



French C-ITS Deployment Coordination committee

Vru-ITS-S for PSA

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Activity 2 : Studies

Sub Activity 2.4 > Specifications

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Information on the document

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Date	Version	Author(s)	Updates & changes	Diffusion
14/11/2019	4.00	S. BENSATOR	Consolidated version for release 4	Release 4

Quality rules

Reference to the version administration

Version number to be composed of 3 digits > vR.XY

- **R** corresponds to the release number : it is upgraded each time SC Studies validates the diffusion of a new release,
 - **X** is the major version number: it is upgraded each time SC Studies validates the deliverable,
 - **Y** is the minor version number: it is upgraded each time a contributor changes anything.
- Once the deliverable is approved, its version number is upgraded from vR.XY to vR.(X+1)0
Once the deliverable is release, its version number is upgraded from vR.XY to v(R+1).00

As illustration :

- 0.03 > Work in progress version
- 0.10 > Del. Approved by SC Studies but not released
- 2.00 > Del. approved & released (in release 2)
- 2.05 > Del. Updated - in progress version

Requirements identification & traceability

In this document, the following verbal forms are used to indicate requirements: **Shall / Shall not**

Recommendations shall be indicated by the verbal forms: **Should / Should not**

Permissions shall be indicated by the verbal forms: **May / May not**

Possibility and capability shall be indicated by the verbal forms: **Can / Cannot**

Inevitability used to describe behavior of systems beyond of the scope of this del. shall be indicated by: **Will / Will not**

Facts shall be indicated by the verbal forms: **Is / Is not**

In the table here below:

2.4.X.XX > is the number given to the deliverable (e.g. 2.4.4.8)

YYYY > for digit are given to identifying which component/entity the requirement is addressing (e.g. LTCA for long terme certificate authority)

ZZZ > is the numeration of the requirement

ID	2.4.X.XX-YYYY-ZZZ
Component(s)	(e.g) ITSS-VU, ITSS-VRO, ITSS-R, PKI
Requirement	(e.g) An ITS station SHALL be able to request and get a Long term Certificate (LTC) from the SCOOP Public Key Infrastructure (PKI).
Acceptance	(e.g) CA1 : ITSS-VU sends a LTC request to the LTCA CA2 : ITSS-R relays the LTC request CA3 : The LTCA verifies the request and sends a response CA4 : The ITSS-R relays the response CA5 : The response is received by the ITSS-VU and is valid
Additional information	

Acronyms & abbreviations

BTP	Basic Transport Protocol
C2C-CC	Car2Car communications Consortium
CA	Cooperative Awareness
CAM	Cooperative Awareness Message
C-ITS	Cooperative Intelligent Transport Systems
DCC	Decentralised Congestion Control
DENM	Decentralized Environmental Notification Message
DP	DCC profile
DPID	DCC profile identifier
DSRC	Dedicated Short Range Communications
GBC	Geo Broadcast
GN	Geo Networking
GPS	Global Positioning System
HST	Header Sub-Type
HT	Header Type
ITS	Intelligent Transport Systems
IVI	Infrastructure to Vehicle Information
IVIM	Infrastructure to Vehicle Information Message
LT	Lifetime
MAP	Geometric information for the intersection
MAPEM	MAP (topology) Extended Message
MHP	Maximum Hop limit
NH	Next Hop
R-ITS-S	Roadside ITS Station (R-ITS-S or ITS-S R in the French Terminology)
RSP	Wifi ITS-G5 Roadside System Profile (short also Roadside System Profile)
RWW	Roadworks Warning
s	Seconds
SCF	Store Carry Forward
SHB	Single-Hop Broadcast
SPAT	Signal Phase and Timing
SPATEM	Signal Phase and Timing Extended Message
TC	Traffic class

TCC	Traffic Control Centre
ITS-G5	<p>ITS-G5 is a European standard for ad-hoc short-range communication of vehicles among each other (V2V) and with Road ITS Stations (V2I). ITS-G5 refers to the approved amendment of the IEEE 802.11 (standard IEEE 802.11p). This technology (possibly others) uses the 5.9 GHz frequency band to support safety- and non-safety ITS applications.</p> <p>In this document ITS-G5 stands for IEEE802.11p/ETSI ITS-G5.</p>
ECU	Electronic Control Unit
Vru-ITS-S	Vehicle Road user –Intelligent Transport System -Station
R-ITS-S	RoadSide-Intelligent Transport System - Station

N/A	<i>Not Applicable</i>
TBC	<i>To Be Checked, with MS or associated partner</i>

Table of Contents

1.	Context.....	8
1.1	Reminder: SCOOP wave 1	8
1.2	SCOOP wave 2.....	8
2.	Design of the Vru-ITS-S.....	9
2.1	Components and general architecture	9
2.1.1	Functional allocation.....	9
2.1.2	Integration in the vehicles.....	11
2.2	Main difference with a serial application.....	11
3.	Application of the standards and functional design	11
3.1	Statement: application of the standards.....	11
3.2	Statement: application of the specification	12
3.3	Functional choice specific to PSA	12
3.3.1	Hybrid-communication	12
3.3.1.1	Architecture.....	12
3.3.1.2	SW architecture in the VBOX.....	13
3.3.1.3	Security	13
3.3.2	Use-case wave 2: in emission	14
3.3.3	Use-case wave 2: in reception.....	14
3.3.3.1	Core principles	14
3.3.3.2	Wrong-way driving:	16
3.3.3.3	Closed lane / roadworks warning	16
3.3.3.4	eVMS	16
3.3.4	Main difference with a serial deployment.....	16
4.	HMI	16
4.1	Core principle – reminder.....	16
4.2	Concept for SCOOP wave 2	17
4.2.1	Wrong way driving	17
4.2.2	Wrong way driving	18
4.2.3	Closed lane / Roadworks.....	18
4.2.4	eVMS.....	18

List of figures

No figure has been found.

1. Context

This document has to be seen as complementary to SCOOP wave 1 deliverable “2423P_Specification des UEV Constructeurs _ PSA”.

The document is limited only to the perimeter of SCOOP@F wave 2 project

1.1 Reminder: SCOOP wave 1

In the scope of SCOOP wave 1, PSA designed a system composed by:

- An ECU called VBOX, which contains the WIFI ITS G5 stack and all the SW specifically deployed for SCOOP to handle the messages:
 - o Creation and emission of the CAM/DENM messages, by using the CAN bus information
 - o Reception and filtering the CAM/DENM messages, depending on the uses-cases
 - o HMI requests to display the warnings to the driver
- 2 G5 antennas (one on the windshield, one on the rear window)
- A specific SW release of the HMI ECU (called SMEG), to display SCOOP information to the driver directly in his serial screen

The integration and validation of this system had to be mature enough for being proposed to “real” driver to equip their personal car.

It allowed to reach a very high level of representativeness, and force every partners to agree on realistic technical requirements.

But it also meant a lack of flexibility in our design.

1.2 SCOOP wave 2

For PSA, SCOOP wave 2 has a dual objective, on one hand to tackle both long range and short range communication vector to extend the availability of data to a broader coverage area, and, on the other hand, the objective is to study the additional use cases envisioned in SCOOP@F wave 2 namely, Wrong way driving, e-VMS and Road Works Warning extended.

In the scope of SCOOP wave 2, the purpose is to update the “SCOOP wave 1” system with

- A cellular (3G/4G) communication
- SCOOP wave 2 uses-cases
- A tablet, to be able to display SCOOP wave 2 events, on a more flexible way than for SCOOP wave 1. The design of the HMI on the tablet, and the integration of the tablet itself in the vehicle need to allow the representativeness of the display.

In the scope of SCOOP wave 2, the main interests of PSA Group are:

- The study of the e-VMS:
 - Implementation of the IVI standard
 - User experience and understanding by the driver
 - Cohabitation with other type of events in the HMI
 - Interest for the ADAS function
 - Feasibility and relevance for the serial deployment
- The study of hybrid-communication, to increase the availability of the V2X to make ADAS function, whatever the type of connectivity available in an area.

- To evaluate the benefit of the service continuity (aka the realisation of the IPv6 session continuity between 2 communicant entities, enabling a transparent connectivity between the entities, whatever the access technology in use for the V2X features
- To evaluate the underlying security issues added by the hybrid communication architecture

2. Design of the Vru-ITS-S

2.1 Components and general architecture

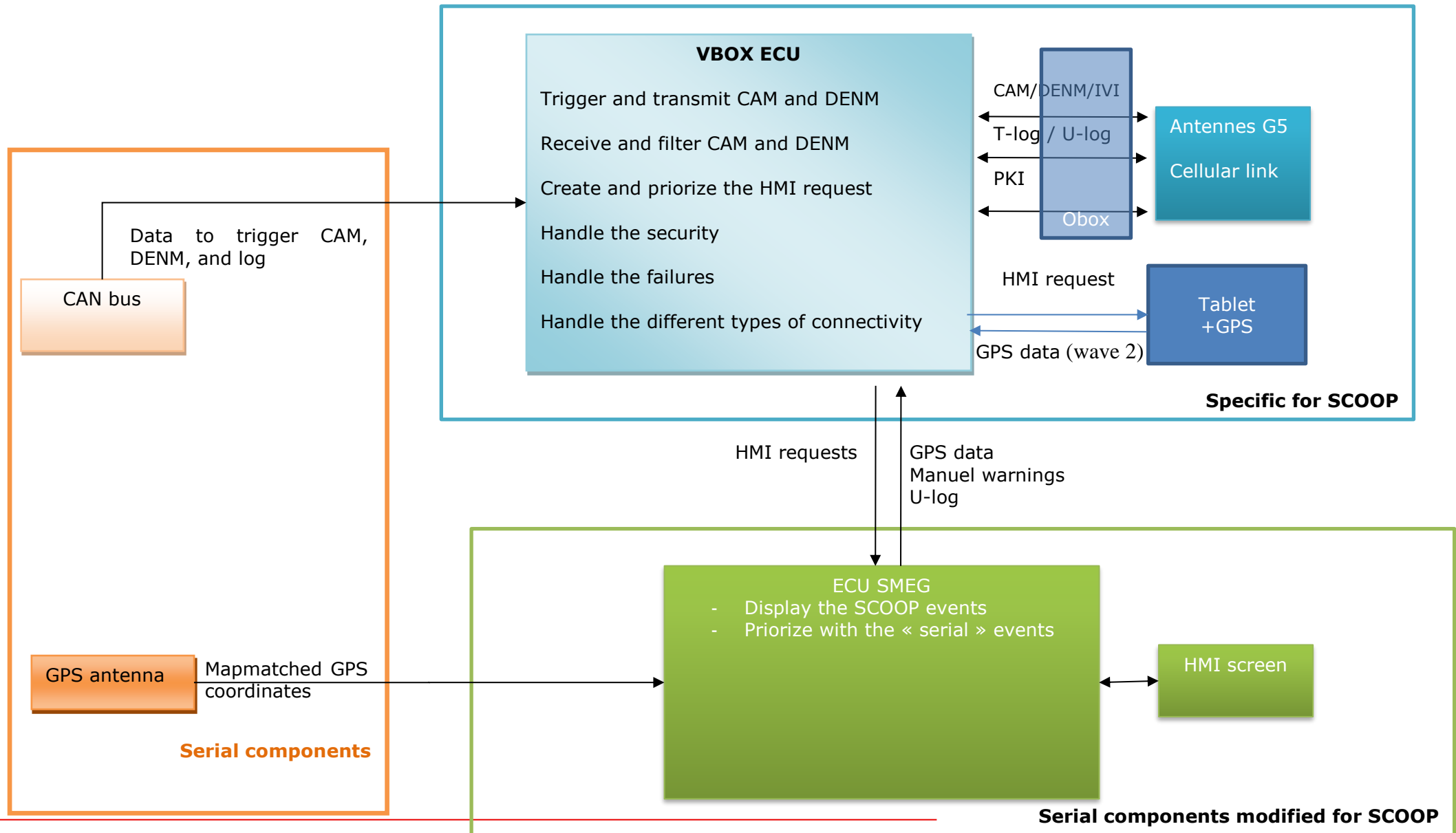
As mentioned, the main components of the **Vru-ITS-S** are:

- The VBOX, supplied by the CTAG, based on Cohda/NXP stack
- 2 G5 antennas, supplied by Ficosa
- 1 specific SMEG SW release, supplied by Magnetti Marelli
- 1 tablet to display the SCOOP wave 2 events.
- 1 OBox supplied by Orange for SCOOP wave 2
- 1 antenna for cellular connectivity for SCOOP wave 2

2.1.1 Functional allocation

Under this functional allocation, events can be displayed either in the SMEG IV2 + serial HMI or in the tablet that has been added in purpose to handle the new Use cases.

Some of the new use-cases can be directly handled by the serial components SMEG IV2+ Serial HMI but some other will not. In this sense we can switch from the serial display sub-system or to the tablet +VBOX sub-system.



2.1.2 Integration in the vehicles



2.2 Main difference with a serial application

See "2423P_Specification des UEV Constructeurs _ PSA" for the SCOOP wave 1 system.
To be completed for the SCOOP wave 2 update, depending on the first tests.

3. Application of the standards and functional design

3.1 Statement: application of the standards

- RFC 5969, IPv6 rapid deployment on IPv4 infrastructures (6rd)
- RFC 3964, security consideration for 6to4.
- IETF RFC 4862: IPv6 Stateless Address Auto Configuration
- IETF RFC 4861: RADVD
- IETF RFC 5175: IPv6 Router Advertisement
- IETF RFC 4429: Optimistic Duplicate Address Detection (DAD) for IPv6
- IETF RFC 3963: Network Mobility (NEMO) Basic Support Protocol
- IETF RFC 5555: Mobile IPv6 support for Dual Stack Hosts and routers
- IETF RFC 6089: Flow Bindings in Mobile IPv6 and Network Mobility (NEMO) Basic Support
- IETF RFC 6275: BU/BA mobility support IPv6
- IETF RFC 5648: Multiple Care-of Address
- 2.4.4.6: PKI architecture and Technical specification
- 2.4.4.6_Bis Use case scenarios with security data

- **2.4.4.6_Appendix ASN1 format**
- **2.4.4.8 Security System integration**
- **ETSI TS 103 097 v1.2.1**
- **2.4.1.2_H Master-SpecUC-v0.12**
- **2.4.1.2_H_D7-WWD-SpecUC-v0.12**
- **2.4.1.2_H C3-eVMS-SpecUC-v0.12**
- **2.4.1.2_H_B1a&b-RWW-SpecUC-v0.12**
- RFC 5569, IPv6 rapid deployment on IPv4 infrastructures (6rd)
-

3.2 Statement: application of the specification

Nothing to report at this moment.

3.3 Functional choice specific to PSA

3.3.1 Hybrid-communication

3.3.1.1 Architecture

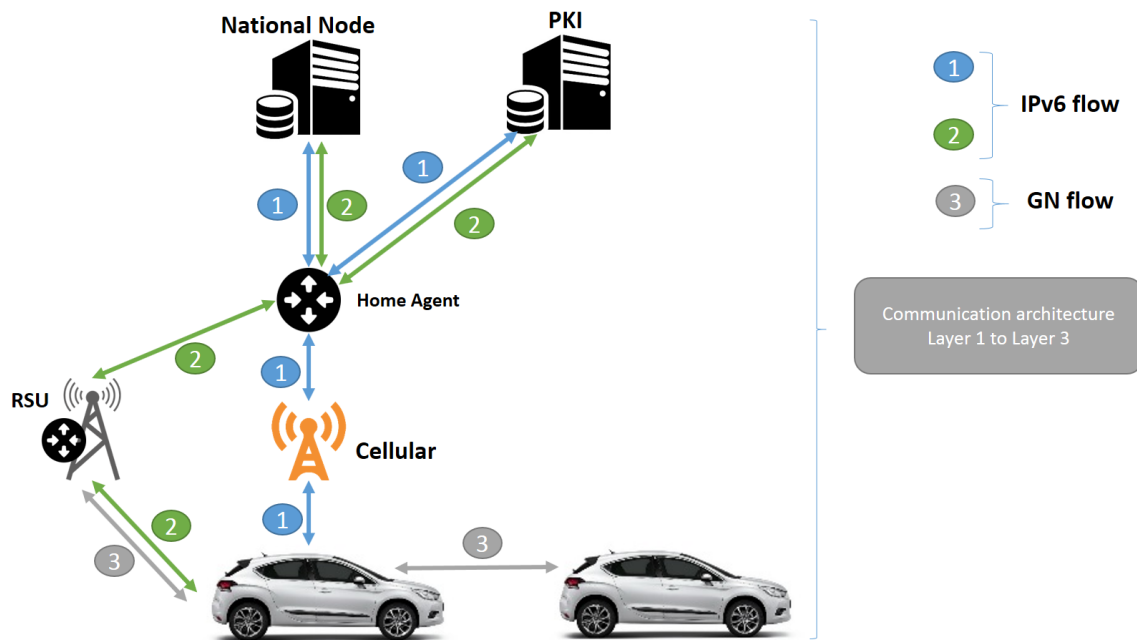
In the scope of SCOOP wave 2, and in accordance with the SCOOP requirements, PSA will:

- Emit in G5, all the time
- Emit in GN over ipv6 when available:
 - o Either through cellular antenna
 - o Either through an R-ITS-S

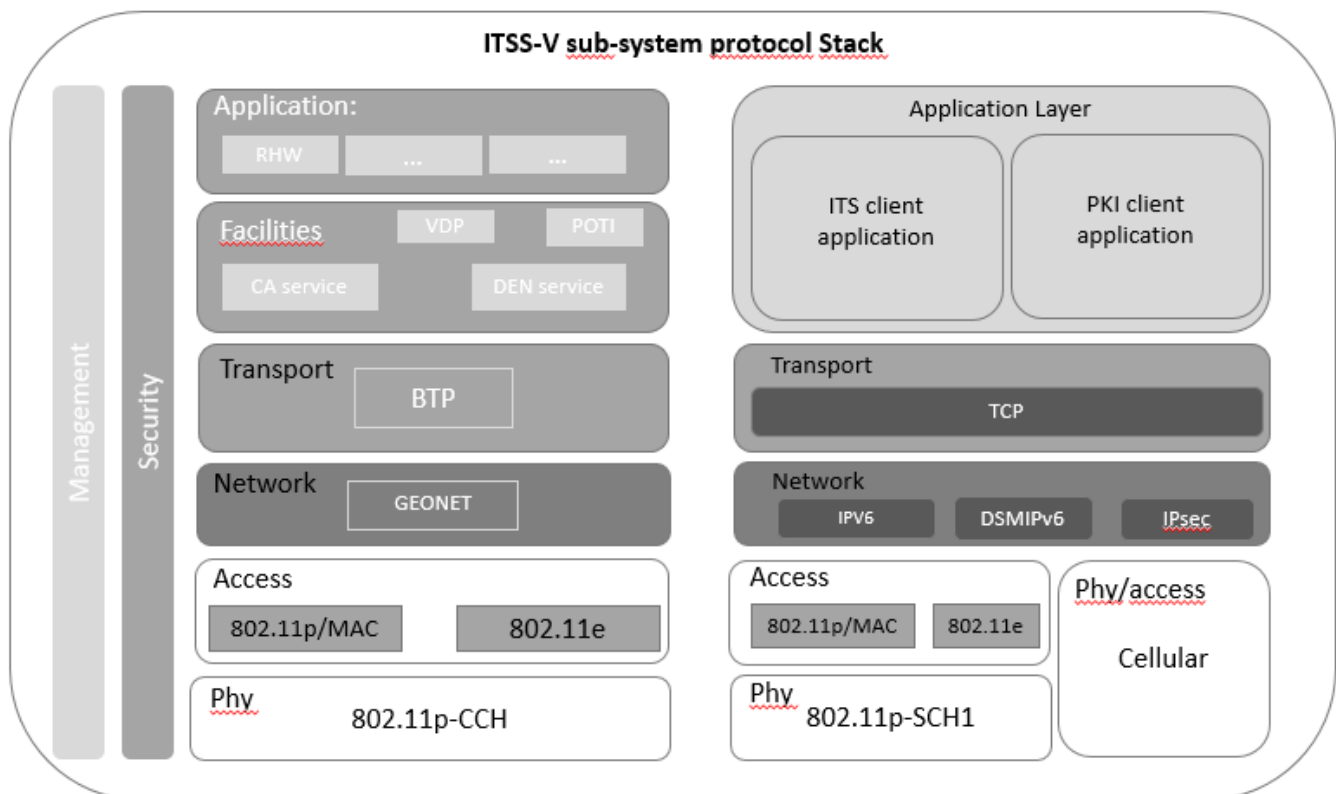
More detail about the architecture can be found in the reference document 2.4.1_H mainly in the following chapters:

- 3.2 ITSS-VU architecture
- 3.2.2 Architecture using a Home Agent
- 3.2.3 V2V communication through Cellular link
- 3.3.4 communication profile
- 4. 2 ITSS-V Functions
- 5.2.1 Technical architecture for interfaces 1, 2, 8,9
- 6.1 Interfaces general description
- 6.2.1 Message Format for interface 1,2
- 7. Access and network layers
- 8. Mobility Management (Home Agent and Mobile Node Stack)
- 8.4 DS-MIP based solution
- 8.5 Architecture using a Home Agent Entity
- 9. Implementation choices: Interface 1, Interface 2
- 11. References

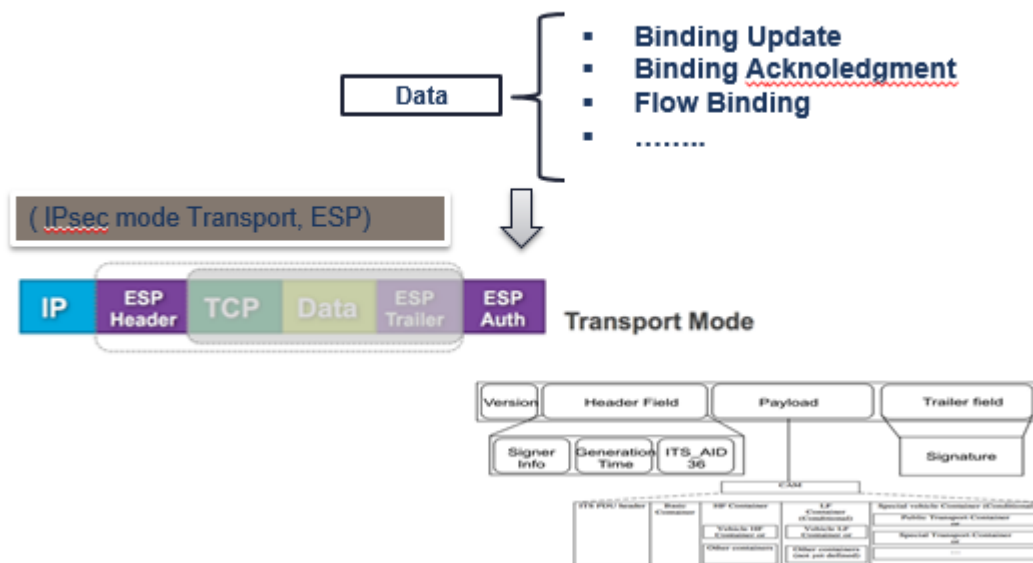
Please note that this architecture may not be acceptable for a serial deployment (see 3.3.4)



3.3.1.2 SW architecture in the VBOX



3.3.1.3 Security



The Binding Update and Acknowledgment must be protected and encrypted. Which explains the choice of PSA to make IPsec on transport mode.

3.3.2 Use-case wave 2: in emission

N.A.

The use-case wave 2 are I2V ones.

3.3.3 Use-case wave 2: in reception

3.3.3.1 Core principles

Important remarks:

On the serial screen, it is possible to display only one warning at the same time (see 4.1 for justification). This is a very common constraint for the HMI in the cars, so we choose to keep this constraint for SCOOP wave 2.

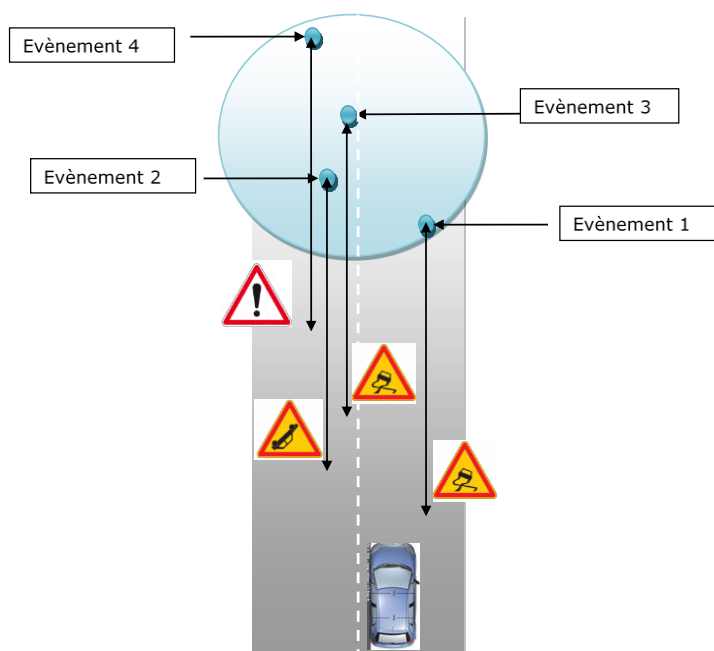
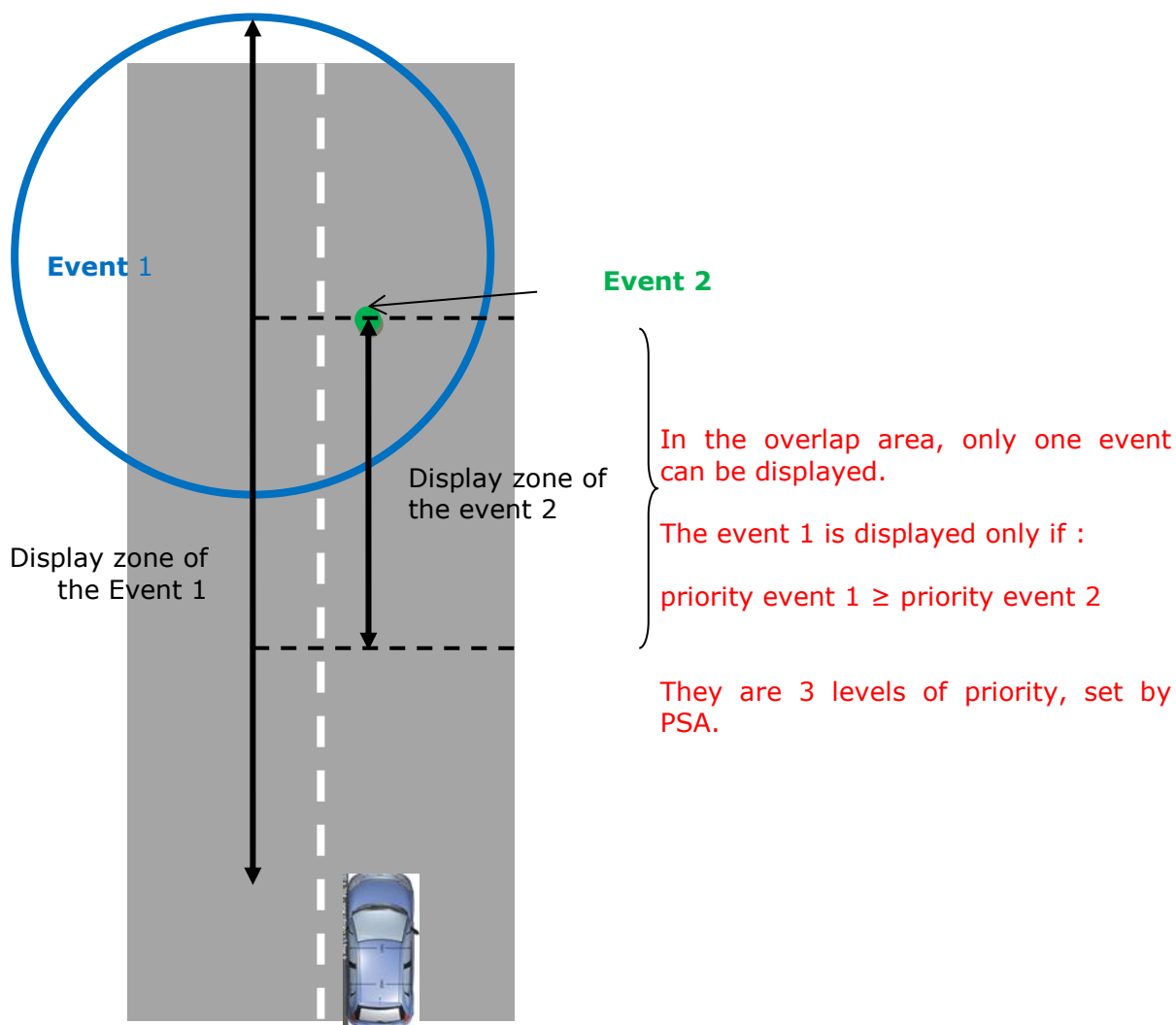
The consequence is that when they are several events “almost” at the same place, a prioritisation is mandatory.

In the scope of SCOOP, PSA made the prioritisation based on the time to event (never the distance!), the nature of the event, its quality, reliability, etc., and also on ergonomic constraints. (see below).

For the e-VMS, we will also be able to display only one eVMS at a time (see 4.1 for justification). We may even be able to display either a DENM, either a VMS.

Reminder: prioritisation principle for the UC SCOOP wave 1.

See “2423P_Specification des UEV Constructeurs _ PSA” for more details



If the time between several events are too small, and to avoid the “flash phenomene” (the alternate between several icon, not easily understandable for the driver), the events are merged.

3.3.3.2 Wrong-way driving:

Same as use-cases SCOOP wave 1, based on warning time and level of priority.
To be completed after the first test on roads.

The priority is set to 1.

3.3.3.3 Closed lane / roadworks warning

Same use-cases SCOOP wave 1, based on warning time and level of priority.
To be completed after the first test on roads.

The additional fields will be used by the HMI.

The priority is set to 2.

3.3.3.4 eVMS

- When an IVI message is received:

The **Vru-ITS-S** is a “slave”. When the message is received, it is displayed.

- When 2 IVI messages are received “almost” at the same time and for the same area:

The one with the highest “IVI” priority is displayed.
In case of 2 identical priorities, the first one is displayed.

- When a IVI messages and a DENM are received “almost” for the same area:

The priority of a VMS with the highest level of “IVI” priority is today set to 2.

Please note that the priority cannot depend on the “real” content of the VMS, since the car is not able to interpret it.

So the priority will be the same for a VMS like “be careful, wrong way driver” than for “remember to take a break”

- ➔ It will be one of the big questions during the validation.
- ➔ The functional design would change accordingly after the test.

3.3.4 Main difference with a serial deployment

Hybrid-communication: the compatibility with the Extended Vehicle is mandatory.
This point is under analysis (to be detailed in the next update).

4. HMI

4.1 Core principle – reminder

- A lot of information has to be displayed in the car HMI (warnings, map, radio, music, etc) → a warning cannot take too many spaces, or only briefly.
- The driver needs to keep his attention on the road → a warning cannot happen too often, or be too long to read
- A warning must be displayed accordingly to the foreseen reaction:
 - If the warning is too early, the driver could forget it
 - If the warning is too late, the driver does not have the time to decrease its speed, or not safely
 - If the warning is too intrusive, the driver can overreact
 - Etc.
- A warning must be accurate enough, so that the driver keeps faith in it
- A warning must not be too intrusive (too frequent, too loud...), otherwise the driver doesn't pay attention anymore

In every situation, the risks could be

- A distraction of the driver, which is dangerous
- A non efficiency of the system because the driver doesn't pay attention to the warnings anymore (most of the time, he will simply deactivate the feature).

Standards, as well as internal guidelines are used to avoid all these issues.

They have been taken into account in the design of the SCOOP HMI.

4.2 Concept for SCOOP wave 2

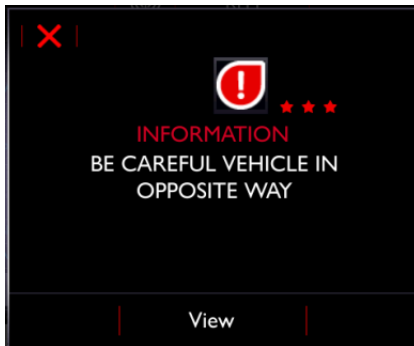
4.2.1 Wrong way driving

If the map is on the screen:



If the map is not on the screen:

4.2.2 Wrong way driving



4.2.3 Closed lane / Roadworks

Same as for SCOOP wave 1.

An additional message such as “right lane closed” according to the DENM can be added.

4.2.4eVMS

!! the 2 hypotheses are integrated in the prototypes. There are 2 hypotheses because they would be both likely for a serial deployment.

First hypothesis: a DENM and a VMS can be displayed at the same time



Second hypothesis: Either a DENM or a VMS can be displayed

