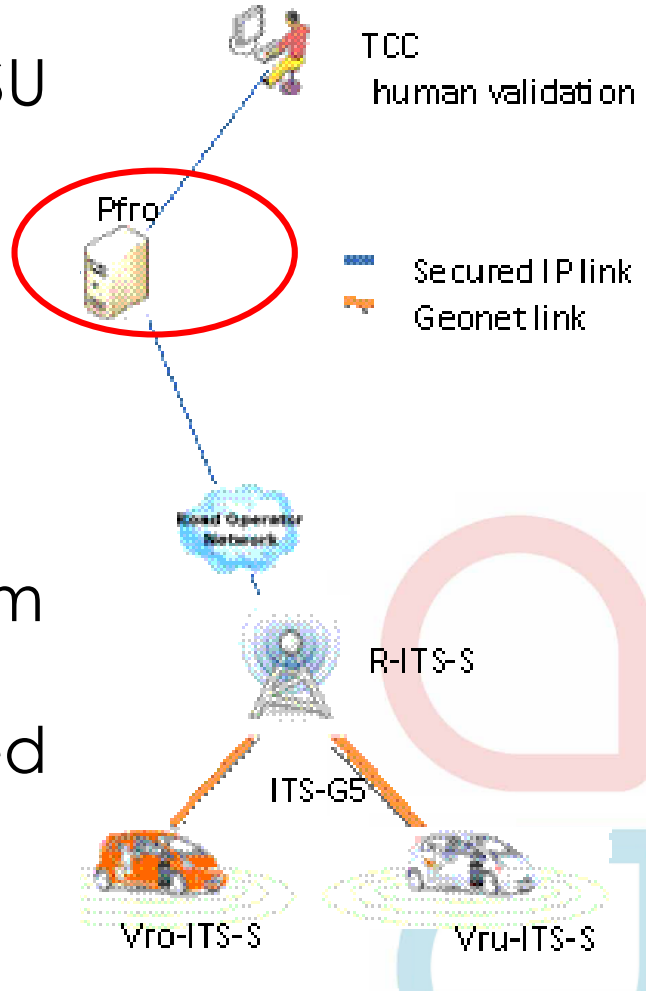
Architecture wave 1

- R-ITS-S main functionalities
  - Transmits CAM(-I) and DENM messages forwarded from the TMS through the Pfro (including Datex II-DENM translation)
  - Adds the security layer to messages
  - Receives DENM messages from vehicles and transmits them to TMS through Pfro (including DENM-DATEX II translation)
  - Forwards messages on ITS-G5 channel
  - Receives CAM messages from vehicles, aggregates data (speeds, lengths, etc.) and transmits them as Datex II messages to the Pfro
  - Router from veh to PKI (IPv6 over ITS-G5)
  - Downloads logs from vehicles



Architecture wave 1

- Pfro main functionalities
  - Transmits DATEX II messages from TMS to RSU
  - Transmits DATEX II messages from RSU to TMS
  - To do so, the DATEX II messages are modified by the platform:
    - Geolocation system (PR+abs<-> X/Y)
    - Addition of trace(s)/event history
    - Addition of roadtype
  - Agregation of Datex messages (from DENM)
  - Filter to RSU (including mobile) based on location



Architecture wave 1 : PFro

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Liste des Équipements

Normal | Erreur mineure | Erreur majeure | Inactif

SAGT

Nom	Date de dernier ping	État
Sirius	2019-06-07 11:07:05	NORMAL

UBR

Nom	Date de dernier ping	Type	État
SCOOP_DIRIF_UBR_K10.001G	2018-03-23 10:32:13	FIXE	MAJEUR
SCOOP_DIRIF_UBR_K10.004K	2019-06-07 11:07:57	FIXE	NORMAL
SCOOP_DIRIF_UBR_K10.008P	2019-06-07 11:07:55	FIXE	NORMAL
SCOOP_DIRIF_UBR_K10.005L	2019-06-07 11:07:19	FIXE	NORMAL
SCOOP_DIRIF_UBR_K10.007N	2019-06-07 11:07:27	FIXE	NORMAL
SCOOP_DIRIF_UBR_K10.006M	2018-03-26 10:38:08	FIXE	MAJEUR
SCOOP_DIRIF_UBR_K10.003J	2019-06-07 11:07:05	FIXE	NORMAL
SCOOP_DIRIF_UBR_K10.017A	2018-06-29 13:41:48	FIXE	MAJEUR
SCOOP_DIRIF_UBR_K10.018C	2019-06-07 11:07:25	FIXE	NORMAL
SCOOP_DIRIF_UBR_K10.019D	2019-02-21 17:10:24	FIXE	MAJEUR
SCOOP_DIRIF_UBR_K10.023H	2019-06-07 11:07:57	FIXE	NORMAL
SCOOP_DIRIF_UBR_K10.014W	2019-03-21 09:20:40	FIXE	MAJEUR
SCOOP_DIRIF_UBR_K10.024J	2019-06-07 11:07:31	FIXE	NORMAL
SCOOP_DIRIF_UBR_K10.026L	2019-06-07 11:07:59	FIXE	NORMAL

Liste des Évènements

En cours | Fini, A venir, Annulé

Id	Émetteur	Horodate de réception	Cas	Type	Type complexe	Axe routier	PR + abs	Duree de validité	Version	Qualité	Horodate de début	Horodate de fin
Sirius_1900023300_1	Sirius	2019-06-07 08:57:03	D5	Accident	ACCIDENT	A0086	31 + 680	0j01h00m00	2	CERTAIN	2019-06-07 08:56:33	
Sirius_500286884_1	Sirius	2019-06-04 13:15:04	B1	MaintenanceWorks	ROADWORKS	A0003	3 + 200	1j00h00m00	7	CERTAIN	2019-04-24 05:11:44	2019-08-14 14:00:00
Sirius_500290041_1	Sirius	2019-06-05 17:08:40	B1	MaintenanceWorks	ROADWORKS	A0014	4 + 198	1j00h00m00	5	CERTAIN	2019-06-05 07:21:42	2019-06-28 11:13:13
Sirius_500290069_1	Sirius	2019-06-05 11:24:54	B1	MaintenanceWorks	ROADWORKS	N0104	38 + 490	1j00h00m00	1	CERTAIN	2019-05-23 11:25:17	2020-03-27 12:13:13
Sirius_500290070_1	Sirius	2019-06-05 11:29:40	B1	MaintenanceWorks	ROADWORKS	A0006	27 + 0	1j00h00m00	1	CERTAIN	2018-05-17 11:29:50	2020-03-27 12:13:13
Sirius_500290071_1	Sirius	2019-06-05 11:33:12	B1	MaintenanceWorks	ROADWORKS	A0006	17 + 700	1j00h00m00	1	CERTAIN	2018-05-17 11:33:22	2020-03-27 12:13:13
Sirius_500290074_1	Sirius	2019-06-05 12:07:25	B1	MaintenanceWorks	ROADWORKS	N0104	0 + 450	1j00h00m00	3	CERTAIN	2019-05-10 11:39:35	2023-06-30 11:13:13
									1	CERTAIN	2019-05-24 07:00:00	2020-03-27 12:12:13
									1	CERTAIN	2019-06-06 08:35:29	
									1	CERTAIN	2019-06-07 03:29:01	

SCOOP véhicules et routes connectés
Version 2.1.48, nous sommes le 07/06/2019, il est 10:58:43

EIFFAGE routes connectés
2019, il est 10:58:28

Affichage | Configuration

Utilisateur : Administrateur admin@cy.fr

Filtrer les événements

Type d'événements
Tous les types

Horodatage
Du
Au

Émetteur
Tous

Localisation
Axe | Sens
Dept | PR | ABS
Début | PR début
Fin | PR fin

Statut
En cours | Fini
A venir | Annulé

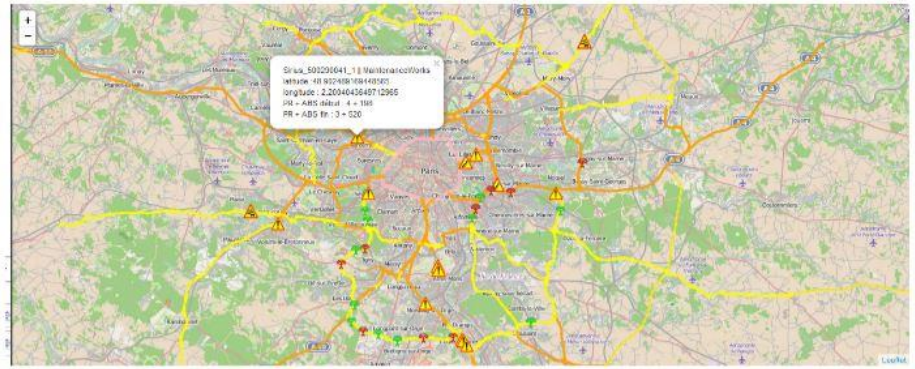
Rafraichissement 30 secondes

Filtrer la liste

Cartographie

Afficher les UBR fixes en état : Normal | Erreur mineure | Erreur majeure

Cartographie

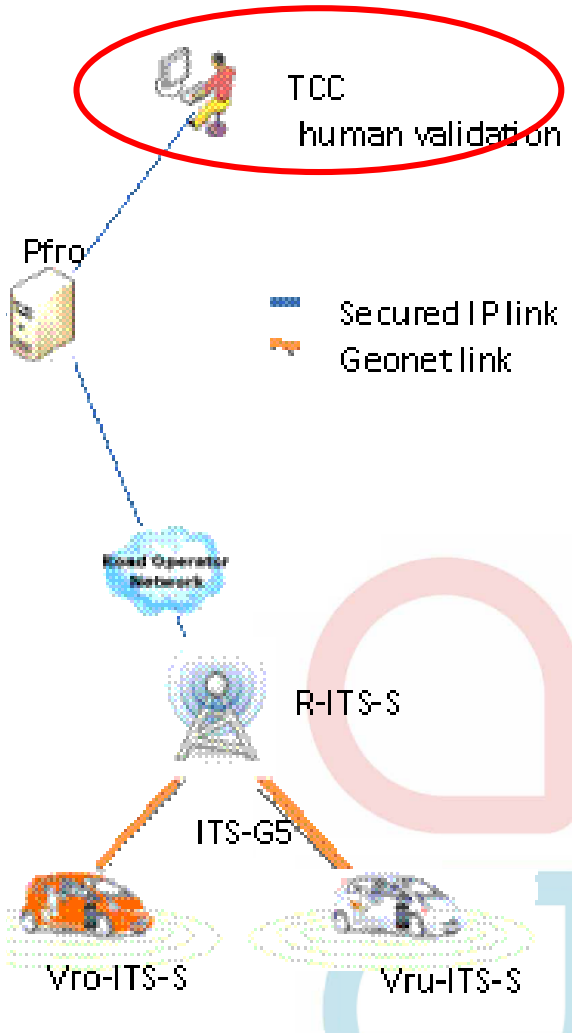


Afficher les UBR fixes en état : Normal | Erreur mineure | Erreur majeure

Architecture wave 1

- TMS main functionalities
  - Transmits DATEX II messages built by an operator from the TCC (based on different information) to PFro
  - Receives DATEX II messages from Pfro to alert the operator from the TCC

- The TMS is used to control all the equipments from a road operator system and was then not modified for the SCOOP matters (hence the Pfro)



Architecture wave 1 : TMS

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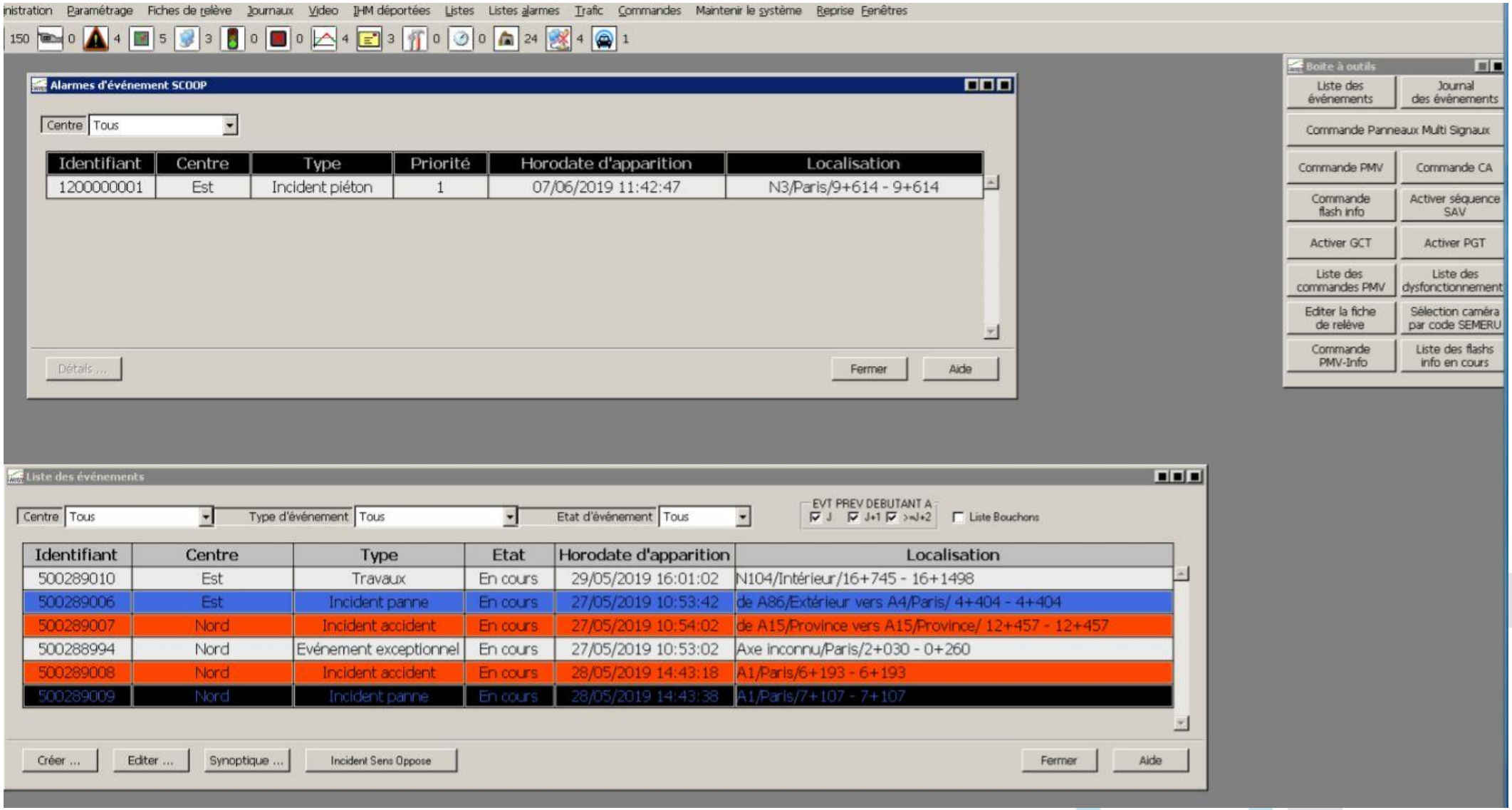

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Hybrid architecture: wave 2

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- Goals:
  - Coupling short and long range communications
  - Larger coverage
  - Reaching non ITS-G5 vehicles
  - Integrating of new stakeholders (e.g service providers)
  - Keeping the direct link between infrastructures and all types of vehicles – road user vehicles, trucks, cyclists, etc.
    => no need for third party that would manage the data
- Principles of French hybrid approach:
  - Stations can be fully hybrid i.e with ITS-G5 and cellular interfaces, and same messages can be transported on both channels
  - Stations need to be included in the C-ITS trust domain, i.e exchanges of C-ITS signed messages
  - Back-end signatures need to be in line with vehicles signature to ensure interoperability
  - Signatures ensure integrity and authenticity of the message whatever the channel

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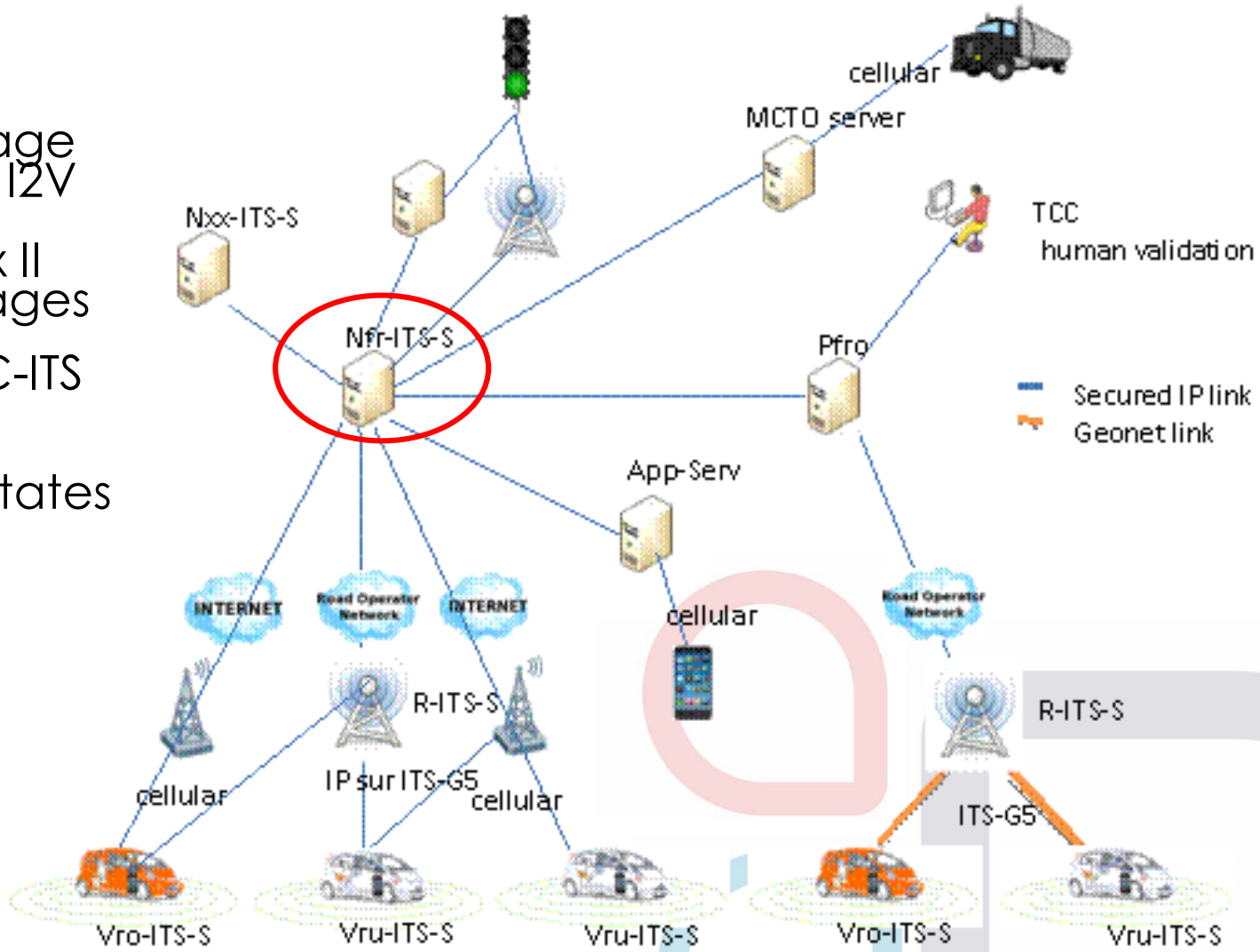
Hybrid architecture: wave 2

- New component: Nfr-ITS-S
- Nfr-ITS-S: main functionalities
  - RSU with a national coverage for road operators (e.g for I2V services) – including a translation between Datex II messages and C-ITS messages
  - Router of already signed C-ITS messages to link two stakeholders (e.g for V2V services) or two Member States
- Modified components:
  - Vru-ITS-S
  - Vro-ITS-S

-> to be linked with the Nfr-ITS-S (directly or through an OEM relay platform – **choice of the OEM**)



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Hybrid architecture: wave 2

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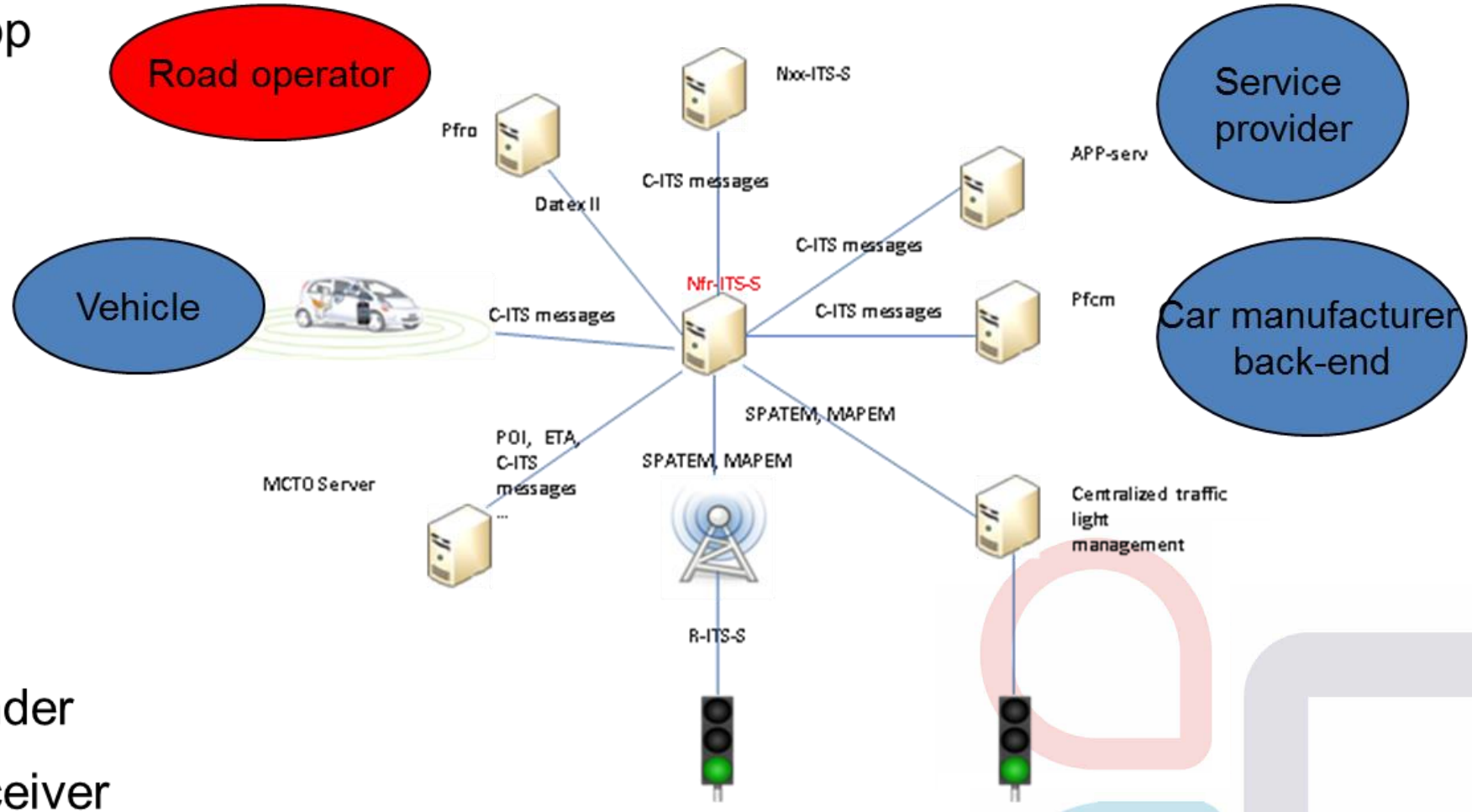
I2V or I2app services

Ex : RWW



Sender

Receiver

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Technical Implementation

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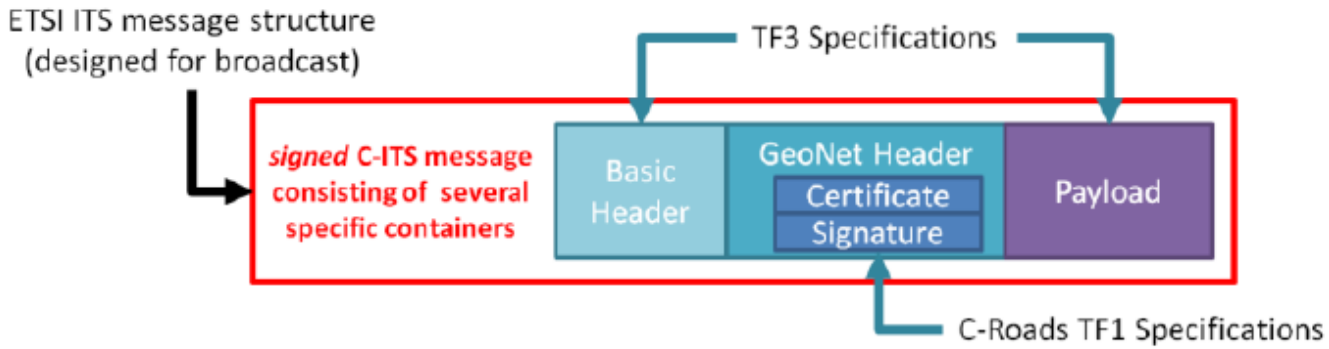
- For now, use of IF2 InterCor specification, will migrate to Basic Interface implementation of C-Roads for back-end interfaces
- For end-user interfaces, different tested implementations:
  - Web socket (with seamless connection to the Nfr-ITS-S over cellular or ITS-G5)
  - Soon MQTT implementation
- Same messages on C-ITS IP interfaces as for C-ITS ITS-G5 interfaces, to be encapsulated on AMQP protocols ie signed messages with geonet layer information to be able to forward information from one channel to the other using hybrid C-ITS stations



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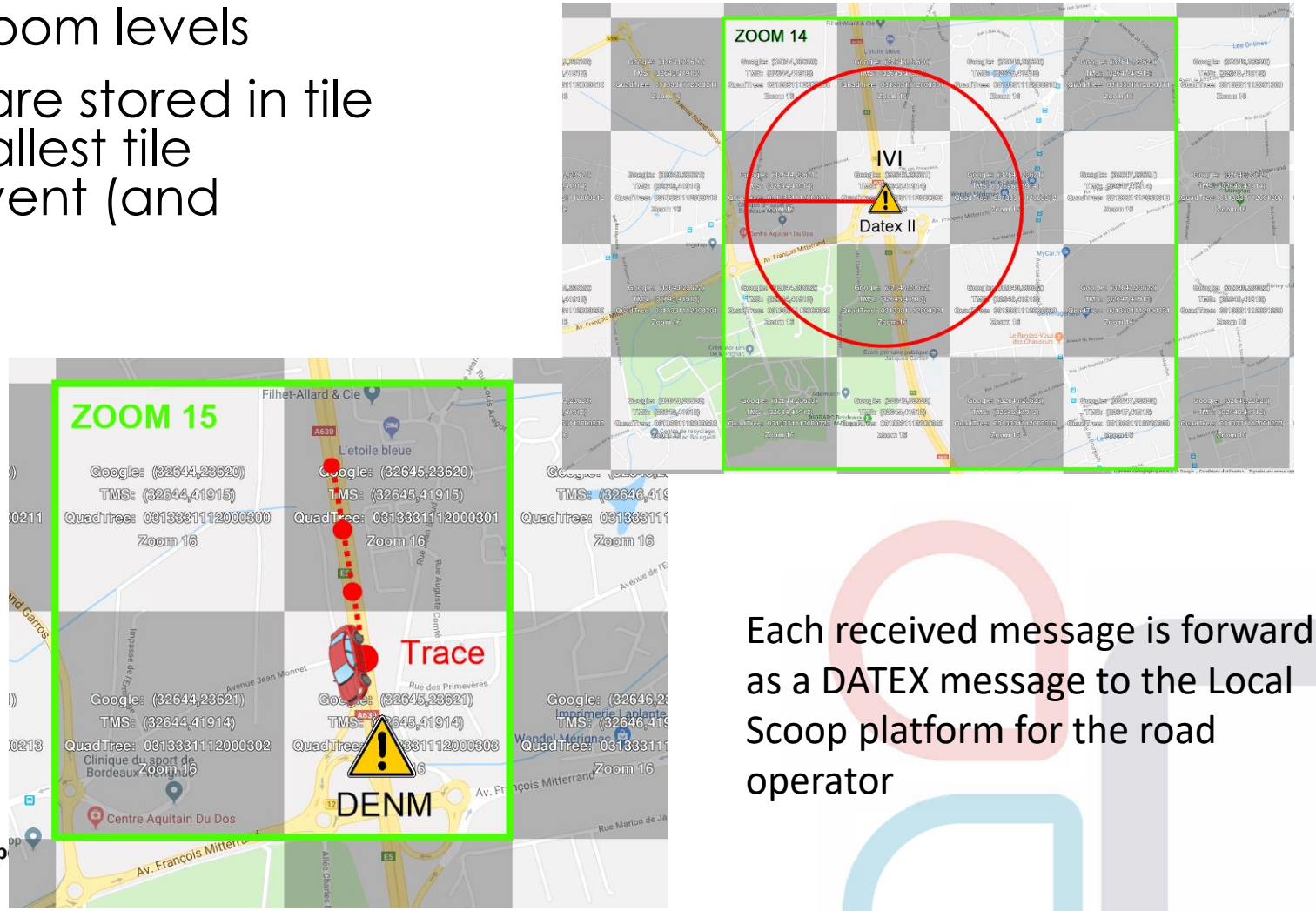
Dissemination on hybrid

- Geographical dissemination is based on tiles with different zoom levels
- DENM, IVI and DATEX are stored in tile database with the smallest tile including the whole event (and destination area)

Tiles: 500X500m to 10kmX10km



Each received message is forwarded as a DATEX message to the Local Scoop platform for the road operator

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Dissemination on hybrid

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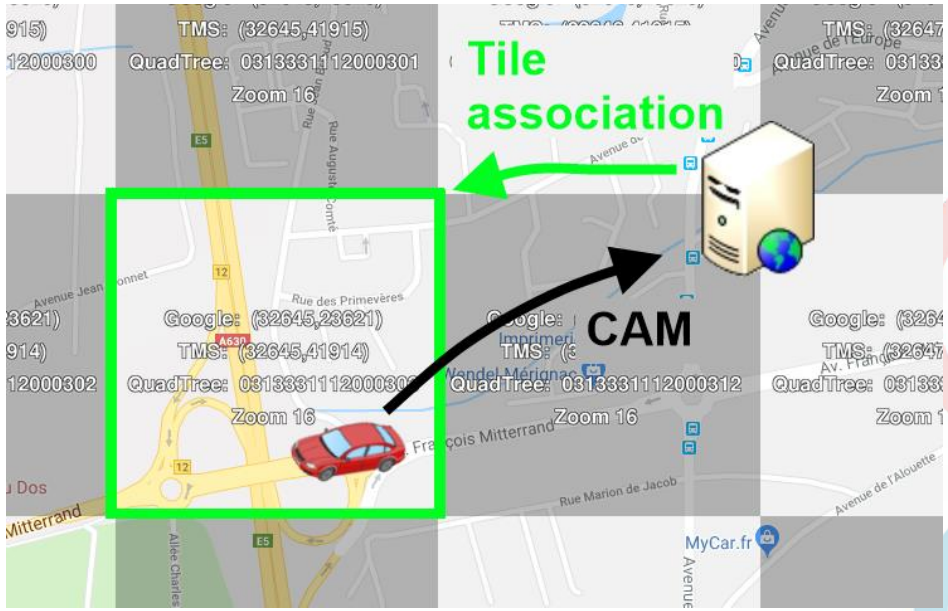
- Two strategies for dissemination towards vehicles relating to the architecture (IPV4 or IPV6)- **OEM choice** but National C-ITS can handle the two options
  - If direct connection and if the vehicle sends CAMs : thanks to CAM used for PVD, the position of each vehicle is linked to a tile (after that, the position is erased in order to respect Privacy) and only push relevant messages to vehicles listed in the database for a given tile
  - AMQP : publish/subscribe mechanism



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Conclusion

- Both architectures have been fully tested, including security a very large number of times, for a lot of different use-cases
- The work on SCOOP wave 2 made it possible to identify the advantages/drawbacks of the different types of architectures
  - Technically
  - And as part of a business model
- Now, the SCOOP is ready to be migrated to be fully in line with C-Roads specifications

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Security

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TELECOM Paris
IP PARIS
IDnomic

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Participants

- Télécom Paris, IDnomic, all SCOOP@F partners
- Associated partners: ANSSI, CNIL, Wavestone, Suppliers

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Security of SCOOP@F wave 1 & wave 2

Main objectifs

- Secure C-ITS use cases
- Secure C-ITS messages
- Secure V2X communications and protocols
- Privacy and data protection safeguards
- Interoperability at all levels

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Security of SCOOP@F Wave1

Day1 use cases, ITS-G5

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Context & security objectives

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- **Combination of wireless access technologies**
  - ITS-G5 /3G/Bluetooth/Wi-Fi,OBD,..
- **Diversity of com. modes**
  - Vehicle-to-Anything (V2X)
  - V2V, V2I, I2V, V2S
- Diversity of protocols
  - Transport, access,…
- ETSI C-ITS Release 1, Day 1 **use cases**

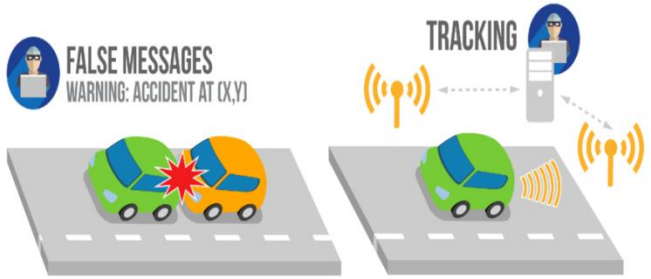
Multiple interfaces of communication

ITS-G5, Wi-Fi, Bluetooth, USB, OBD…

Weaknesses

Increase in the complexity of embedded systems and software

Cyber attacks



- On the vehicle (embedded system)
- On the infrastructure

How to secure the SCOOP@F system?
How to protect the exchanged messages?
How to trust received messages?
How to guarantee privacy?

- End-to-end security architecture
- Trusted C-ITS system
- Tradeoff between scalability, security, safety, performance and cost
- Ensure the protection of personal data

Compliance with ETSI security standards

- Specify / implement / test and validate security of the system
  - Secure V2X messages
  - Implement the certificate management system (**PKI**)
- Design an **interoperable** security system with the security systems of other C-ITS systems deployed across Europe.

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Risk analysis

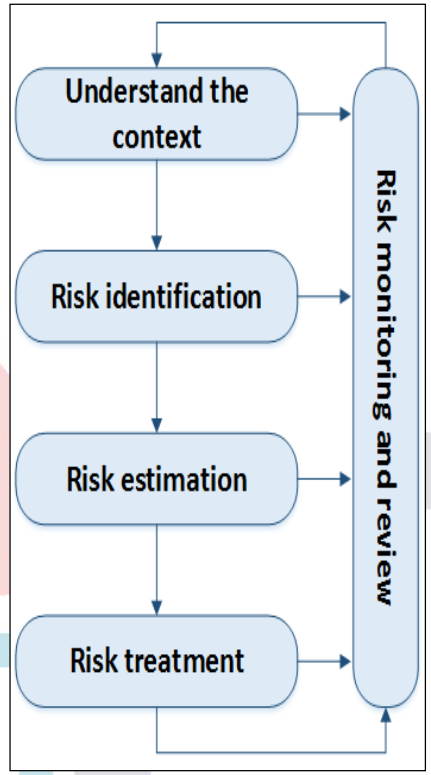
Analyze the risks of cyber attacks
- on the vehicle (embedded system)
- on the infrastructure

Define countermeasures and cyber protection/cyber defense solutions

Validated by ANSSI

- ❑ **An approach based on the EBIOS risk analysis methodology**
- ❑ **Compliance check with ETSI TVRA (TR 102 893 v1.1.1)**
- ❑ Security requirements related to use cases were identified
  - ❑ availability, integrity, confidentiality, non-repudiation/traceaability, privacy, authentication/autorization, plausibility
- ❑ **Risk scenarios were defined**

WAVESTONE



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Macro risks & entities

Risk scenarios have been classified according to several criteria :

- their usage
- the affected security needs
- the impacteds entities

4 Families of macro risks

- **Unavailability of SCOOP@F services**
- **Theft of user data**
- Data corruption, error in traffic management
- Disturbance of the controls of a vehicle

7 Entities

- **Vehicles**
- **RSUs**
- **SCOOP@F Platform**
- **ITS-G5**
- **Cellular network**
- **PKI**
- **Information systems of road operators**

Security/Protection Plan

A regrouping and a prioritization of the security measures to be put in place
The security actions to be implemented are grouped into 6 categories …

- Design secure access management
- Implement security measures in software design
- Design redundant and physically secure architectures
- Sustainability of operation and service
- Preserve vehicle safety
- Define a precise legal framework

…and prioritize according to the following conditions:

■■■ **High priority security measure**

■■□ **Medium priority security measure**

■□□ **Low priority security measure**

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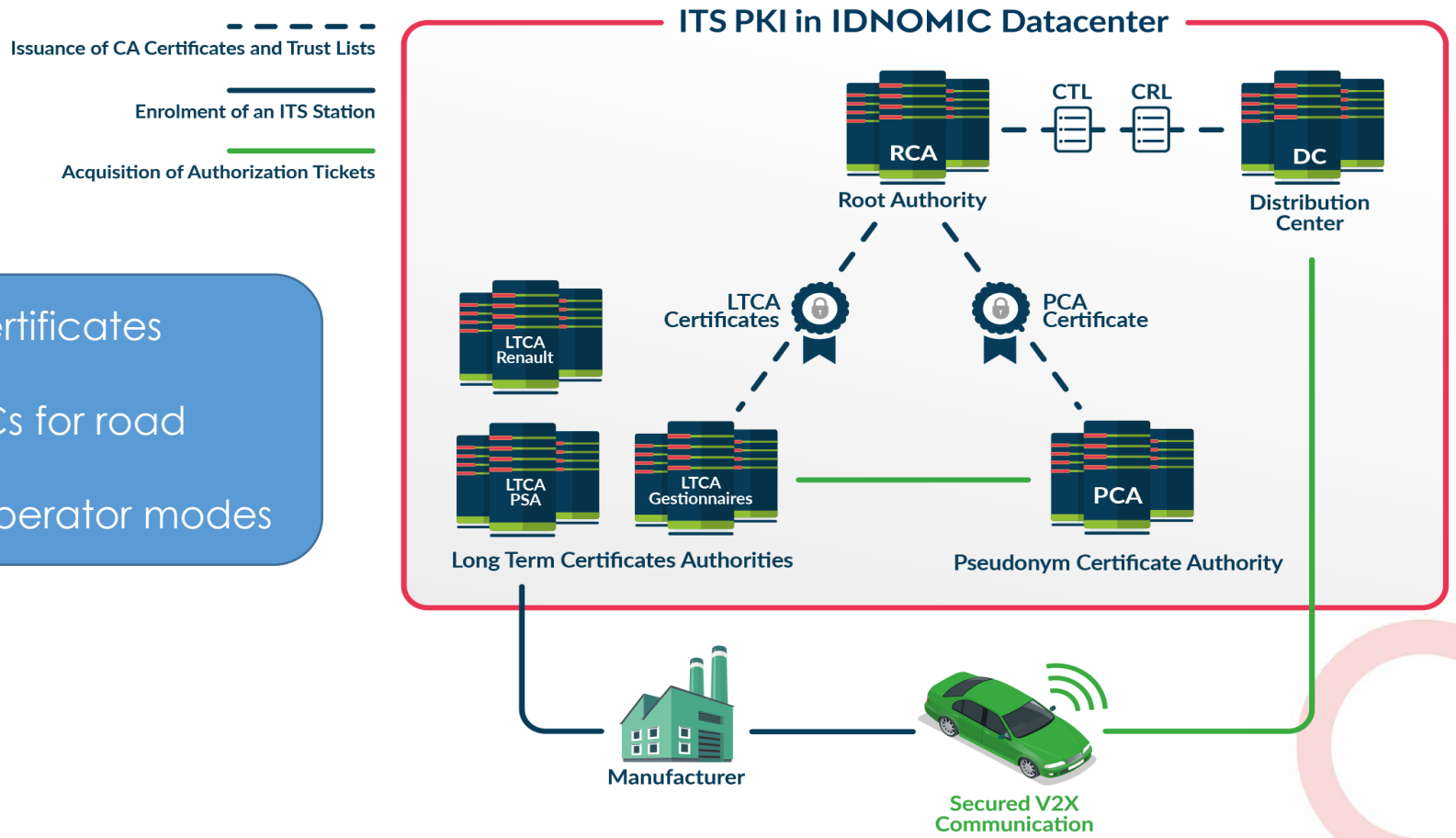
PKI

Trust model based on a hierarchical certification chain



- 2 types of certificates
  - LTC/ PC
- 2 types of PCs for road operators
  - user &operator modes

Collaboration with ISE project (IRT-SystemX)

A fully operational security solution

- ✓ designed and implemented
- ✓ compliant with ETSI standards(TS 103 097 v1.2.1, TS 102 941 v1.1.1,…)
- ✓ Certificate Policy(CP) and Certification Practice Statement(CPS)

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PKI

- **Root Certificate Authority (RCA):** is the root of trust for all certificates within the PKI hierarchy. It operates in an offline mode and is responsible for the management of LTCAs and PCAs (creation, security requirements authorizing the issuance of certificates to ITSSs).
- **Long Term Certificate Authority (LTCA):** is a security management entity responsible for the issuance of LTC and the validation of PCs as well as the management of the ITSSs (registration, status update, permissions…). It operates in an online mode.
- **Pseudonym Certificate Authority (PCA):** is a security management entity responsible for the delivery, the monitoring and the use of PCs. It operates in an online mode.
- **Distribution Centre (DC):** provides the ITSSs with the updated trust information such as TSL and CRL necessary to assure that received information is coming from legitimate and authorized ITSSs or PKI certification authority.

- **ITSS:** ITS station (vehicle, RSU)
- **Long Term Certificate (LTC):** gives its holder (ITSSs) the right to request PCs.
- **Pseudonym Certificate (PC):** gives its holder (ITSSs) the right to perform specific actions.
- **Certificate Revocation List (CRL):** is a list digitally signed by a CA that contains certificates identities that are no longer valid
- **Trusted Service List (TSL):** is a signed list which contains trusted RCAs, LTCAs and PCAs certificates and PKI service access points. This list is updated frequently.

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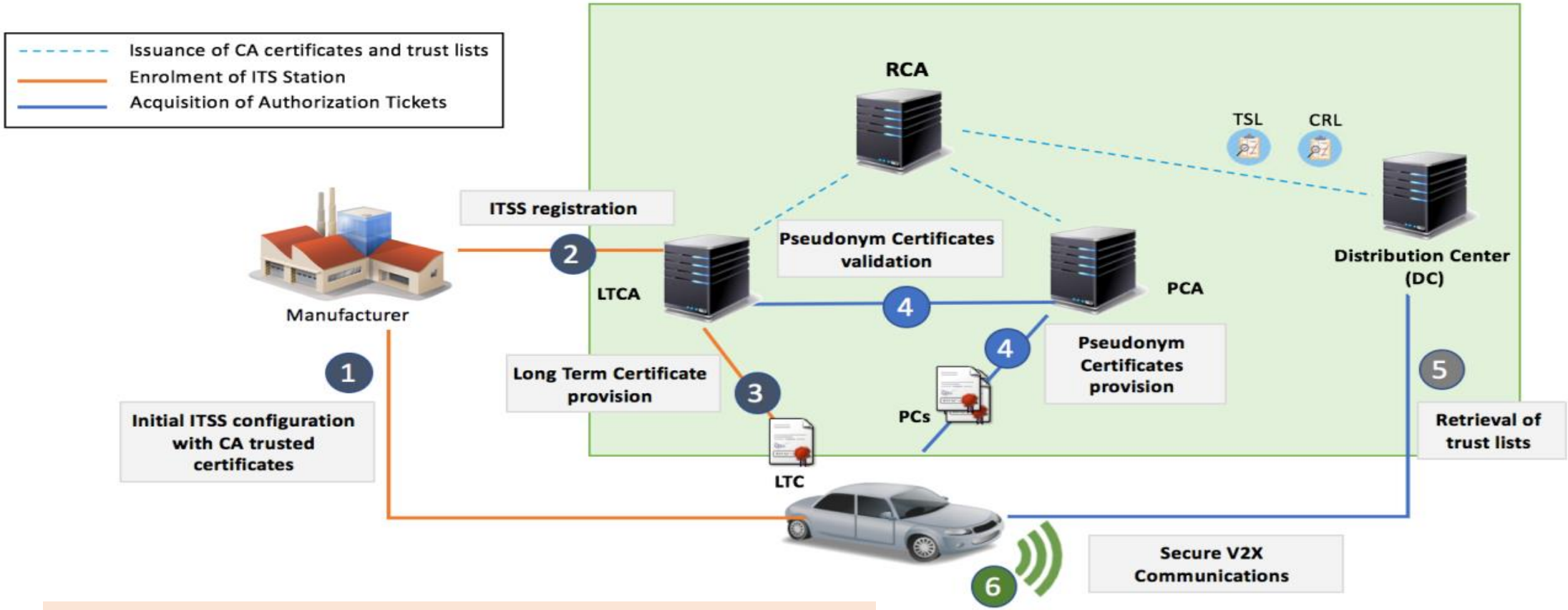
SCOOP@F wave 1 PKI : Lifecycle



All ommunications with PKI are encrypted !
SSPs have been defined for all C-ITS messages

A new defined message: ***CAM-I***
SCOOP@F CTL/CRL Formats defined

Secured protocols
PC download & log upload

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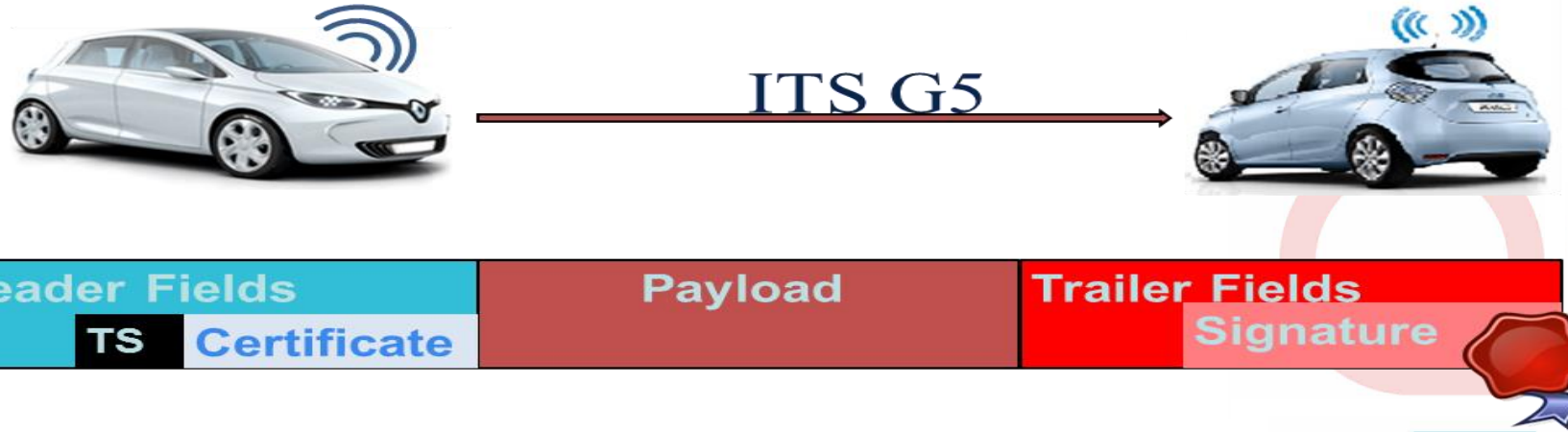
Secured C-ITS messages

- SENDER
  - Creates payload (**CAM, DENM**, **CAM-I**)
  - Add Header fields (Profile specified in ETSI TS103 097)
    - Adds current Pseudo Cert
    - Adds timestamp (+other check data)
  - Signs message

- RECEIVER
  - Checks header fields (Profiles ETSI TS103 097)
  - Checks certificate of sender
  - [once] Check certificates chain up to Root CA
  - Checks timestamp (and others)
  - Verifies signature



Authentification, Autorization, Non-repudiation, Anonymity

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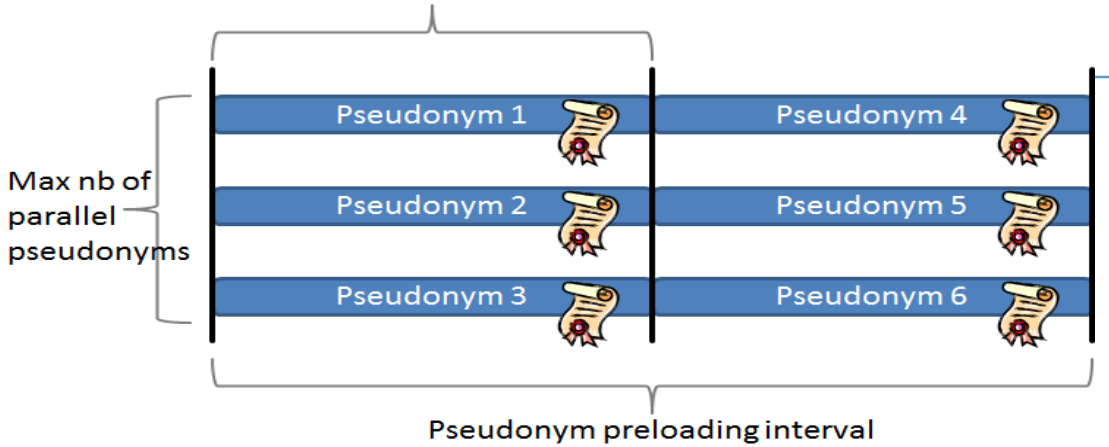
Privacy: change strategy of pseudonyms

- Privacy: Pseudonym Concept
  - Pseudonymous key pairs / certificates
  - Privacy Requirements
    - Sender Anonymity
    - Message unlinkability
- ITS stations have a pool of Pseudonym certificates (or Authorization Tickets)
- ITS stations change certificates regularly and all their identifiers
- Reloading of pseudonyms (or ATs) either on-line or off-line
- Key challenge: specify efficient pseudonym change strategies



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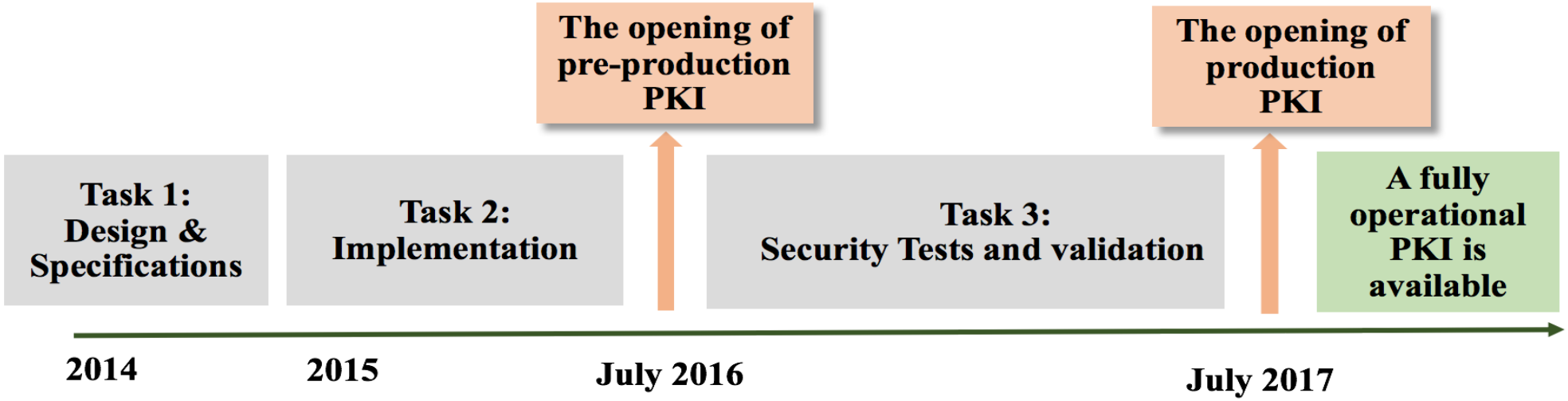
SCOOP@F wave 1 PKI: Achievement



key Ceremony of Production PKI (September 2016)

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Security of SCOOP@F wave 1: Tasks

- **Task 1: Specifications**
  - Used algorithms/protocols
  - Architecture
  - Interactions with the PKI
  - Access/registration

- **Task 2: Development**
  - PKI
  - Communication protocols with the PKI
  - Registration mechanism, ….

- **Task 3: Tests & validation**
  - PKI of test
  - Production PKI
  - Security Checklists and test plans for tests ontable and on roads
  - Test tool: TP Security Client Test

29 Deliverables …..

The latest available ETSI security standards were used
Release 2 published on the project web site
http://www.scoop.developpement-durable.gouv.fr/specifications-techniques-a22.htm

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Security of SCOOP@F Wave 2

New Day1/Day2 use cases
Hybrid ITS-G5&4G/LTE Communication,
Inter-PKIs interoperability

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New security objectives

Similar approach

- Combination of short-range and long-range wireless access technologies
  - ITS-G5 (IEEE 802.11p)
  - 4G/LTE
- Various communications types
  - V2V, V2I, I2V, **V2S**
- Diversity of protocols
  - Transport, TLS, IpSec, …
- New Day 1 use cases
- New use case: Device P2V
- New use case: smartphone application

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- **New versions of security standards**
- **EU trust model**
- **New C-ITS messages**
  - SPaT, MAP, IVI, POI, ETA
- **Definition of SSPs of the new messages**
- **Integration of new ITS stations inti the trust domain**
  - **Nfr-ITS-S**
  - **NAP-SER**

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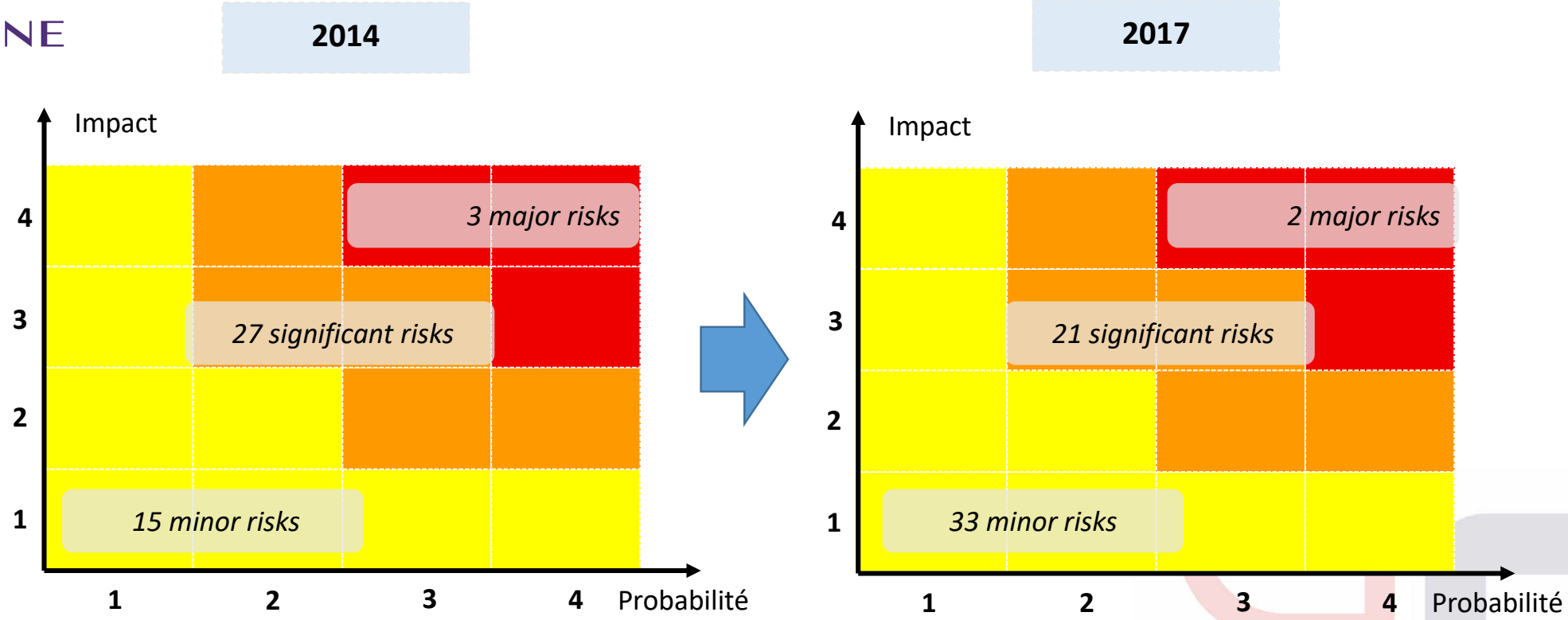
Risk Analysis – revision – July 2017

WAVESTONE



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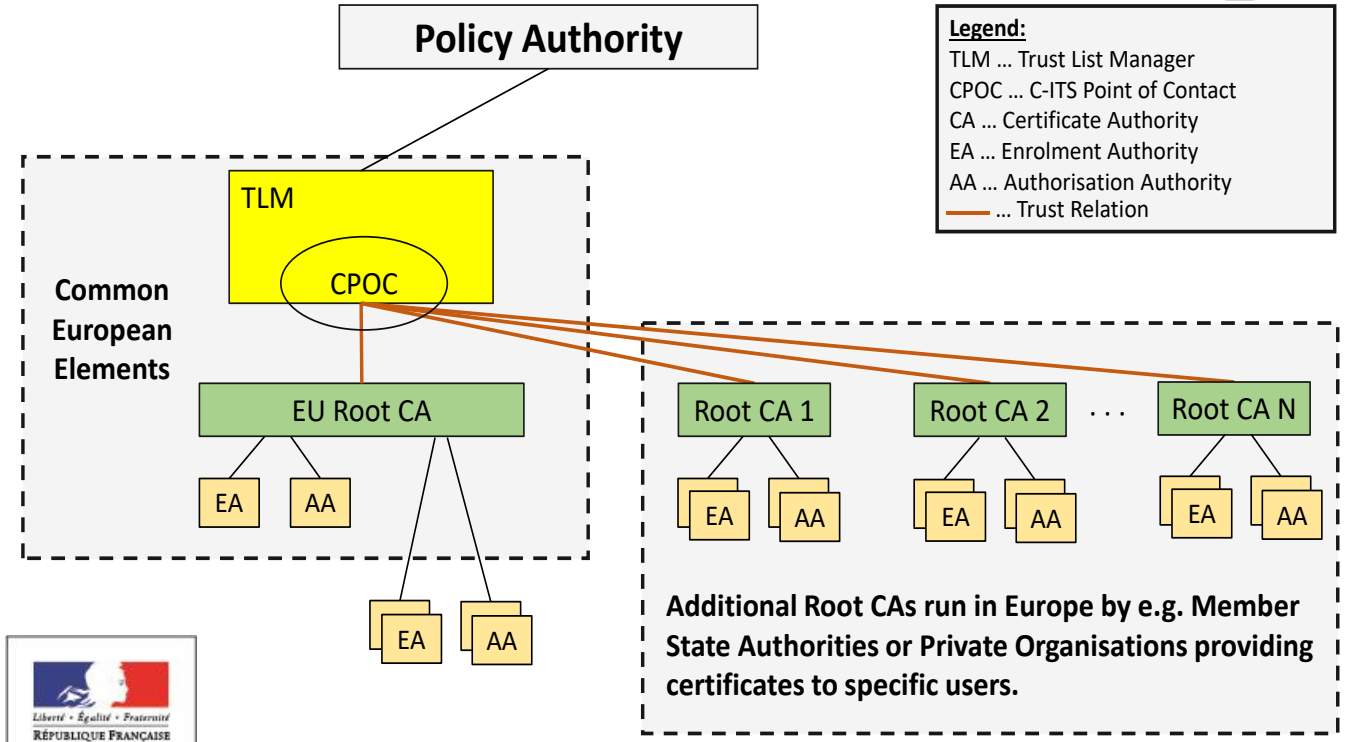
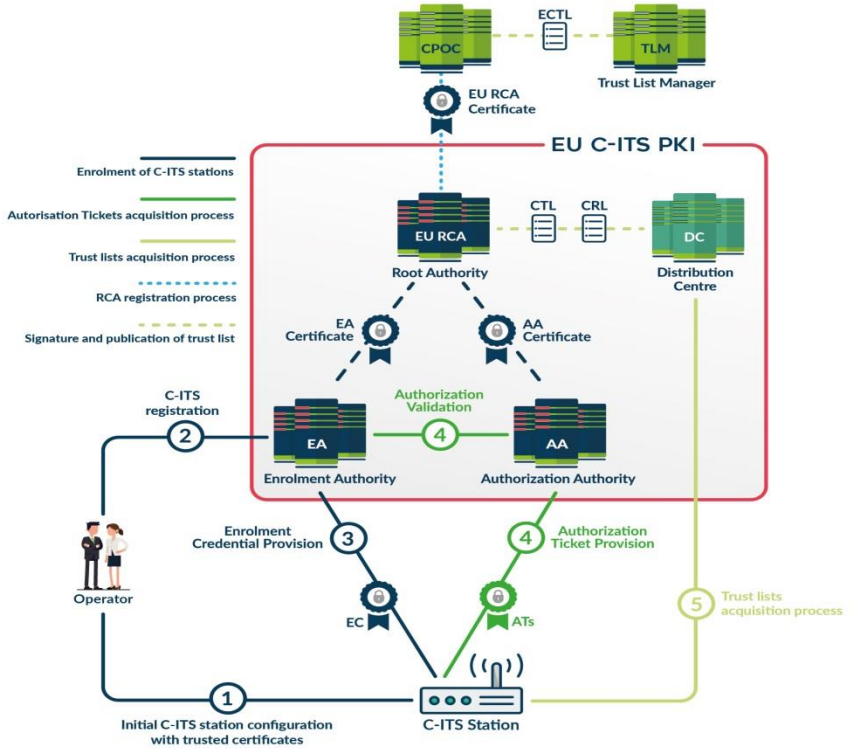
Risk evolution between 2014 and 2017

C-ITS Platform: EU trust model



Legend:
TLM … Trust List Manager
CPOC … C-ITS Point of Contact
CA … Certificate Authority
EA … Enrolment Authority
AA … Authorisation Authority
… Trust Relation



Source: European Commission
Certificate Policy, Release 1, Juillet 2017

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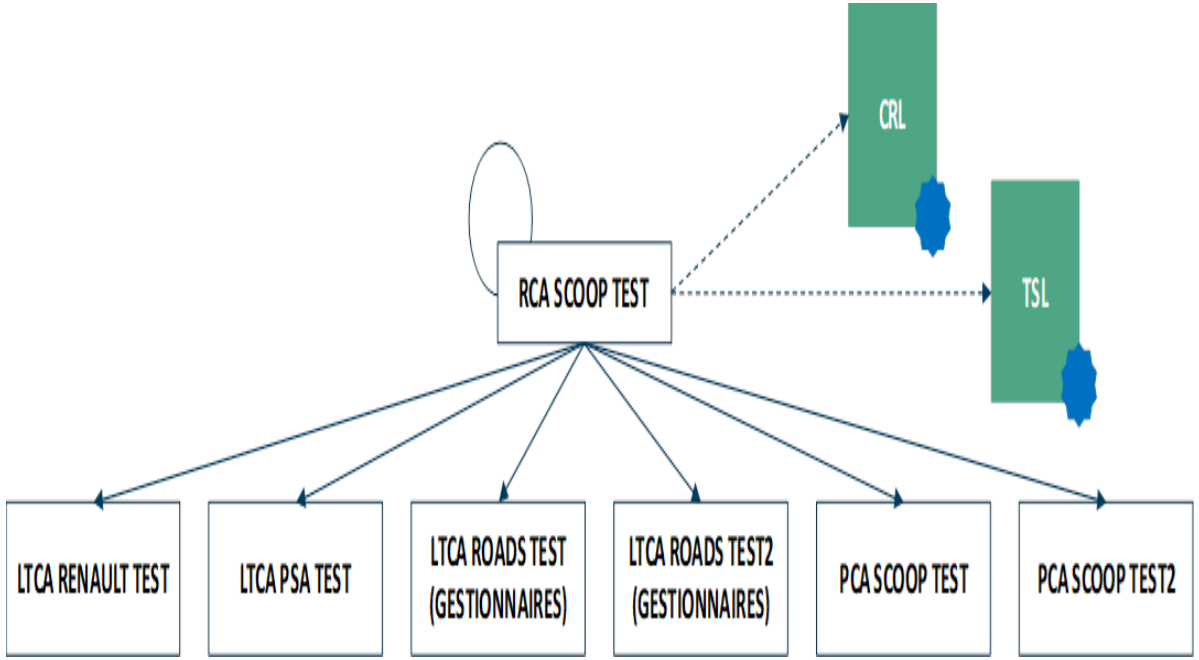
A validation PKI for Wave 2



- A new PCA SCOOP TEST2 to provide new ITS-AIDs for new messages C-ITS (SPAT, MAP, IVI, POI, ETA).
- A new LTCA ROADS TEST2 for road operators to provide new C-ITS messages

A migration process to set up an updated security solution

- ✓ designed and implemented
- ✓ compliant with ETSI standards (TS 103 097 v1.2.1, TS 102 941 v1.2.1,…)
- ✓ compliant with the EU trust model and the CP.

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Security of hybrid communications

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Architecture with a **Home Agent**

Architecture with car manufacturer **Platform**

Architecture of road operators

Use cases **GLOSA & P2V**

Use case Smartphone App.

Standards IETF & ETSI

End-to-end security IP mobility signaling security

Security at facilities layer proposed in 2017

Unadopted Solutions

TLS with ETSI/IEEE certificates

IPsec (Transport Mode) to secure signaling

TLS with X509 certificates to secure transport of C-ITS messages & DatexII

Mutual authentication

C-ITS messages signed according to TS 103097 v1.2.1

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Hybrid security

- PoCs IPv6 Mobility with IPsec/IKEv2
- Télécom Paris, IMT-Atlantique

TELECOM Paris

IP PARIS

IMT Atlantique
Bretagne-Pays de la Loire
École Mines-Télécom

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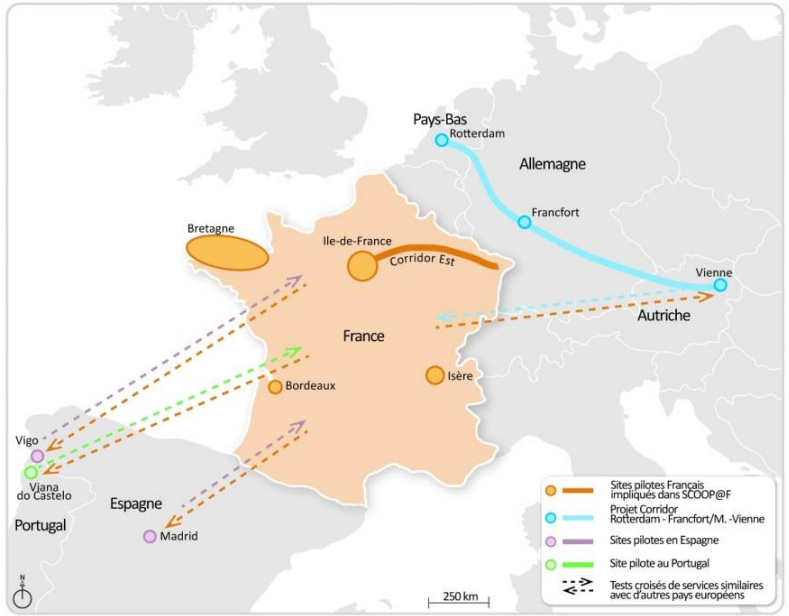
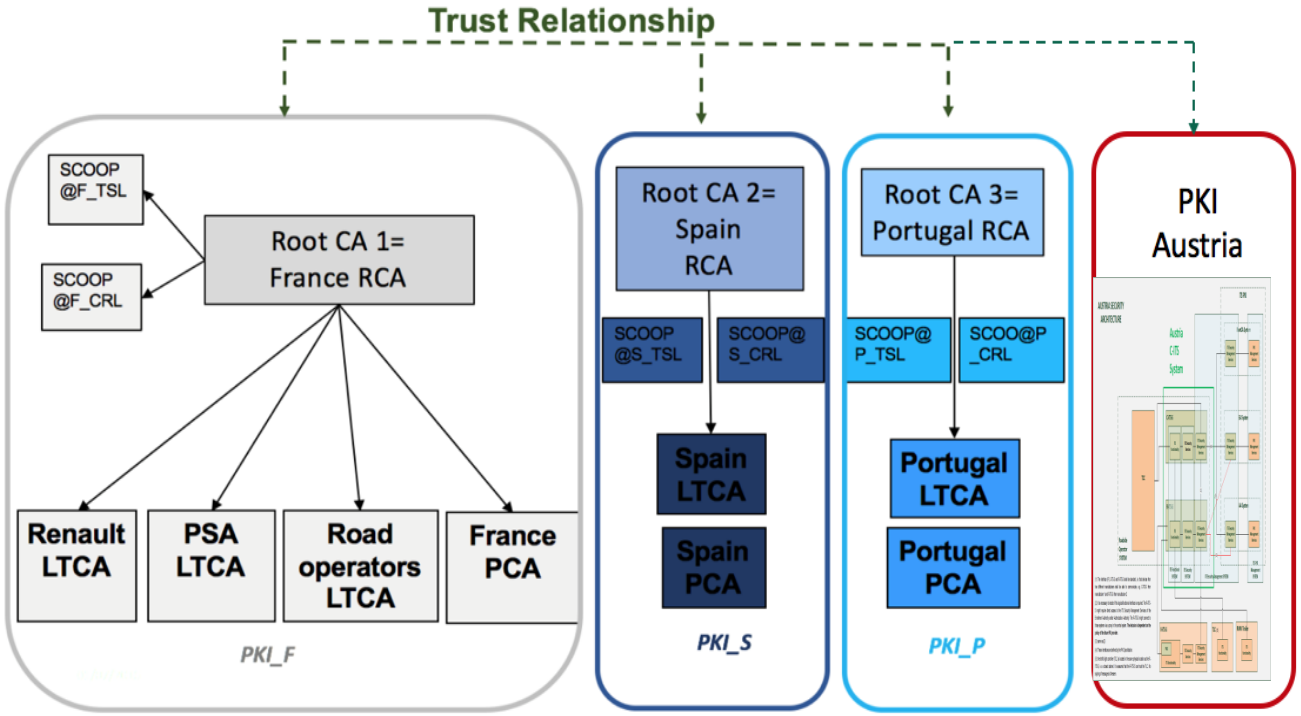
Crossed tests & inter-PKIs interoperability





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Security Tests

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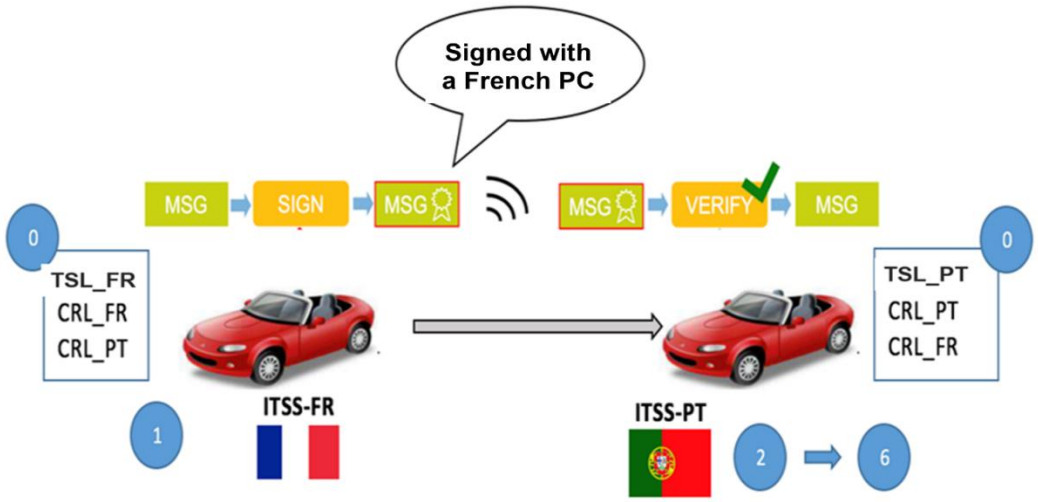
Test interopérabilité between 4 PKIs



Test ID	Description
Security TESTFEST_1	Verification of message signature received from a foreign ITSS and signed with a valid AT.
Security TESTFEST_2	Verification of message signature received from a foreign ITSS and signed with an AT issued by a revoked foreign AA.
Security TESTFEST_3	Verification of message signature received from a foreign ITSS and signed with a valid AT but the common InterCor_CRL has expired
Security TESTFEST_4	Verification of message signature received from a foreign ITSS and signed with an AT issued by a non-trusted foreign RCA.
Security TESTFEST_5	Verification of message signature received from a foreign ITSS and signed with a valid AT with a new updated InterCor_CTL

TS 103097 v1.2.1, TS 102941 v1.1.1
***SCOOP@F CTL/CRL Formats and* SSPs**

Signed C-ITS messages with preloaded PC/AT certificates, common CTL and preloaded CRLs

Verification of the validity of the trust chain
Verification of the signature
Verification of secured message

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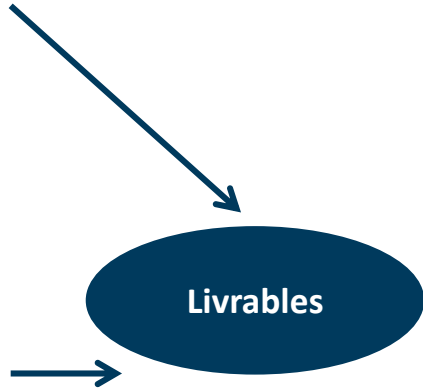
Security of SCOOP@F wave 2: Tasks

- **Task 1: Spécifications**
  - End-to-end security
  - inter-PKI interoperability
  - Interoperability for message security

- **Task 2: Development**
  - PKI
  - Update because of standards evolution

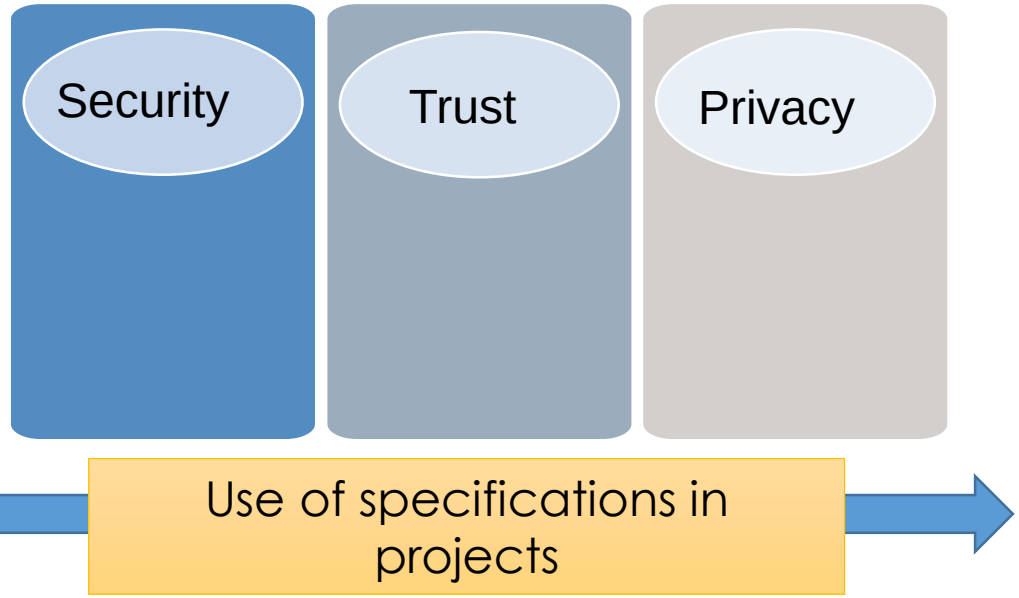
- **Task 3: Tests & validation**
  - Validation PKI
  - Checklists and tests plans
  - Scénarios of tests for crossed tests
  - Tools: TP Security Client Test, PoCs

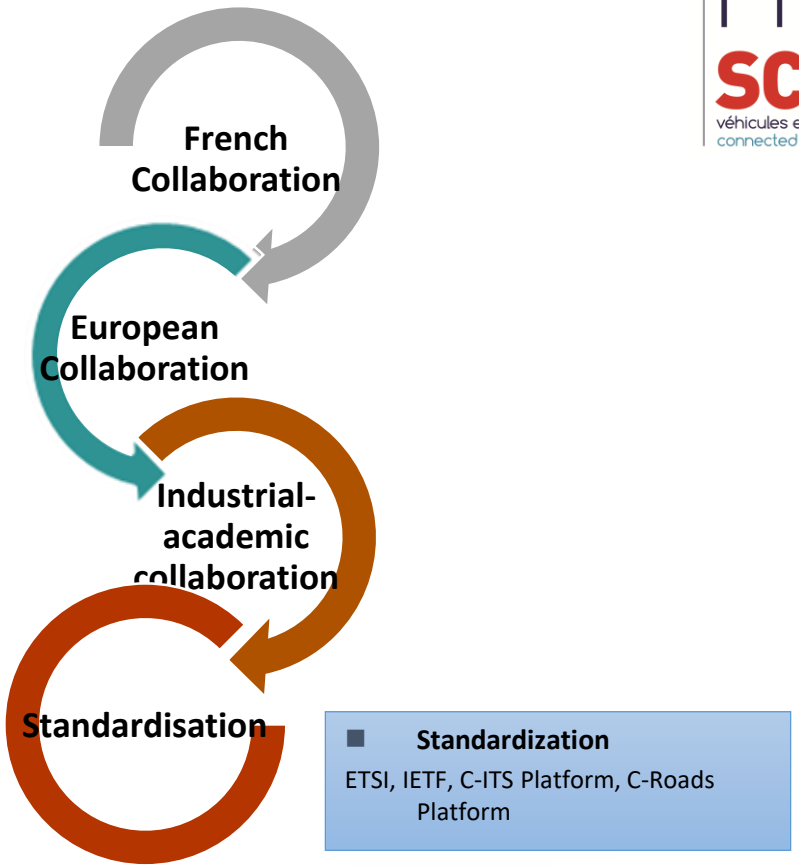


The latest available ETSI security standards were used
Release 2 published on the project web site
http://www.scoop.developpement-durable.gouv.fr/specifications-techniques-a22.htm

Visibility

A solid base of spécifications





- **EU C-ITS Platform**
  - Report C-ITS Platform Phase I, January 2016
  - EU C-ITS platform trust model
  - CP release 1, July 2017
  - Report C-ITS Platform Phase II, September 2017

InterCor

C-ROADS

InDID

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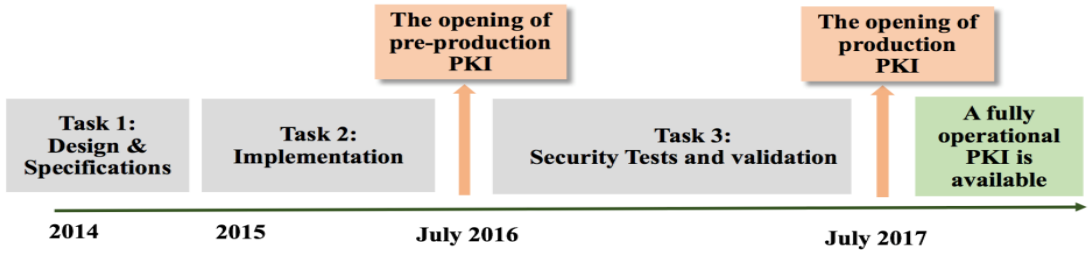
Key Achievements

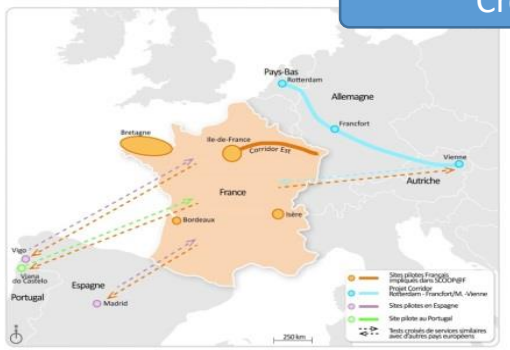


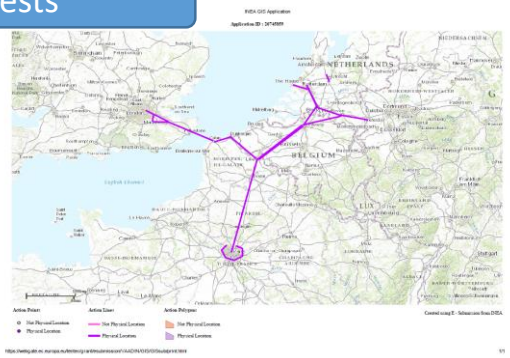
SCOOP@F PKI roduction, 9/2016

144 participants, 27 institutions - 11 countries
10 PKIs, 12 RSUs, 22 OBUs

TESTFEST#2 PKI-Security, Reims, April 2018

Crossed Tests





SCOOP@F2

InterCor

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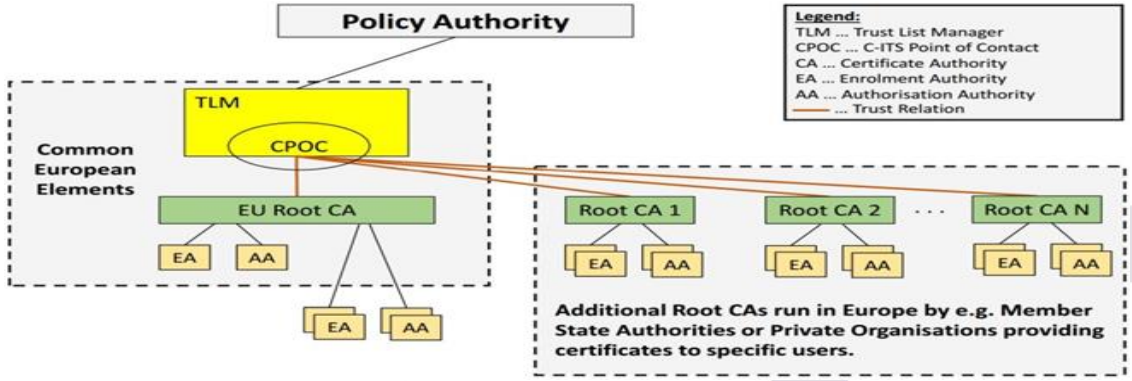

European trust model

Towards migration …
PoC for test of security standard TS 103097 v1.3.1
Collaboration Télécom Paris-NeoGLS

Matériel

RSU

OBU1

OBU2

Ordinateur 1

Ordinateur 2

Thank you for your attention

Contact

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Equipe CCN - Département INFRES- Télécom Paris

Email: houda.labiod@telecom-paris.fr

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connected vehicles and roads

Questions / answers

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THE SCOOP MOMENTS

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THE SCOOP METHOD

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Projet SCOOP
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Specifications

Marie-Christine ESPOSITO
(French Ministry of Transport)
(Former) SCOOP@F Technical project manager

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The SCOOP method

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- 1st step: definition of services – functional specifications
- 2nd step: technical specifications
- 3rd step: development
- 4th step: validation
- Following steps: deployment and evaluation

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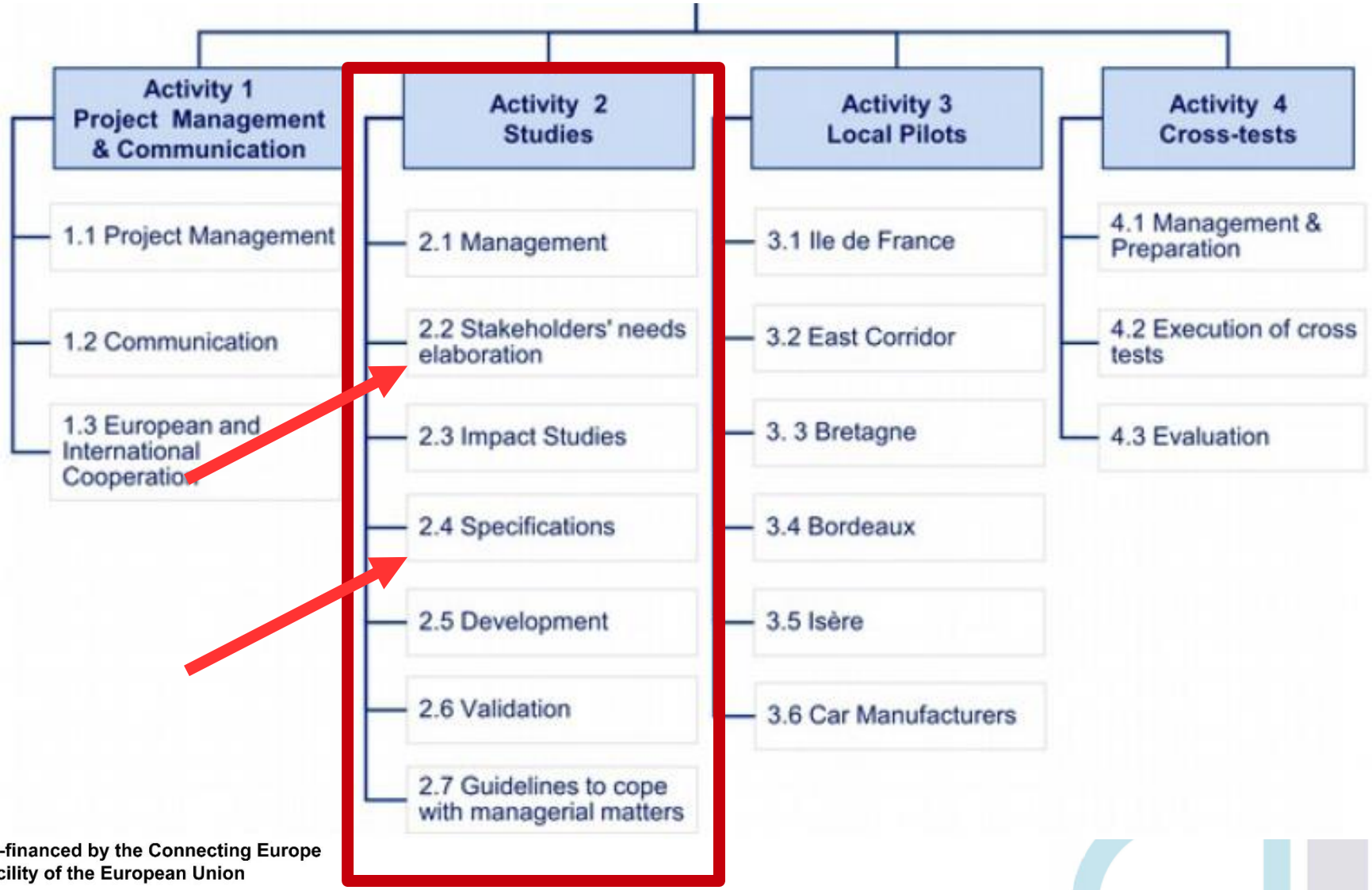
Activity 2 : studies



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First step: functional specifications

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- SCOOP@F Wave 1 process:
  - Definition of services declined in use-cases at a macro-level
  - Focus on road safety
  - Prioritisation of use-cases that were ready to be deployed (standards ready), especially day 1 services
  - Link with action b and action c priority use-cases

→ Difficulty to define properly the use-cases, each partner had a different understanding of it while deploying it

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First step: definition of services

- SCOOP@F Wave 2 & new projects (C-Roads France and French partners of InterCor) process:
  - Definition of services declined in use-cases at a micro-level, technologically agnostic
  - Focusing on the objective of the use-case taking into account each stakeholder involved
  - One message exchanged between different parties = one use-case

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First step: definition of services

- The template for description has been developed within InterCor, and is commonly agreed by the 4 countries involved (NL, UK, FR, Flanders)

- It's also mostly used by the C-Roads Platform

Use case introduction	
Summary	Here we provide a summary of the use cases (one or two lines)
Background	Here we describe the motivation/rationale of the use case
Objective	Here we describe the intended outcome of the use case
Desired behavior	Here we describe the behavior of the system and the intended behavior of users
Expected benefits	Here we described the added value and actor benefits
Use case description	
Situation	Here we describe one or more situations relevant to the use case
Logic of transmission	Here we describe the transmission logic (I2V, V2V, V2I, V2I2V… + broadcast / unicast / multicast)
Actors and relations	Here we list all relevant actors and their relation/interaction to the system and their role in the use case (incl. sender and receiver). The actors are: vehicle driver, road operator, service provider, end user, vulnerable road user and other. In particular : Sender and End-receiver.
Scenario	Here we describe the story of the use case based on a sequence of situations (e.g. initial and after), events and actions. With illustration. Sender and End-received should be addressed, in stakeholder neutral manner.
Use case implementation	
Implementation outlook	Here we provide a functional description of a typical implementation of the use cases
Functional architecture	Here we provide a high-level architecture (as in act2.1b) to illustrate the main components, interfaces, data flows and display principles.
Display / alert principle	Here we describe triggering conditions and what is displayed to the user when.
Functional and non-functional requirements	
Sources of information	Here we describe the necessary data
Standards	Here we list relevant standards
Constraints / dependencies	Here we describe constraints and dependencies that are requirements (if any) related to e.g. business, security, telecommunications, privacy, legal, human behavior, etc.

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First step: definition of services

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- Categories of 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

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First step: definition of services

Projet SCOOP
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- Categories of services
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SCOOP wave 1

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First step: definition of services

Projet SCOOP
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- Categories of services
  - A – Probe vehicle data
  - B – Road works warning (enhanced) SCOOP wave 2
  - C – Signage applications
  - D – Hazardous location notifications (WWD)
  - E – Traffic information and smart routing
  - F – Parking, park & ride, multimodality
  - G – Intersections
  - H – Traffic management
  - I – Vulnerable users
  - J – Logistics

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First step: definition of services

List of use-cases SCOOP wave 1/2

- A – Probe vehicle data
  - **A1** – Traffic data collection
  - **A2** – Probe vehicle data on detected events
  - **A3** – Probe vehicle data on declared events
- B – Road works warning
  - **B1a/b – Alert planned road works (RWW)**
  - **B2a** – Alert operator vehicle approaching
  - **B2b** – Alert operator vehicle in intervention
  - **B2c** – Alert operator vehicle in patrol
  - **B3a** – Winter maintenance – Salting in process
  - **B3b** – Winter maintenance – Snow removal in process
  - **B3c** – Winter maintenance – Alert vehicle moving
- E – Traffic information and smart routing
  - **E6** -Alert extreme weather conditions
- F – Parking, park and ride, multimodality
  - **F1 – Information on parking locations, availability and services**
- C – Signage applications
  - **C3 – In-vehicle signage (embedded VMS**)
- D– Hazardous location notifications
  - **D1** – Alert temporary slippery road
  - **D2a** – Alert animal on the road
  - **D2b** – Alert people on the road
  - **D3** – Alert obstacle on the road
  - **D4** – Alert stationary vehicle / breakdown
  - **D5** – Alert accident area
  - **D6** – Alert reduced visibility
  - **D7 – Alert wrong way driving**
  - **D8** – Alert blockage of a road
  - **D10** – Alert emergency brake
  - **D11** – Alert end of queue

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Second step : specifications

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- After sharing the definitions of services:
  - Elaboration the detailed functional description of the use-cases within the architecture (not technologically agnostic there)
  - Precise study of the available standards to technically define the use-cases and then the common specifications of all partners
  - Specifications of the different components

- Nearly 30 deliverables of specifications were needed in wave 1
  - Necessity to share between the partners
  - Shows the lacks in the standards

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Specifications wave 1

- 2.4.1 category – common specifications

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

Specification of communication profiles and content of CAM, CAM-I and DENM messages

Specification of logs and their collection

Specification of Datex II messages in conjunction with CAM and DENM

Specification of technical architecture

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Specifications wave 1

- 2.4.2 and 2.4.3 categories – specifications of individual components
- 2.4.4 category – specifications of security elements

Specification of RSU and OBU for road operators

Specification of car manufacturers OBU

Specification of SCOOP platform

Specification of security elements

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

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Specifications wave 2

- All of those deliverables have been either updated or completed by a new one within SCOOP wave 2

New use-cases

Deliverables impacted by both new use-cases and hybrid architecture

Hybrid architecture

Reference	Title
2.4.1	Common set of functional and technical specifications
2.4.1_Bis	List of standards
2.4.1_H	Deliverable functional and technical hybrid architecture - Common specifications
2.4.1_appendix 1	Renewal of PC & Upload of LOGS
2.4.1.2	Specifications of DENM fields
2.4.1.2_H	Common technical specifications for use cases - Master document
2.4.1.2_H	Master_annexe IISR9
2.4.1.2_H	D7 - WWD - Wrong Way Driving
2.4.1.2_H	C3 - eVMS - embedded VMS
2.4.1.2_H	B1a & B1b - RWW+ - Road Work Warning Enhanced
2.4.1.2_H	F1 - Information on parking lots, location, availability and services (I2V)
2.4.1.3	LOGs specification
2.4.1.4_H	Specification of Datex II v2.3 messages in conjunction with C-ITS and annexes :
	ANNEXE 1 _ Datex II adapted for DENM between PF and R-ITS-S
	ANNEXE 2 _ Datex II v2.3 between TCC and Platform
	ANNEXE 3 _ Datex II adapted for IVI between PF and R-ITS-S
	DATEXIISchema_2_2_3_C-ITS-Sdatex .xsd
2.4.1.5	Network architecture for road operators
2.4.1.6	IPv6 addressing over G5
2.4.2.1_H	ITSS-R Specifications
2.4.2.2	OBU specification for road operators
2.4.2.2_Bis	Specification of the SCOOP Software for vRo-ITS-S
2.4.2.2_Tcr	Management of displays on the MMIs of road operator OBUs
2.4.2.4_H	LTE/ITS-G5 Hybrid architecture french national central ITS station specifications
2.4.3.1_H	TMS-ro Specifications
2.4.3.2_H	Detailed functional specifications of local scoop platform
2.4.4.1	Analysis of safety objectives
2.4.4.2	Security Risk analysis
2.4.4.2_Bis	Security Risk analysis - Appendix
2.4.4.3	Comparison between the risk analysis performed by Solucom and [...] in [...] 102 893
2.4.4.4	State of the art of public key infrastructures for cooperative ITS
2.4.4.5	PKI system requirements specifications - v1.1
2.4.4.6	PKI architecture and technical specifications
2.4.4.6_Bis	Use case scenarios with security data
2.4.4.7	Strategies for changing pseudonyms and sizing the PKI traffic
2.4.4.9	SCOOP@France Certificate Policy
2.4.4.11_H	Hybrid end-to-end security specifications

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Second step : specifications

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- Production of deliverables : scoping, structuring, production, proofreading, approval
- Validation of each step of the production of the deliverables :
  - Only during a Steering Committee for Studies (once a month)
  - Approval only after a complete review process involving all partners
- Release 4 of specifications in the USB drive!
  - With C-Roads France : specifications to be updated to take into account new standards (migration)
- Total number of deliverables: more than 38

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Developments

Marie-Christine ESPOSITO
(French Ministry of Transport)
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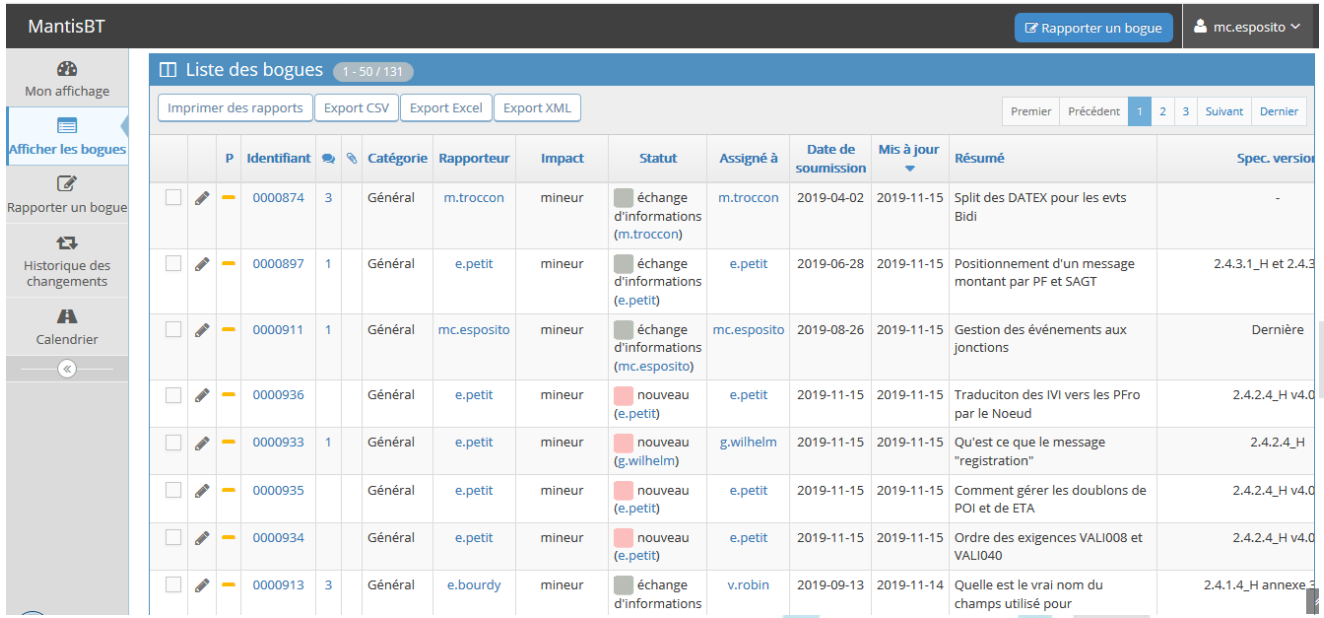
Third step : development

- After the specifications, the developments started
- Those provided feedbacks on the initial specifications (more than 900 questions needed to be resolved over the whole project)



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Third step : development in wave 2

Projet SCOOP
véhicules et routes connectés
connected vehicles and roads

- **Bilateral tests**
  - Bilateral tests during developments were done to ensure a smooth validation
- **Proofs of concept**
  - Hybrid security POC
  - Hybrid seamless LTE/ITS-G5 POC (with IPv6 over ITS-G5)
  - Those 2 developed POC helped consolidate the hybrid specifications before deployment
- Total number of shared deliverables: 48

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Development : suppliers

- **Renault : LGE**
- **PSA : CTAG**
- **Road operators :**
  - **Lacroix**
  - **neoGLS**
  - **Yogoko**
  - **Valeo**
- **Both : Marben**

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LG Electronics in SCOOP@F

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LG Electronics in Connected and Automated Mobility

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Connectivity
- V2X /In-vehicle Network
- Cyber Security
- Hybrid-V2X [DSRC+4G/5G Cellular]

Automated Driving
- Sensor Fusion
- Urban/Highway AD
- Mobility Shuttle AD/Remoted Driving

5G Telematics

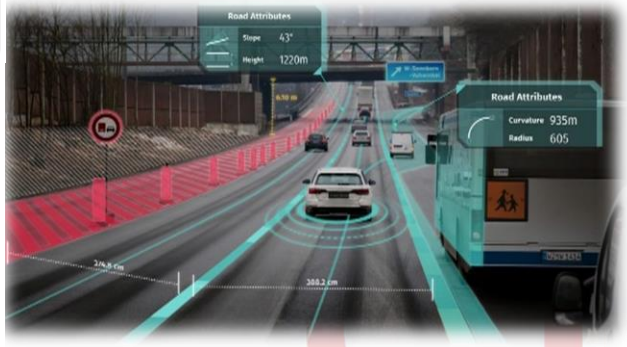
5G Telematics Control Unit
- Ultra Low-latency
- Massive Connectivity
- Extreme Throughput
- 5G associated in-vehicle architecture design
- High speed network

Key Use Cases
- V2N See-Through
- Big Data Processing(AI, HD-Map)
- Remote Driving & Monitoring
- Cloud Computing

Radar

Middle Range Radar
- 77GHz CMOS MMIC & CDM-based MIMO Technology
- High Performance with Low Cost
- Radar Only AEB(Pedestrian, Target Height Classification)

Short Range Radar
- 76~81GHz Ultra Wide Band
- Multi Functional Surround
  - Far range by 77GHz and Near accurate range by 79GHz
- Radar SLAM



LiDAR

Scanning LiDAR with MEMS Mirror
- Non-motoring Structure
- Compact Size
- Long Range Detection

Electronic Horizon

Electronics Horizon with HD-Map
- ADASIS Standard V3
- Efficient HD-map Caching/Update
- Sensor Data Collection
- HD-Map fusion with V2X data for AD system

HD-Map ECU
- Flash-memory lifespan estimation and enhancement
- Improving driving comfort, fuel efficiency and safety
- Providing dynamic information to ADAS/AD system

Camera

Mono Camera
- Advanced Features for NCAP 2020
- Wide FoV for High Speed Cross Traffic Scenario
- Next Generation Hardware Ips for High Performance SoC

Deep Neural Network
- Embedded DNN Algorithm & Optimization
- Real-time Inference Engine

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LG Electronics in SCOOP@F

Phase-I (2014~2017) : ITS-G5 OBU + HMI (R-LINK)
Phase-II (2017~2019) : Hybrid : ITS-G5 + Tablet (4G+HMI)
Phase-III (2018~2020) : C-ROADS Interoperability

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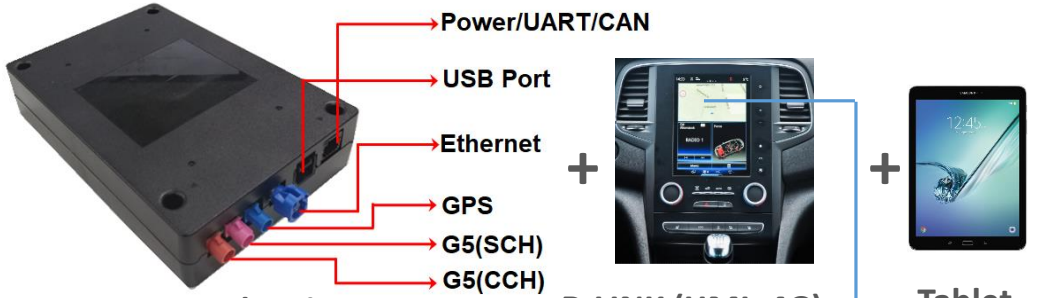
LGE Contribution in SCOOP@F

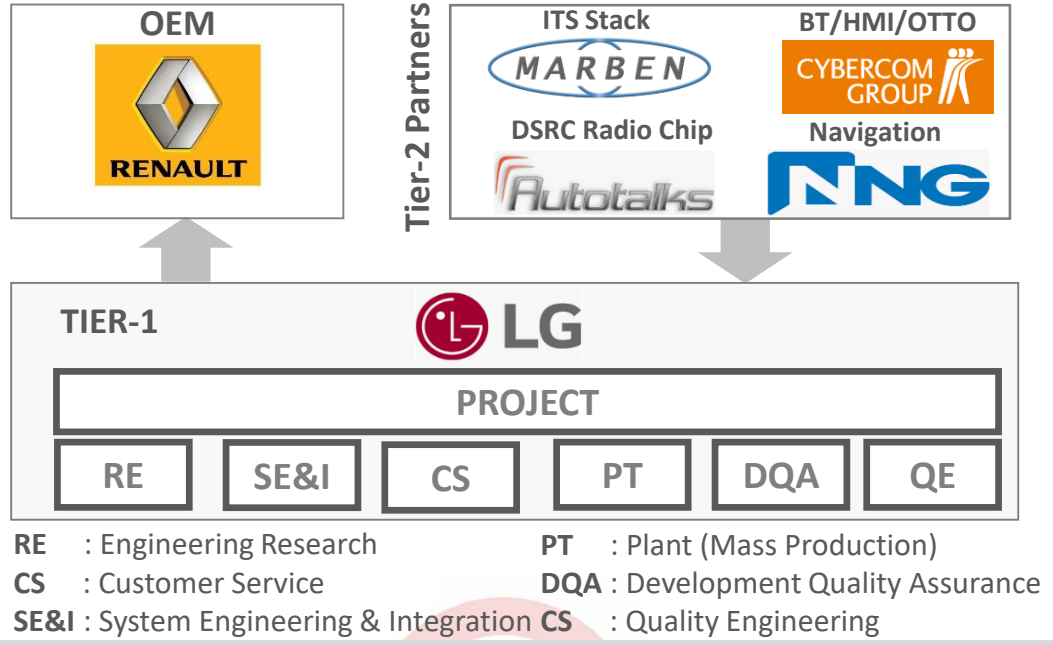


V2X On-Board-Unit + R-LINK (HMI+4G) + Tablet (4G+HMI)

- Contribution to SCOOP@F (Co-funded with Renault)
- Fully Validated V2X On-Board-Unit
- Certified for EMC, CE, Bluetooth
- ETSI Compliance ITS Stack Ported
- Fully validated Use Cases using OTTO tool
- PC-based system OBU Configuration and Management tool
- HU Navigation Integrated HMI (perhaps the world's first of its kind)

EMC : Electro Magnetic Compatibility
CE : *Conformité Européenne*

Organization Structure



RE : Engineering Research
CS : Customer Service
SE&I : System Engineering & Integration
PT : Plant (Mass Production)
DQA : Development Quality Assurance
CS : Quality Engineering

Interactive HMI for V2X Services on R-LINK & Tablet

Event Display on Navigation

Circular Range Events

HMI User Event Generation

Supplier Innovation Award from Renault

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Cybercom in SCOOP@F

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- Innovative IT consultancy firm helping clients capture opportunities in a connected world
- 1 300 employees in 5 countries
- Specialties: - Connectivity - Secure - Internet of Things - Managed Cloud Services
- 15+ years of software IP Licensing to the automotive industry

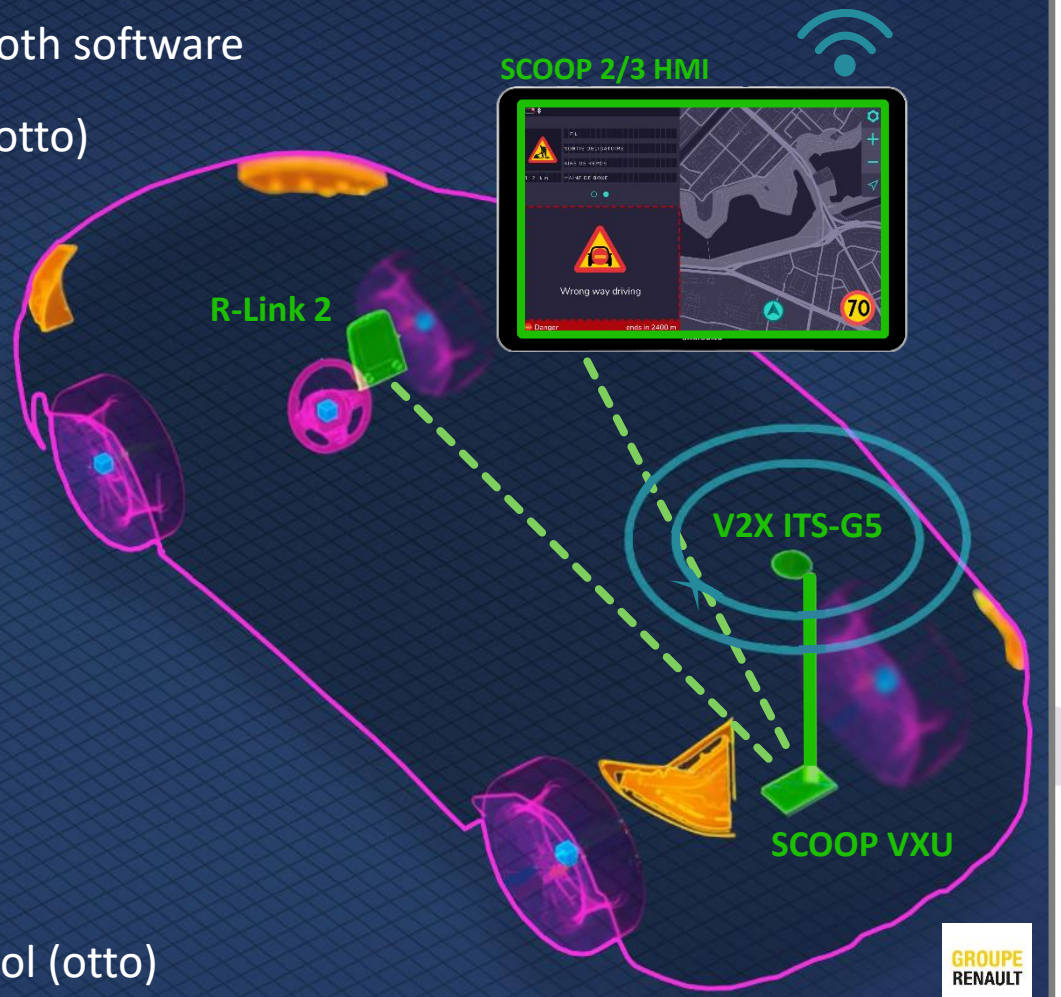
blueGO BY CYBERCOM **50+ million** cars with Cybercom Bluetooth software

osCar BY CYBERCOM V2X software SDK and osCar test tool (otto)

CYBERCOM GROUP

SCOOP@F

- **O**verall system software integration responsibility
- HMI design and development
- Wireless communication link design and integration
  - R-Link 2
  - SCOOP VXU
  - HMI Tablet
- Cellular communication to National Node
- Test and verification
- Technical support
- Interoperability testing using osCar and osCar test tool (otto)



GROUPE RENAULT

Picture origin: SCOOP movie https://youtu.be/edAfZR2fpqw

CTAG-PSA collaboration

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- Management and validation of Cohda MK5 customization (HW level).
- Provision of CTAG V2X SW stack (Network, Transport, Facilities & Security(cryptographic functions by Trialog)).
- Development of SCOOP applications and logging system.
- Development of tailored SW gateways for
  - Obtention of in vehicle information via CAN.
  - Communication with HMI serial device (Magneti Marelli SMEG).
  - Logging in external device (LAB DAS).
  - Communication with cellular communication box(Orange).
- Pre-validation of SCOOP system at CTAG facilities and support during official SCOOP validation tests.

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City LACROIX

Our Scoop@F adventure

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Providing our customers with Equipment for a smarter and more sustainable world

LACROIX City

Own-brand equipment for **smart road** infrastructure management

- Street lighting
- Signage
- Traffic management
- V2X

LACROIX Environment

Own-brand equipment for **water and energy** infrastructure management

- Energy
- Wastewater treatment
- Drinking water

LACROIX Electronics

Design and manufacturing of embedded systems and connected devices for its **professional customers**

- Automotive
- Home automation
- Civil & Defense avionics
- Healthcare
- Industry

SMART MOBILITY
LACROIX City
€98M revenue
21%

SMART ENVIRONMENT
LACROIX Sofrel
€40M revenue
9%

SMART INDUSTRIES
LACROIX Elec.
€330M revenue
70%

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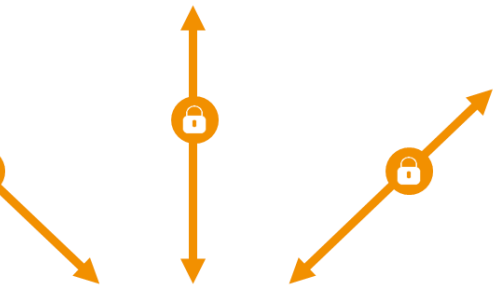
Our Scoop & Evolutive C-ITS offer

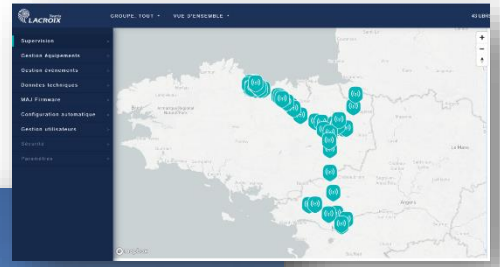
Roadside Unit
Neavia V2I Station
OEM

Roadside Unit
Neavia V2I Station
OUTDOOR

Onboard Unit
Neavia V2V Unit



V2X Server



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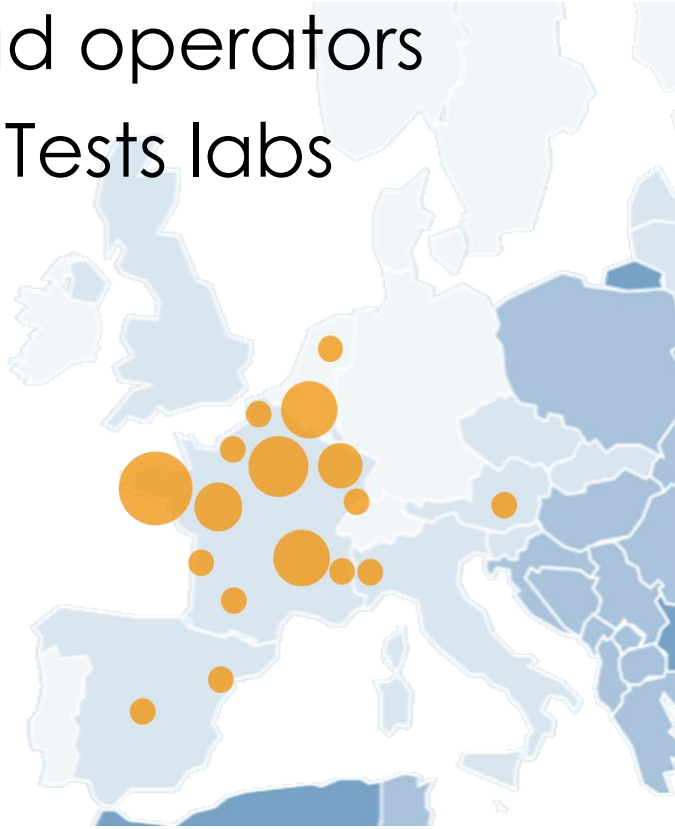
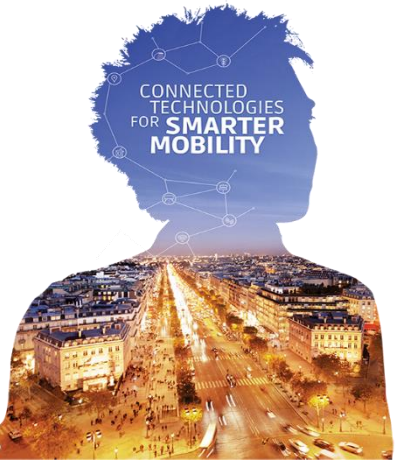
To Scoop@WORLD concepts

- Strong relationships with pioneers Road operators
- Scoop, C-Roads, EVRA frameworks & Tests labs
- France, Spain, Belgium, US, CA



- Connected Highways
  - Smart City
  - Autonomous mobility



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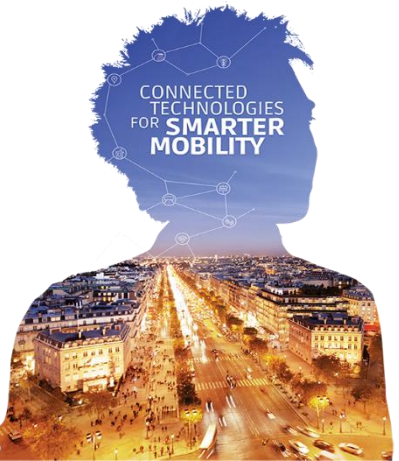
One vision to face C-ITS revolution

- Tech Investments / Collaborative R&D

- 2021, new French 4.0 Electronics plant



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NeoGLS
Intelligent Transport

Projet SCOOP
véhicules et routes connectés
connected vehicles and roads

NeoGLS

André Perpey, CEO

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NeoGLS
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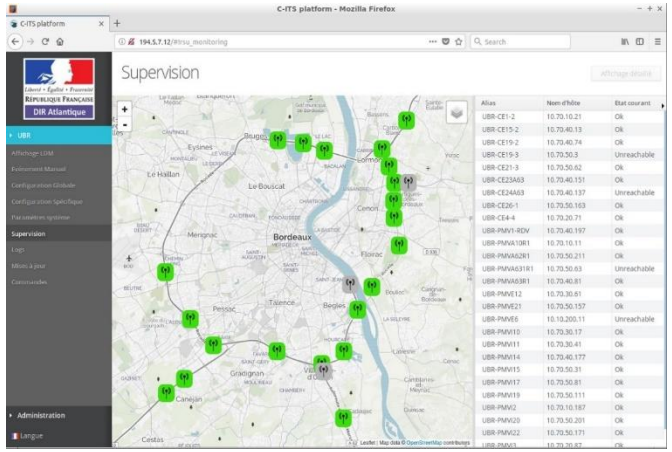
Software

- Scoop tablet application POC/tests
- Scoop use cases
- Platform for configuration/maintenance
- Exploitation platform
- ITS stack
- Scoop tablet application
- Road operator specific tablet application
- Scoop server



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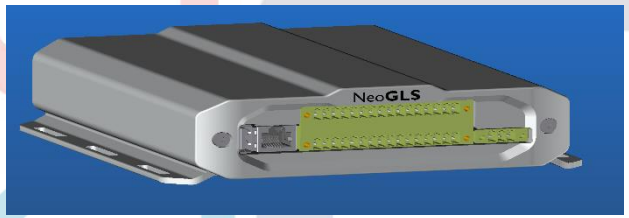
Material

- Integration of C-ITS material
- Scoop deployment DIRA/SANEF/…
- RSU Scoop : 40
- OBU Scoop : 26
- Development of our own material



Scoop, C-Roads, InterCor
Complete solution

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YoGoKo

Communication solutions for connected & cooperative mobility

Thierry Ernst

contact@yogoko.fr / www.yogoko.com

@YoGoKoCEO / @YoGoKoFR

YoGoKo

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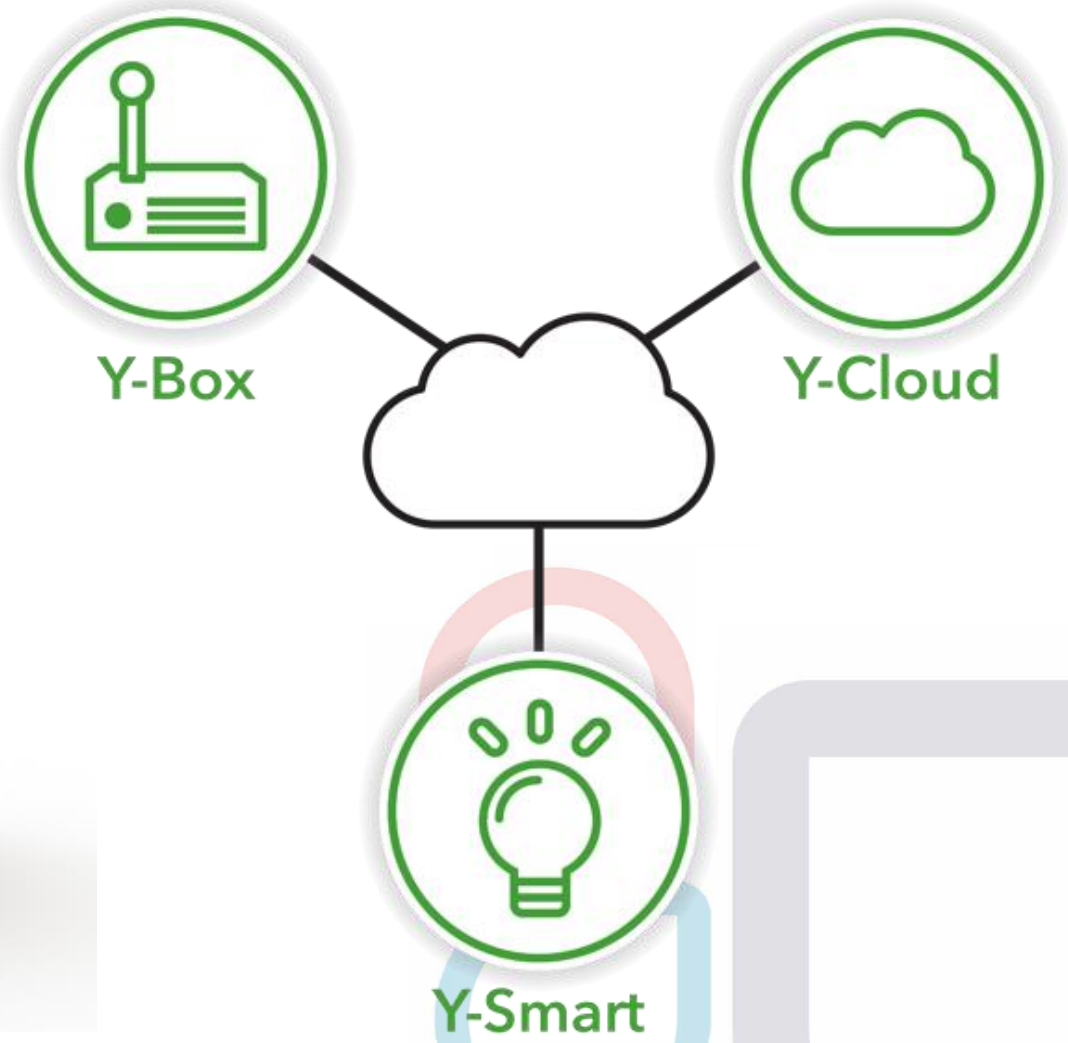
YoGoKo communication system

Customized C-ITS services

YoGoKo Y-SMART
Software platform

YoGoKo Y-BOX
Hardware platform
Equipped with ITS-G5 & cell

YoGoKo



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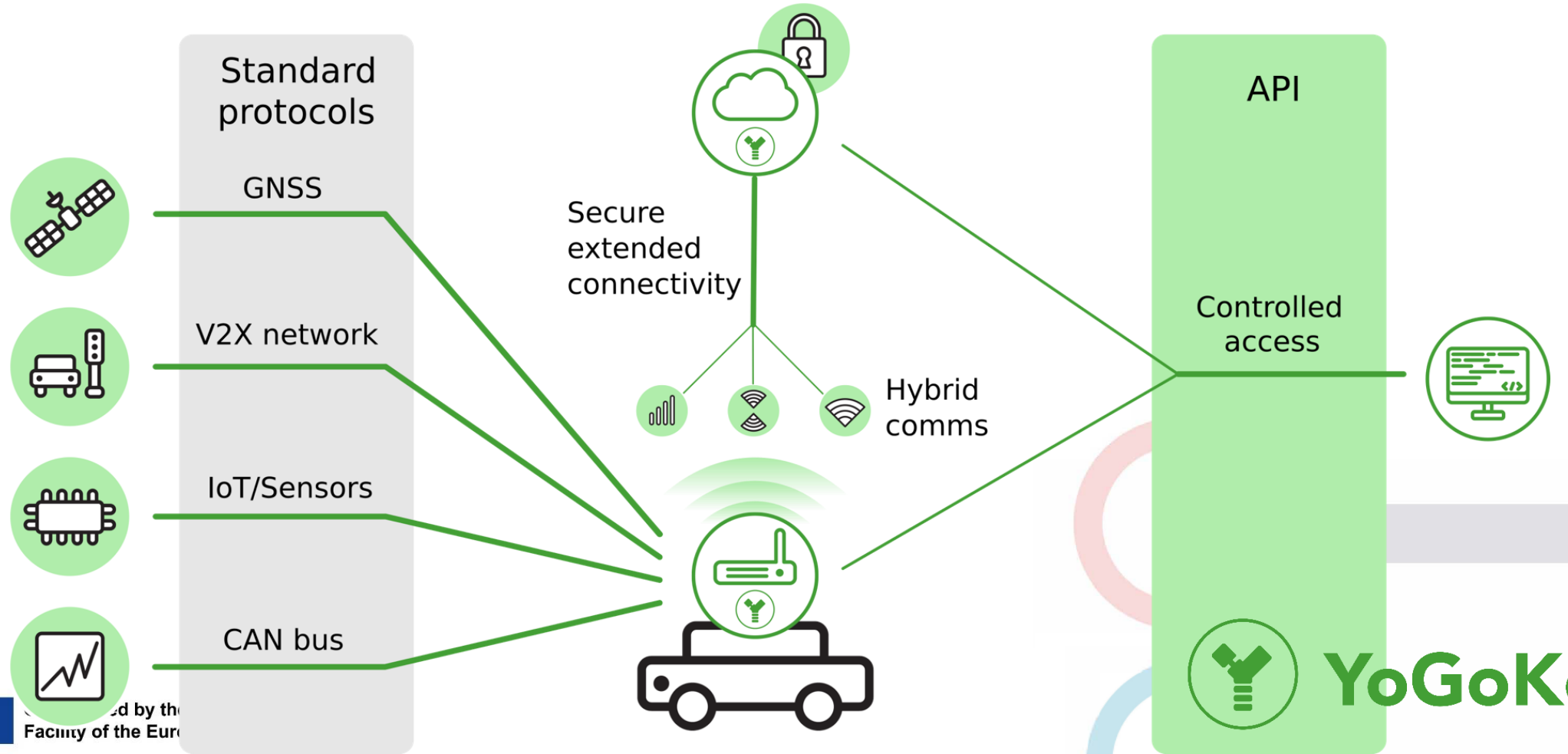
YoGoKo communication system



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Facility of the Eur

Provider of vehicle ITS stations

- 200 vehicles equipped by YoGoKo in Brittany (DIR Ouest and partners)
  - Road maintenance vehicles
  - Police vehicles
  - Coaches (Transdev / Keolis)

- YoGoKo hybrid communication system (Y-BOX hardware with Y-SMART software)
  - ITS-G5 for V2X localized communications
  - Cellular for remote connectivity to control center

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Hybrid communication solutions

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VALEO

Emine Naouar, *SCOOP Software Lead*

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SCOOP Specifications

UTIC de Base Middleware

SCOOP UTIC Application

SCOOP Tablet Application

Metier Tablet Application

SCOOP Server

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SCOOP Specifications

UTIC de Base Middleware

SCOOP UTIC Application

SCOOP Tablet Application

Metier Tablet Application

SCOOP Server

SCOOP Supplier Management

Marben
(SCOOP UTIC Application)

NeoGLS
(SCOOP Tablet Application,
Metier Tablet Application, SCOOP Server)

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SCOOP Specifications

UTIC de Base Middleware

SCOOP UTIC Application

SCOOP Tablet Application

Metier Tablet Application

SCOOP Server

SCOOP Release Delivery

Software SCOOP Integration, Test, Validation (UTIC de Base, SCOOP UTIC, SCOOP Tablet, Metier Tablet, SCOOP Server)

SCOOP delivery

SCOOP Supplier Management

Marben
(SCOOP UTIC Application)

NeoGLS
(SCOOP Tablet Application,
Metier Tablet Application, SCOOP Server)

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SCOOP Supplier Management

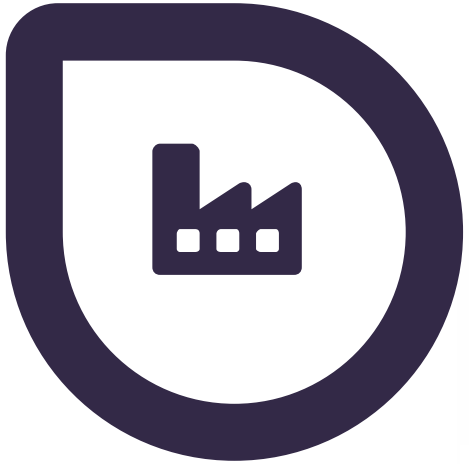
Marben
(SCOOP UTIC Application)

NeoGLS
(SCOOP Tablet Application,
Metier Tablet Application, SCOOP Server)

SCOOP Release Delivery

Software SCOOP Integration, Test, Validation
(UTIC de Base, SCOOP UTIC, SCOOP Tablet, Metier Tablet, SCOOP Server)

SCOOP delivery



SCOOP Production

Production, Software flashing, Configuration

UTIC installation on DIRIF vehicule

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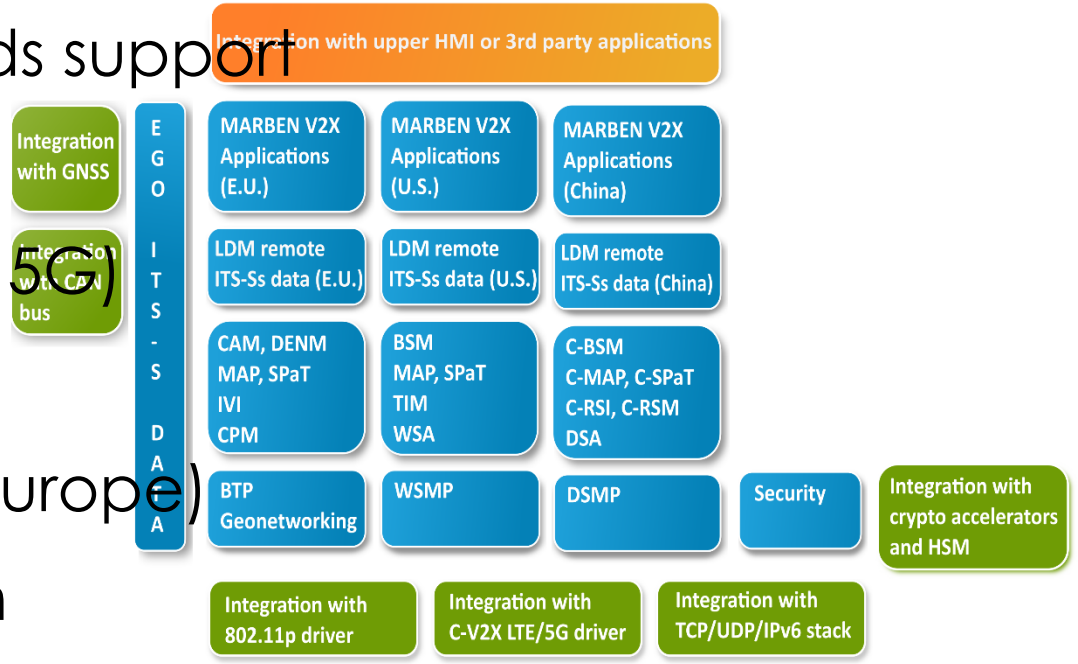
Worldwide leading V2X software supplier

Marben provides a complete ready to-use software solution for rapid development of V2X equipment (OBU, RSU) offering:

- European, US and Chinese standards support
- Hardware agnostic
- Network agnostic (DSRC / LTE V2X / 5G)
- Security and privacy management
- PKI support (SCMS, SCOOP ISE, PKI Europe)
- Road safety and traffic optimization applications.



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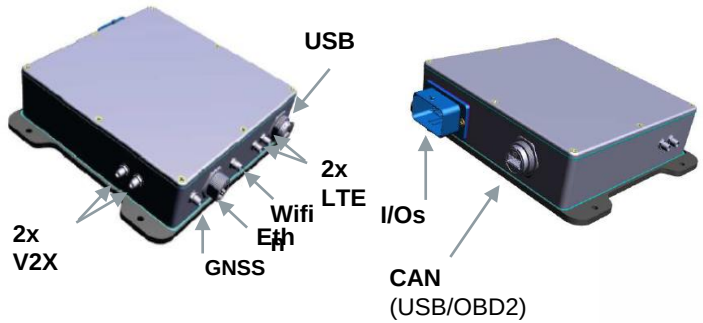
Marben Contribution in SCOOP@F

- Marben has provided the V2X software solution running:
  - in **LGe OBU-UEV** embedded in Renault cars and
  - in **Valeo OBU-UEVg** embedded in Dirif vehicles.
- ETSI Compliant V2X protocol stack including GeoNET, BTP, CAM, CAM-i, DENM, MAP, SPaT, IVI, LDM, Security and ISE PKI.
- V2X Applications including:
  - Road hazard Signalling: temporary slippery road , emergency brake, end of queue, stationary vehicles, breakdown, reduced visibility, exceptional weather conditions,
  - Animal on the road, people on the road, obstacle on the road
  - Accident, unmanaged blockage of a road
  - Enhanced Road Work Warning, Wrong Way Driving, Vehicle in
  - Embedded Virtual Message Sign, Road Worker in the Field,
  - Dynamic Speed Limit, Dynamic Lane Management,
  - Green Light Optimal Speed Advisory.
- U-Logs, T-Logs, Mitigation mechanism and Hybridization



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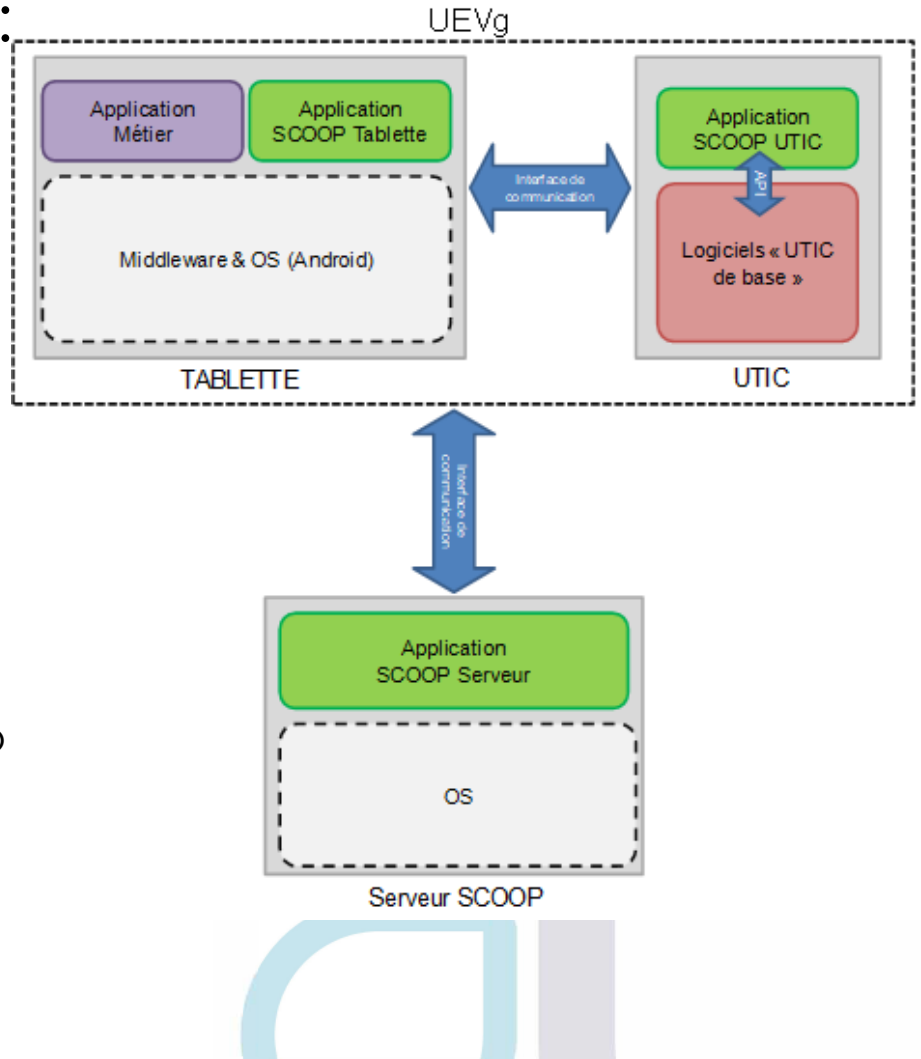
Marben Contribution in SCOOP@F

- « Scoop UTIC Application » for OBU-UEVg:
  - Manages communications with the tablet-HMI and SCOOP Platform.
  - Processing of DENM « Métiers »:
    - Mobile RoadWork Alert, Road Operator Vehicle on Patrol, out on service call,
    - Road Operator Vehicle stops in a protected mode,
    - Winter Road Maintenance- Vehicle clearing snow, Vehicle is salting, Vehicle in action, Vehicle on the road.
    - Traffic Jam - End of Queue
  - Mobile RSU operation mode :
    - Periodic sending of the current ITS-Station position to the SCOOP platform using Datex II
    - Conversion DATEX II - DENM
    - DATEX II SOS message generation.
  - Emergency Call Management



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Validation

Marie-Christine ESPOSITO
(French Ministry of Transport)
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Fourth step : Validation

- **Validation : learning by doing**
- For SCOOP wave 1, we had to build all the tests from nothing
  - Unitary tests
  - Bilateral tests
  - Collective tests

- For SCOOP wave 2, we have identified the necessary "non-regression" tests from wave 1 and added the wave 2 tests

Use Cases	Document Reference	Type
B1a	2.6.1.1_H-Détail-de-test_B1a	Detail
B1a	2.6.1.1_H-Plan-de-test_B1a	Plan
B1b	2.6.1.1_H-Détail-de-test_B1b	Detail
B1b	2.6.1.1_H-Détail-de-test_B1b	Plan
C3	2.6.1.1_H-C3_Plan-de-test	Plan and detail
D7	2.6.1.1_H-D7_Plan-de-test	Plan and detail
Master	2.6.1.1_H-Commun_Plan-de-test	Plan and detail
All	2.6.1.3.H-Matrice-traçabilité	Matrix
B1a/B1b	2.6.3.2_H-B1a&b	Plan and detail
C3	2.6.3.2_H-C3	Plan and detail
D7	2.6.3.2_H-D7	Plan and detail
Master	2.6.3.2_H	Master

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Fourth step : Validation

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SCOOP wave 1

During 1.5 years (2016-2017), there were tests running every week, either lab tests, track tests or on-road tests
Given the big scope of the SCOOP 1 specifications, it was needed to help improve the suppliers products and improve our tests.
After all of those, even if all the specifications were not validated by all the prototypes, we were confident in them for deployment

SCOOP wave 2

The validation refocused on its goal : validation and not bug corrections. A limited number of tests was necessary :

- Big session in February/March 2019
- Completed for sake in September/October 2019

-> positive results after those two sessions

Total number of deliverables : about 60

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Unitary tests – SCOOP 1

Tests	Lab	Test track	Open roads
Compliance to standard communication tests	x		
Functional application tests	x		
Logs generation tests	x	x	
Security tests	x		
PKI access tests	x		
Performance testing	x		
Radio coverage		x	
Messages contents	x	x	
SCOOP platform Tests	x		

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Bilateral tests – SCOOP 1

Components	Tests	Lab	Test tracks	Open roads
OBUu-RSU	**Tests of requests from an ITS Station to the PKI via RSU**	x	x	
OBUu-RSU	**Uploaded logs tests from ITS Station via RSU**	x	x	
OBU-RSU	**Mitigation tests**	x	x	
OBU-RSU and OBU-OBU	**Radio coverage**		x	
OBUro-PF	**DatexII exchanges**	x		

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Collective tests – SCOOP 1

Tests	Lab	Test tracks	Open roads
Interoperability messages tests between ITS Station with security	x		
Forward test at a geonet layer level	x	x	
Use cases A (including security and log management)			x
Use cases B (including security and log management)			x
Use cases D (including security and log management)			x
Mitigation (at a toll station) tests			x
Latency tests		x	

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Consolidation of the process

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- Internal tests
- Bilateral Tests
- Local reception Tests
- Unitary tests
- Interface Tests
- On-road Tests
- Full reception Tests
- Cross-Tests

National validation

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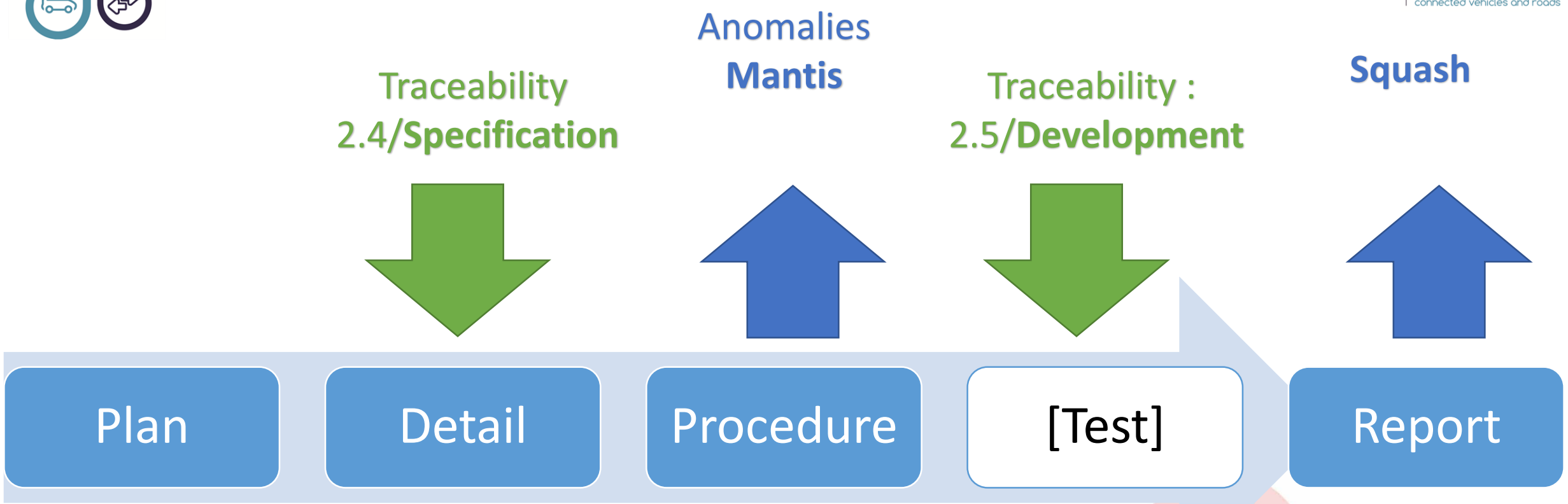
Tools : process



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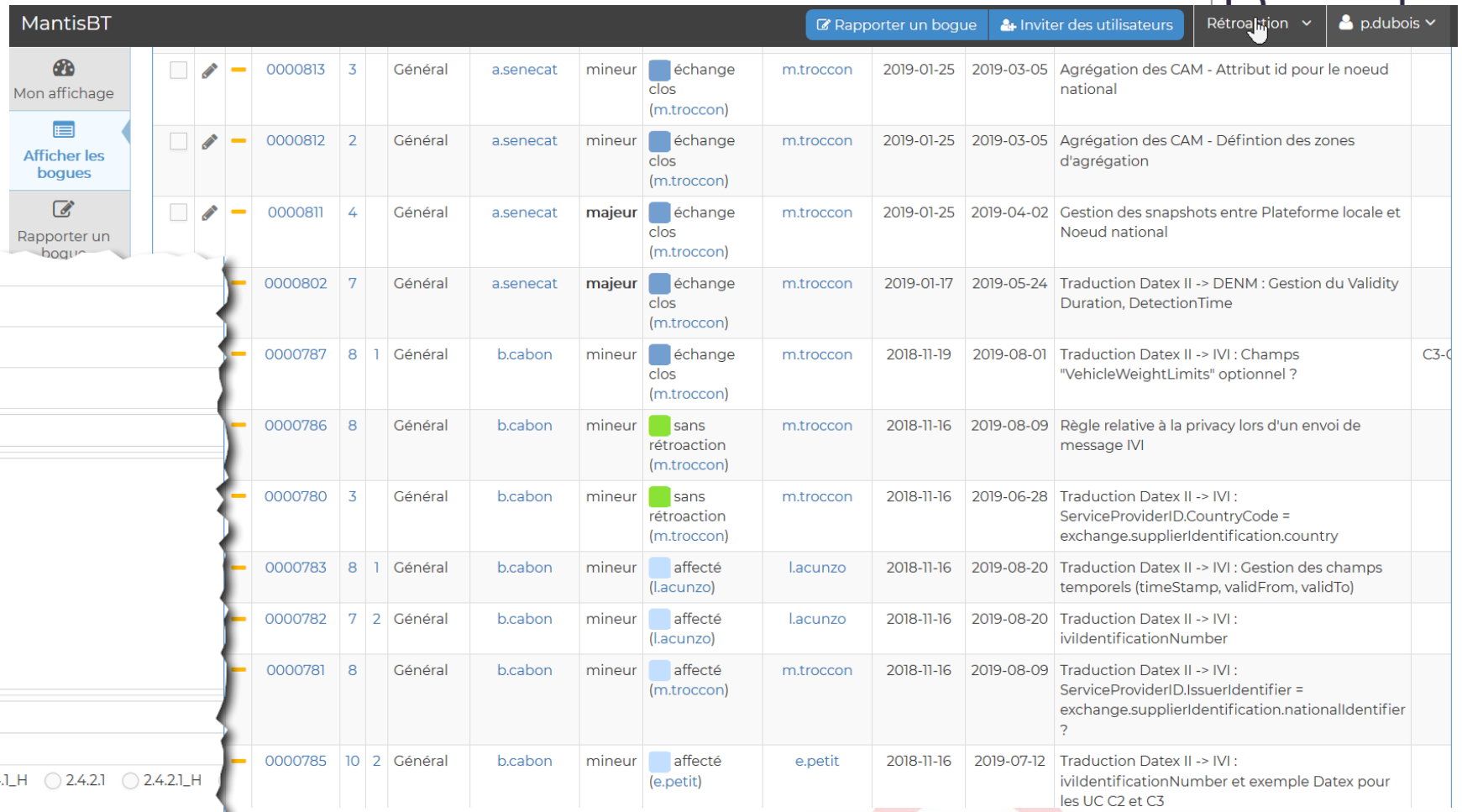

Tools : Mantis

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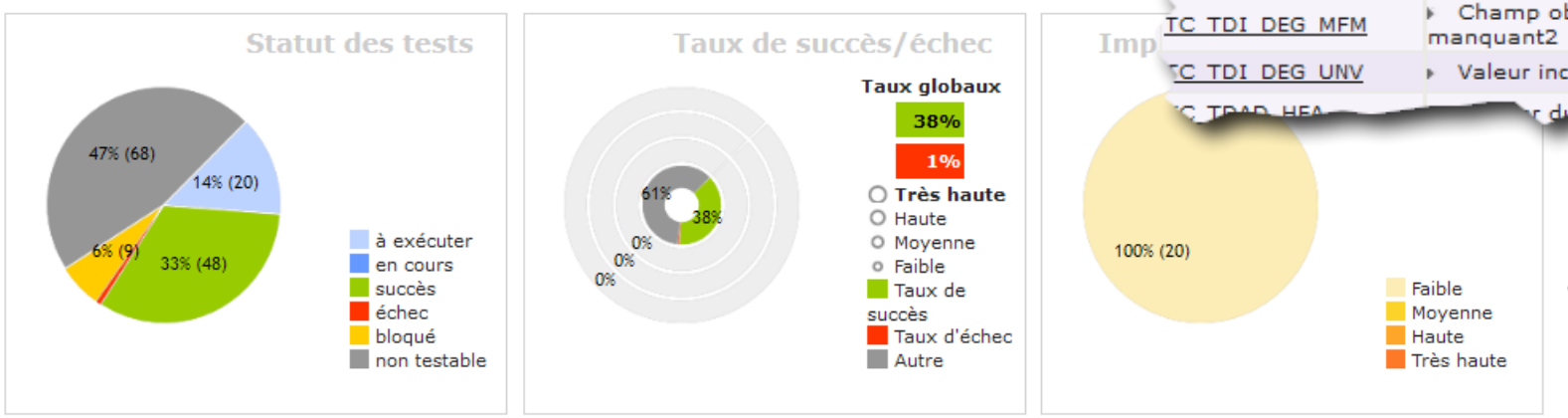
Tools : Squash

TC_DEG_VAL	Validité	F	-	succès
TC_DEG_UNV	Valeur inconnue	F	-	succès
TC_TDI_HEA	Header du message IVI	F	-	succès
TC_TDI_MGMT_CCODE	countryCode	F	-	succès
TC_TDI_MGMT_IID	issuerIdentifier	F	-	non testable
TC_TDI_MGMT_IIN	iviIdentificationNumber	F	-	succès
TC_TDI_MGMT_TIME	Horloge	F	-	succès
TC_TDI_MGMT_STATE	iviStatus	F	-	non testable
TC_TDI_GLC	GeographicLocationContainer	F	-	bloqué
TC_TDI_GIV	General IVI Application Container	F	-	succès
TC_TDI_DEG_MFM	Champ obligatoire manquant2	F	-	succès
TC_TDI_DEG_UNV	Valeur inconnue de l'UBR	F	-	succès

Statistiques de la campagne



Inventaire des tests par itération

Itération	A exécuter	En cours	Succès	Echec	Bloqué	Non testable	Nombre de tests planifiés	Avancement de l'exécution
1 - 2019-04-25_UBR-Lacroix-v2.5.2	1	0	3	0	0	13	17	94 %
2 - 2019-07-04_UBR-Lacroix-v2.5.3	0	0	10	0	1	6	17	100 %
3 - 2019-07-04_UBR-Lacroix-v2.5.3-auto	18	0	23	1	3	19	64	72 %
4 - 2019-07-19_UBR-Lacroix-v2.5.3	1	0	12	0	5	30	48	98 %
Total	20	0	48	1	9	68	146	86 %

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Following steps of the SCOOP method

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- Deployments – done in parallel (distinction of hardware and software)
- Evaluation – this afternoon!

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Thanks !

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Questions/answers

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