Enablers and Assessments in the Continuity of Services

Major Statements and Field Test Results

HeERO 112 SOS

Harmonised eCall European Pilot

Version number:	1.1
Main author:	Martin Grzebellus
Dissemination level:	PU
Lead contractor:	NAVCERT
Due date:	31.12.14
Delivery date:	14/05/2015
Delivery date updated document	14/05/2015

ICT PSP ICT POLICY SUPPORT PROGRAMME

Grant agreement no.: 325075

Pilot type A co-funded by the European Union under the Competitiveness and Innovation Programme

ICT Policy Support Programme

DG Communications Networks, Content and Technology

Page left intentionally blank

CONTROL SHEET

Version history			
Version	**Date**	**Main author**	**Summary of changes**
0.1	2014-08-26	Monika Stapelfeld	creating template
0.2	2014-08-28	Monika Stapelfeld	update template
0.3	2014-11-19	Monika Stapelfeld	including input from partners
0.4	2014-12-3	Monika Stapelfeld	including input from partners
1.0	2014-12-16	Martin Grzebellus	Review and finalization
1.1	2015-05-14	Martin Grzebellus	Including comments by reviewers

	Name	**Date**
Prepared	Martin Grzebellus	2015-05-14
Reviewed	Andy Rooke	2015-05-27
Authorized	Andy Rooke	2015-05-27

Circulation	
Recipient	**Date of submission**
Project partners	2015-05-27
European Commission	2015-05-27

TABLE OF CONTENTS

FIGURES

TABLES

1 Management summary

In this document the enablers for eCall have been analysed from a technical perspective. Derived from the DoW following aspects have been analysed:

- eCall only
- Roaming
- Dangerous goods tracking
- Cross border aspects
- Continuity of service per pilot site

The first important aspect is the eCall only functionality which is not easy to understand. Therefore the technical background is explained to make clear that there is no need but also no opportunity to procure a specific SIM card. Therefore the process chain for an eCall only device (?) is presented together with the necessary components. The required average time for registration in the network is about 2.3 seconds based on experiments done in Belgium. This time is in accordance with the expectations and seems to be reasonable.

Although for roaming not real test scenarios could be analysed, the theoretical approach confirmed, that the experience for eCall is in accordance with TS112 calls. There might be situations in international roaming in which the calling number does not allow a redial between PSAP and vehicle.

For dangerous goods the potential solutions for expanding the data transfer within eCall are presented. Based on today's knowledge the most practical way forward is described to combine both divergent requirements for data security and open sharing of information.

Between two PSAPs in one member or between two neighbouring member states, the mobile network will establish in some instances the connection to the wrong PSAP which is not responsible to handle emergency calls from that specific location. In that case the data transferred via the MSD can't be processed directly by the appropriate PSAP.

The situation in the pilot sites is in most cases that the mobile network operators so far have not implemented the eCall flag in the respective networks. However there have been in part national stakeholder groups identified or already schedules agreed for the deployment of eCall on national base. The experience in handling the full process chain is regarded as valuable for the next steps although the infrastructure in the PSAP will not be used for final deployment.

2 Terms and abbreviations

Term	Definition
3GPP	Third Generation Partnership Project
AT	Attention Command
CEN	Comité Européen de Normalisation
CIP	Competitiveness and Innovation Programme
DoW	Description of Work
EC	European Commission
ETSI	European Telecommunication Standards Institute
EUCARIS	European Car and Driving License Information System
ESO	European Standards Organization
GNSS	Global Navigation Satellite System
GPS	Global Positioning System
GPRS	General Packet Radio System
GSM	Global System of Mobile telecommunications
GSMA	GSM Association
IMSI	International Mobile Subscriber Identity
ISO	International Standardization Organization
ITS	Intelligent Transport Systems
IVS	In-Vehicle System
MNO	Mobile Network Operator
MSC	Mobile Switching Center
MSD	Minimum Set of Data
MSISDN	Mobile Subscriber Integrated Services Digital Network Number
NIST	National Institute of Standards and Technology
PLMN	Public Land Mobile Network
PSAP	Public Safety Answering Point

SDR	Software Defined Radio
SIM	Subscriber Identity Module
SOP	Standard Operating Procedure
UMTS	Universal Mobile Telecommunication System
USIM	Universal Subscriber Identity Module

3 Introduction

3.1 Purpose of Document

The purpose of this document is to present the enabler for the continuity of service per pilot sites in a comprehensible and consistent manner. The overall evaluation is based on results of the pilot sites (Belgium, Bulgaria, Denmark, Luxemburg, Spain and Turkey). Each pilot site was requested to consider operational and technical aspects to reflect the assessment of their mobile networks, PSAPs and the relevant cross border aspects.

3.2 Intended audience of this document

This Document is aimed at the following audiences and respectively at the fulfilment of the following objectives:

- European Commission: to communicate the project communication strategy and planned dissemination activities;
- Consortium partners: to coordinate and harmonise their individual dissemination activities and align these with those of the project ;
- HeERO Management Team: to provide an overview of activities, tools and procedures for dissemination
- Member states to deploy eCall in their territory

3.3 HeERO Contractual References

HeERO is a Pilot type A of the ICT Policy Support Programme (ICT PSP), Competitiveness and Innovation Framework Programme (CIP). It stands for Harmonised eCall European Pilot.

The Grant Agreement number is 325075 and project duration is 24 months, effective from 01 January 2013 until 31 December 2014. It is a contract with the European Commission, DG CONNECT.

The principal EC Project Officer is:

Wolfgang Hoefs
EUROPEAN COMMISSION
DG CONNECT
Office: BU 31 – 6/35
B - 1049 Brussels
Tel: +32 296 2188
E-mail: wolfgang.hoefs@ec.europa.eu

One other Project Officer will follow the HeERO project:

Dimitrios AXIOTIS

Dimitrios.AXIOTIS@ec.europa.eu

Address to which all deliverables and reports have to be sent:

Wolfgang Hoefs
EUROPEAN COMMISSION
DG CONNECT
BU 31 – 6/35
B - 1049 Brussels
Tel: +32 296 2188
By mail: wolfgang.hoefs@ec.europa.eu

Any communication or request concerning the grant agreement shall identify the grant agreement number, the nature and details of the request or communication and be submitted to the following addresses:

European Commission
Communications Networks, Content and Technology
B-1049 Brussels
Belgium
By electronic mail: CNECT-ICT-PSP-325075@ec.europa.eu

4 Technical aspects

4.1 eCall only IVS

4.1.1 Basic description of Dormant IVS

There is a lot of confusion caused by mixing up terms like “dormant IVS” or ”dormant SIM”. Therefore the most important aspects are described in the following with reference to the underlying standards.

In general one can say that an IVS with eCall only functionality (?) should never register into a mobile network except in case of a trigger for an eCall. However to speed up the registration process, a continuous scan of mobile networks should be done, to know in case of trigger to which network the registration shall take place. After the disconnection of the call, the IVS will stay registered in the network for a defined period.

According to CEN EN 16062:2011, when IVS is configured as “eCall only” IVS (Dormant IVS) then IVS NAD shall not systematically perform mobility management procedures, including registration on a PLMN, except when attempting to initiate an eCall and during an emergency call, or to initiate a test or reconfiguration of the terminal during the maintenance operation (ETSI TS 122 101 release 8 onwards). The main purpose for this restriction to avoid network congestion due to large number of unnecessary network registration, de-registration and location update signalling from terminal configured only to make eCalls.

After power ON, the IVS configured for “eCall only” shall go to standby mode and adopt “Inactive state” according to the eCall terminal state machine procedures specified in ETSI TS 124 008. The “eCall only” IVS shall periodically scan and maintain a list of available PLMNs during its inactive state, so as to reduce the network selection and registration after eCall initiation in accordance with ETSI TS 122 011. When eCall is triggered, IVS NAD shall then perform the network section and registration procedures, using the highest priority allowed PLMN found during most recent background scan.

4.1.2 Dormant IVS Operation

Under the normal circumstances, the eCall only IVS (Dormant IVS) should perform following steps during the stages of pan-European eCall transactions:

Step 1- Start-up procedures after power-up and initialisation of the IVS unit.

Step 2- As IVS configured is as “eCall only” then IVS NAD shall go to the dormant mode (Standby mode) where it’ll not interact with the network. However the IVS is listening to the available frequencies to identify a suitable network for registration in case of an emergency call initiation request.

Step 3- System Activation; IVS Unit initiates Automatic and/or manual eCall (a Teleservice 12 call) depending upon its trigger type (via crash sensor or manual button) which will contain Minimum set of data (MSD)

Step 4- “eCall only” IVS comes out of “Inactive State” and perform call Set-up (including identifying call type, could make call, network selection and registration, authentication, cell localisation (by network), established audio connection to PSAP modem server). Mobile network operator establish the TS12 call including MSD to the appropriate PSAP and uses eCall flag received in the emergency call set-up which allows to differentiate eCalls with other TS 12 calls.

Step 5- MSD transfer (including disconnect microphone and loudspeaker in vehicle from the line, send call tone, synchronise. Request MSD, send MSD, error check), and link layer ACK (including stop MSD transmissions)

Step 6- Application layer ACK; after successful MSD transfer, PSAP checks MSD contents. If format check succeeded, the PSAP shall automatically send positive AL-ACK to the IVS

Step 7- Established audio link or voice call with the vehicle occupants

Step 8 – PSAP operator speaks with vehicle occupants and clarify emergency situation.

Step 9 – Voice call clear down;

Step 10 – IVS wait for a possible call back (minimum network registration period – T9) from PSAP

Step 11 – After call back timer (T9) expires, IVS NAD deregister from the network

Step 12 – IVS goes back to standby mode (Dormant mode) as described in Step 2 and remains in this mode until there is a new eCall trigger or a request to perform test/configuration call.

4.1.3 IVS components

An in-vehicle system contains following components:-

1. Network Access Device NAD, GSM/UMTS
2. GNSS receiver – GPS/GLONASS
3. Main CPU
4. External antenna for GSM & GNSS
5. Control Box (eCall trigger switch, USB interface to PC, status indicator)
6. Audio interface (Microphone and speaker)
7. HMI interface for eCall(Automatic/Manual switch)
8. SIM card interface

The block diagram of the In-vehicle system fitted in the Test vehicle is shown below:

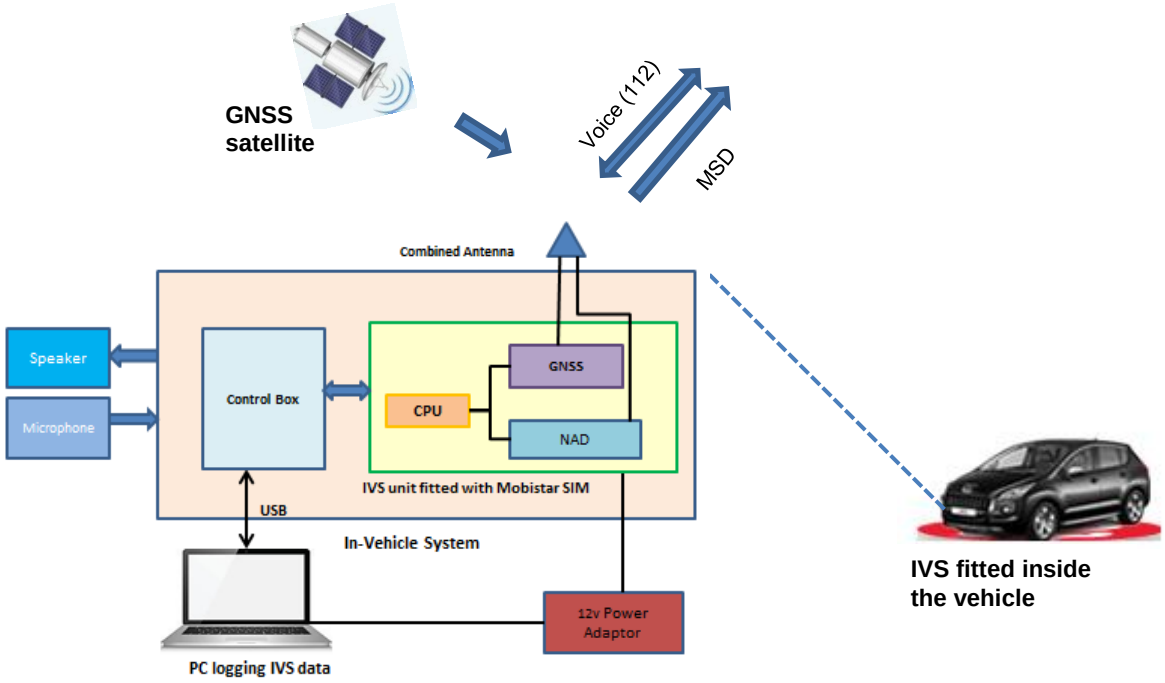

Figure 1: In-Vehicle system block diagram

4.1.4 Field Test Result

DENSO have conducted its field testing at the Belgium Pilot site with support from ITS Belgium and Mobistar (MNO) in the Brussels area, where the eCall flag is implemented. The table below shows an overall summary of the result of both static and dynamic drive testing. All eCalls initiated during this testing to the network were TS12 (112) calls using a combination of GSM/UMTS network technologies. In each IVS power cycle, the unit successfully entered the “eCall only” state (Dormant state) – limited services only without registering to the network.

Number of eCall Triggered (Static Test) - Total = 26

Automatic = 14, Manual = 12

Total ECalls	Call Set-up		MSD Transmission	
	Registration	Call Establishment time (s)	MSD Success Rate	MSD transmission duration (s)
26	100%	Mean - 2.34	85%	Mean - 7.9

		Min - 2 Max - 8		Min - 3 Max - 20

Table 1: Static Test Result Summary Table

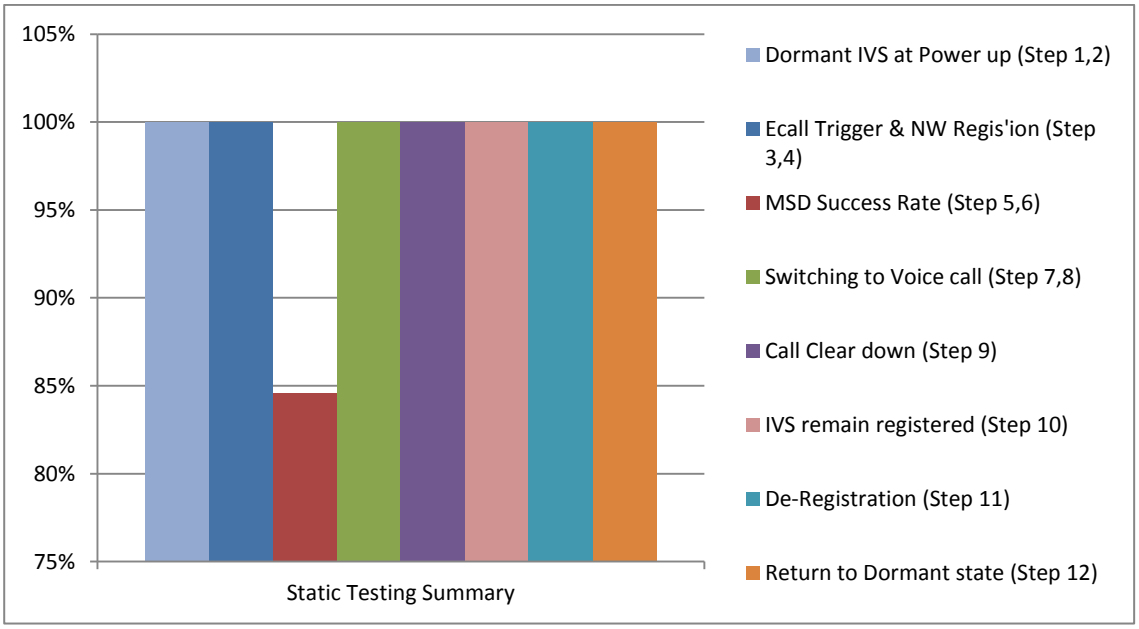

Figure 2: Static Testing Summary

Number of eCall Triggered (Drive Test) - Total = 24

Automatic= 14, Manual = 10

	Call Set-up		MSD Transmission	
Total eCall	**Registration**	**Call Establishment time**	**MSD Success Rate**	**MSD transmission duration(s)**
24	100%	Mean - 2.5 Min -2 Max - 4.5	50%	Mean - 6.9 Min - 5.5 Max - 15

Table 2: Dynamic Test Result Summary Table

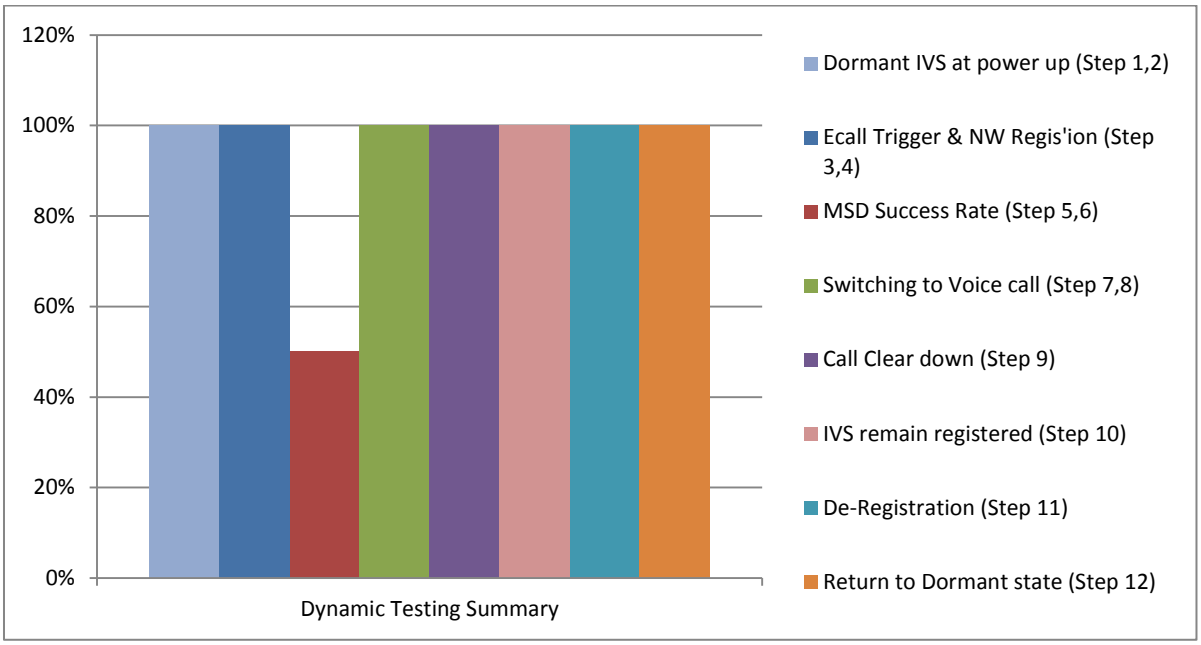

Figure 3: Dynamic Testing Summary

Drive test was performed mainly to check the eCall/MSD success rate especially when vehicle occupant triggers manual eCall while vehicle is still moving.

During these tests, the IVS NAD minimum network registration timer (T9) was reduced from 60 minutes to less than 5 in order to have more eCall triggers for better statistic. Some confirmation eCalls were also triggered with the full 60 minutes timer value to confirm IVS dormant behaviour as per CEN standard requirement.

4.1.5 Conclusion about eCall only and Dormant

Overall the Dormant IVS testing was successful against the ITS Belgium PSAP. In static testing, the complete MSD transfer success rate was 85 %, whereas in drive test the complete MSD transfer success rate was considerably lower nearly 50 %. The main reasons for MSD failure was reduced reliability (for both static and drive test) and cell handover situation (for drive test). In each eCall, switching to voice call was OK with clear audible voice from PSAP. From the above result, it is shown that 16 MSD transfers did not fully complete from the IVS perspective (HL-ACK received) during TS-12 112 emergency calls, even with higher network priority compare to normal TS 11 voice calls. However, the MSD receive rate at the PSAP may have been higher.

4.2 Roaming aspects

IVS NAD with necessary capability and a valid SIM/USIM can access emergency services when roaming to a visited PLMN. In this case, IVS NAD shall commence an emergency call set-up in accordance with ETSI TS 124 008 and include in the TS 12 service category request message the “eCall flag” as specified in ETSI TS 122 101 and ETSI TS 124 008 and network recognise this service request and perform necessary actions.

The Emergency call should be possible in both International roaming and National Roaming situation. In International roaming, IVS of a given PLMN shall be able to obtain emergency service from a PLMN of another country. In National roaming, IVS of a given PLMN shall be able to obtain service from another PLMN of the same country as per ETSI TS 122 011.

For the In-Vehicle system, there is no difference whether TS 12 call is performed in either home PLMN or visited PLMN area because IVS doesn’t recognise geo-graphical borders. The strongest network should be selected where eCall flag is enabled and this network should connect the call to the most appropriate PSAP.

However, in some cases, during the authentication of the subscriber (as part of network registration process), identity of the subscriber -IMSI number stored on the SIM/USIM is sent to the subscriber’s PLMN home location registry for authentication. If the IMSI authentication fails for any reason then, subjected to network operator and national regulatory policies, it may not be possible to establish an eCall. In this case, IVS shall continue to search and register to another network. The numbers of registration attempts will depend upon its retry counter value or timer value or if available power expires.

Roaming testing could not be performed in the member states due to limitation in the network infrastructure at the time of the HeERO2 project. This is due to the relatively sporadic implementation of the ‘eCall flag’ by all Mobile Network Operators in all network cells of each member state.

4.3 Dangerous Goods tracking

The HeERO2 project has extended its work on the eCall support for handling of dangerous goods transports.

The important question is:

How can the 112 centre get information about the dangerous goods loaded into a vehicle that just reported an accident via the eCall service?

The standard eCall message transfers include Minimum Set of Data (MSD), containing "emergency relevant" information:

4.3.1 Additional data in the MSD

It was envisaged from the start that there would be a need for additional data. MSD can be extended with an optional set of (well defined) data, not exceeding the available number of bytes. At the moment of writing at least two applications for Optional Additional Data are recognised:

- Embedding information about the load of commercial vehicles – this usage has been defined in EN16405 [2] (currently in CEN ballot)
- Embedding GLONASS extended accident information – this usage has been defined by GLONASS

4.3.2 MSD data structure

The MSD structure is well defined in EN15722 [1] and will not be discussed here other than the figure shown below, outlining the basic structure of the MSD:

MSD				
msdVersion	INTEGER (1..255)	-	M	
msd				
msdStructure				
optionalAdditionalData			O	
oid	RELATIVE-OID			
data	OCTET STRING			

Figure 4: –Structure of MSD

The main goal of EN15722 in respect to Optional Additional Data was to make sure that different applications could use the available space as optimal as possible, and at the same time making sure that interoperability was secured. This has resulted in the Optional Additional Data component in the MSD to consist of two elements:

- The Object Identifier (OID), referencing contents and definition of the data
- The data itself

As such any definition can be made for any use of additional data. The receiving PSAP can recognise what data is sent, decide whether it can decode the data and (if so) decode and use the information provided.

4.3.3 Methods of embedding relevant data

For the embedding information about the load of commercial vehicles the data part of the Optional Additional Data can be used in two ways:

- containing all relevant data that needs to be transferred to the emergency services;
- containing a reference to an external source with the relevant data – in this case the OID can also be used to define the method to retrieve data from that source e.g. a web service providing detailed information about loaded dangerous goods or a link to a pdf with the transport documentation.

4.3.4 Optional Additional Data Registry

In order to facilitate referencing the meaning and definition of data an Optional Additional Data Registry is of imminent importance. EN15722 envisages the existence of such registry, but does not define it. Such a registry for the OID needs to be setup. Rules and procedures for maintaining this registry need to be defined and agreed by all participating countries.

As the need for such registry is recognised, the following steps are currently foreseen:

- The OID is used to determine meaning and encoding of the optional data.
- A (public) register is being set up, that lists the OID together with the definition of the data
- A registration procedure is being set up, to ensure additional data is both functional and correctly defined
- PSAPs can choose to implement registered definitions in order to ameliorate the emergency process

How the additional data can be used for handling of dangerous goods and the ways to code this into an MSD have been explained in detail in Chapter 5.1 of the deliverable D6.5 eCall Guidelines.

4.3.5 Dangerous Goods tracking services

The additional data concept using web service can be used to access a dangerous goods tracking service called DG-Trac. The DG-Trac service is used to track transports of medical

items like blood samples or pharmaceutics. These items could mean serious health risks for emergency workers and people involved in the incident. Among other information the DG-Trac service can provide the real-time location of the dangerous goods, the type (UN-number) and the quantity. This would be very important information for emergency services when they have a handle an incident with this transport.

To link the information of the DG-Trac service and the eCall the additional data of the MSD is used.

In the additional information a link to the web service of the DG-Trac service is stored and the OID corresponding to the web service.

When an eCall is issued by the transporter of the dangerous goods, the additional Information is transmitted to the PSAP application in the Call server. The PSAP application finds in the OID that there is an additional link to a dangerous goods tracking service. The application will call this web service and provide as a parameter the licence plate number of the transporter. The licence plate number was derived from the standard MSD information of the eCall and the help of EUCARIS.

As a result of the call of the web service the application receives the detailed information about the dangerous goods loaded. This information can then be provided to the operator to help him to decide on the necessary actions.

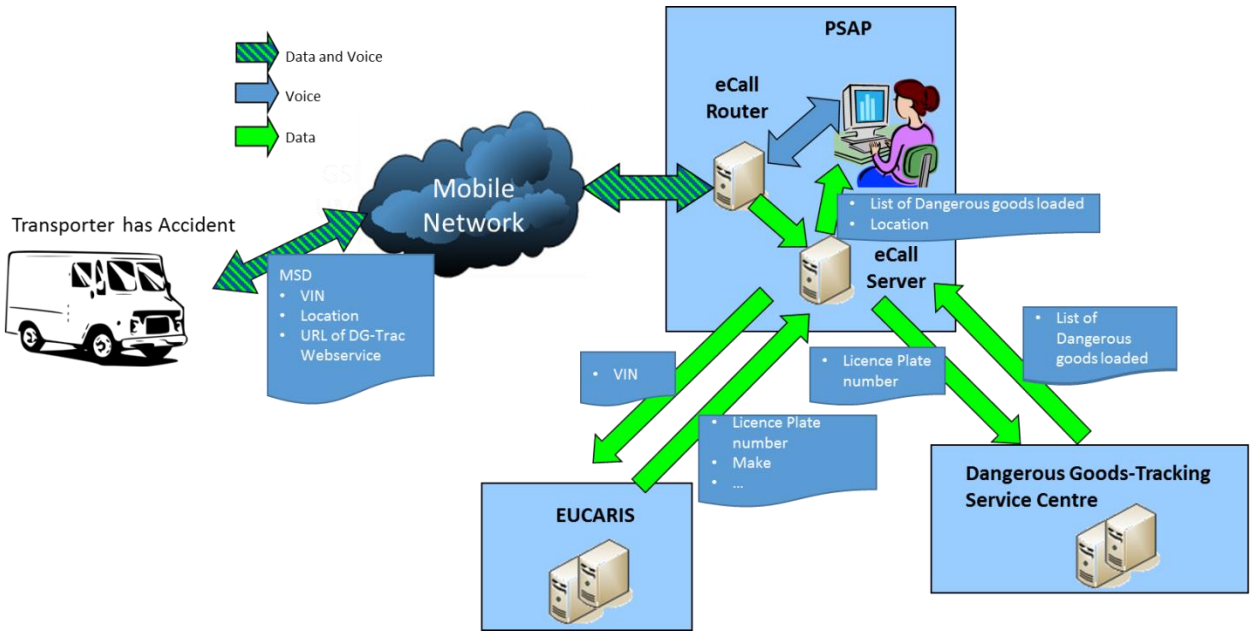

Figure 5: Data flow from the accident vehicle to the PSAP operator

This tracking service will be setup in 2015 and the web interface to eCall can be implemented according to the standards defined for eCall.

It is therefore important that the new MSD standard is defined and agreed until mid of 2015 latest.

5 Operational aspects

5.1 Cross border within a member state

In some member states the PSAP are allocated to dedicated geographic areas in part identical to the ones for TS12 in other implementations different geographical coverage. The routing of the eCall to the corresponding PSAP takes place based on the routing table of the mobile network at that specific node (mobile switching centre). As the strength of the mobile network and the respective coverage does not reflect the political boundaries of the PSAP allocated areas, a call might be forwarded to the wrong PSAP. Even if the location information of the mobile network is used identifying the appropriate one, the assumed location might be different to the actual location causing the call being forwarded to the wrong PSAP. Today there is no issue as the TS12 call is only voice based and the voice call may be transferred to the appropriate PSAP without any loss of quality. For eCall however within the voice channel additional data is transferred which will be made available to the call taker in an adequate way. The transfer of the call to the appropriate PSAP is possible only for the voice communication between occupants and call taker, not for the data already transmitted. This information has to be exchanged verbally between the two call handlers in the respective PSAPs.

5.2 Cross border between two member states

Between two neighbouring member states a similar situation will occur. There are close to the border areas where the IVS will identify the mobile network of the other member state as the most appropriate to establish an emergency call. As the strength of the mobile network and the respective coverage does not reflect the political boundaries of the member states, a call might be forwarded to the PSAP of another member state than that in which the vehicle is located.. Today there is no issue as the TS12 call is only voice based and the voice call may be transferred to the appropriate PSAP without any loss of quality. There are procedures defined and the phone numbers of the corresponding PSAP know. For eCall however within the voice channel additional data is transferred which will be made available to the call taker in an adequate way. The transfer of the call to the appropriate PSAP is possible only for the voice communication between occupants and call taker, not for the data

already transmitted. This information has to be exchanged verbally between the two call handlers in the respective PSAP agreeing on the language of choice for their conversation.

5.3 Management of subscriber numbers

This issue at the present moment in time is stated as not being an issue[1], however an EeIP Task Force has been raised to look at the issue of End of Life of a vehicle to ensure that the disposal and release of number is effective across all member states. The management of numbers is also linked to the type and length of the SIM contract entered into by the vehicle makers. At this time this is yet to be determined.

5.4 Dangerous Goods tracking

As described in chapter 4.3 Dangerous Goods Tracking (HiTec) means are proposed to provide the information about loaded dangerous goods immediately with the MSD.

This additional information has an impact on the operational procedures for the 112 centre.

As long as it is not mandatory for all transports to provide the information about loaded dangerous goods, the 112 centre cannot be sure that no dangerous goods are involved when the arriving eCall does not provide any information about loaded dangerous goods. In fact the 112 centre will apply standard procedures to this incident.

If an eCall arrives at the 112 centre and the MSD provides information about the dangerous goods loaded, then the 112 centre can act according to the procedures for handling of dangerous goods. The prerequisite is that the 112 centre SW is able to recognise the additional information provided and is able to display it in an appropriate way. The 112 centre SW should provide following information:

a. Type of the dangerous goods loaded (UN number)
b. Volume of dangerous goods loaded per type
c. Information about the handling of the dangerous goods

The PSAPs needs to define their procedures how they will react on eCalls with dangerous goods information.

5.5 Filtering Instance

One focus of the Belgian test site is to validate the concept of the filtering instance. This call centre is in charge of receiving all eCalls (automatic and manual), to decode MSDs and to store MSDs data into a database. The operator of the filtering entity determines if the call is genuine and worthy of being transferred to the PSAP. If so, he enriches the data, puts it in

[1] GSMA Statement EeIP meeting no 13

the database and transfers the call to one the local PSAPs based on the vehicle position. To transfer the information from the filtering entity to the PSAP the protocol of third party service providers is used (EN 16102). This has two advantages:

1. A Standard is already worked out in detail.
2. PSAPs are also ready to handle third party private eCall.

The Belgian site has validated the technical architecture of the filtering instance as well as the operational procedures to handle voice and data calls. One key issue for Belgium is to define funding mechanism for this entity. The mission is likely to be given to a private operator but the financial model has yet to be defined. One scenario was to push the costs to the telecom operators but this was strongly rejected. A working group has been set-up by the ministry of interior to look, among others, at this issue.

6 Interoperability

According to the description of work, one of the major conditions for the successful implementation of the eCall service on European level depends on the interoperability and cross-border continuity. The respective tests have been done in WP3, the evaluation in WP4. As such the focus in the following descriptions per Pilot sits is on those aspects which enable the continuity of the service.

7 Results of Pilot Sites

7.1 Belgium

7.1.1 eCall flag

The eCall flag has been implemented by Orange on a specific part of the network. Belgium could therefore test the eCall flag during the testing period. No issue has been detected.

Full roll out of the eCall flag is a cost for the operators but will be done as part of the normal network upgrade procedure.

7.1.2 PSAP

The Belgium test site demonstrated the concept of the filtering instance with its interface to one PSAP. Both the filtering instance and the PSAP were test environments. Both would need to be re-deployed for a full operational service deployment. Some of the building blocks that were implemented in HeERO 2 (e.g. the XML interface between the filtering instance and the PSAP) could be reused.

Today's Belgian implementation highlighted a number of shortcomings that would need to be addressed in a full operational deployment. As the PSAP for instance has no call back feature implemented, the PSAP operator was pulling all MSDs and not the filtered ones, etc. At the filtering instance, it was not possible for the operator to enrich the MSD data and to ask to the car to resend the MSD.

In conclusion, there are still in Belgium a number of legal, technical and operational issues to be solved at both the filtering and PSAP level to ensure an efficient deployment of the eCall system. The next step for Belgium is to perform a gap analysis to tackle remaining technical issues.

7.1.3 Cross border procedures

Belgium has many neighboring countries. Cross Border is a key element for the successful implementation of the eCall.

If an accident occurs close to a border, it is possible that that car's IVS is still connected to the network of the country it has just left. Therefore this country receives eCall and the MSD and a mechanism needs to be set in place that allows the transmission of the eCall to the correct country's PSAP.

This issue was looked at by Belgium and Luxembourg. Two options for solutions are proposed:

1. The operator receiving the call transfers it to the destination PSAP located in the country where the accident took place (country 2). The IVS phone number is transferred too. The operator in country 2 can then request the MSD from the IVS using the standard mechanism and can talk to the victims.
2. The operator receiving the call transfers it to the destination PSAP located in the country where the accident took place (country 2). The IVS phone number and the MSD are transferred to the server of country 2 using EN16102. The MSD and the IVS number are then displayed to the operator in country 2 immediately when the call arrives.

Option 1 would take more time as the operator of country 2 needs to request the MSD information while he is talking to the victims and this could delay the treatment of the eCall. This may be the only solution if there is no EN16102 interface between the PSAPs.

Belgium would therefore recommend implementing an interfacing mechanism based on EN16102 to transfer MSD's and additional information between different neighbouring countries. This mechanism would need to be further developed and agreed among the different countries.

7.2 Bulgaria

7.2.1 eCall flag

In Bulgaria 3 MNO are operating

i. Mobiltel
ii. Vivacom
iii. Globul (future Telenor)

At the end of 2014 the fourth one will start to operate on the territory of Bulgaria. Currently, Mobiltel and Vivacom have implemented eCall flag/discriminator and expectations are Telenor (formal Globul) to do so until the end of 2014.

Since the end of 2013, Mobiltel has successfully deployed the software upgrade of the MSC (Mobile Switching Centre), which includes the new "eCall-flag" functionality and all MNO eCall-flag related tests have been performed successfully. Since January 2014 Mobiltel has deployed the eCall-flag functionality in production nationwide and tests have been successfully carried-out.

7.2.2 PSAP

Bulgaria operates six 112 centres interconnected to an active PSAP located in Sofia and one stand-by PSAP located in Russe.

PSAP Sofia is included within the activities in HeERO2 project related to delivery of hardware, software adaptation and integration of eCall functionality in test environment.

The eCalls are received on the operator's application on the same place where the voice connection is established, MSD and VIN data are presented, as well the Resend MSD and Callback functionalities are available as well. The integrated eCall solution allows testing of the complete eCall functionality in pilot environment.

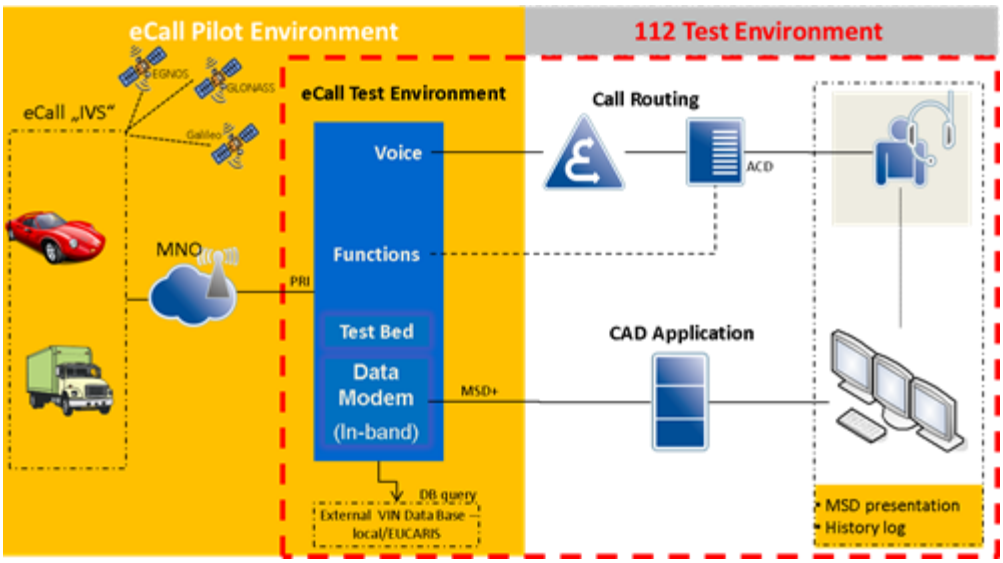

Figure 6: Bulgaria eCall PSAP architecture

The main components are:

- PBX
- eCall router
- Call centre
- CAD Application
- External VIN data base

The tests executed in 2014 showed that this configuration works very well.

Bulgaria therefore plans to update the pilot to the final operational solution and equipped stand-by 112 center in Russe.

7.2.3 Cross border procedures

There was only one cross-border test in April 2014 between Romanian IVSs and PSAP test environment. The KPIs have not been evaluated for it.

The next steps are going to be included in the National eCall implementation plan.

7.3 Denmark

The pilot test and participation in HeERO2 in Denmark, has all been a part of implementing eCall in Denmark. We planned to have all five PSAP installations (three operational environments and two permanent test-environments) upgraded to eCall during HeERO2, but due to a number of issues, we had to lower ambitions.

At the time of conclusion for HeERO2, a full test-environment has been implemented, and useful learning has come out of this process.

In order to coordinate HeERO2 participation and eCall implementation, a program was built with a steering committee with senior participants from Danish Transport Authority (Chair and responsible for vehicles), Danish Police (PSAP owner), Copenhagen Fire Brigade (PSAP owner) and Danish Business Authority (Responsible for tele communication).

The program will close 31 December 2014, and a new organization will have to be built to carry on the implementation. This new organization is expected to have the same participants, and is expected to have a clear mission statement regarding eCall implementation in Denmark.

7.3.1 eCall flag

The eCall flags were not implemented before the pilot tests were conducted. It is expected, that eCall flag will be implemented during 2015. The way how they will to be implemented have been decided during HeERO2 participation: eCalls will be routed to the same PSAP as 112-calls but to a specific ISDN PRI, so the modem-communication in no way can interfere with legacy 112-calls.

A meeting between PSAP authorities and MNOs is scheduled to be held in December 2014, by the initiative of the Danish Business Authority. The aim of this meeting is to initiate a work formulating and conducting a test plan for eCall flag implementation.

7.3.2 PSAP

We found good value in using the ITS Niedersachsen/OECON eCall router. We expect higher probability for future stability being reliable on equipment that is being used in several other countries, and hope for a critical mass of users to guarantee support for the years to come.

It is our plan to equip all five PSAP-installations with the eCall router (3 operational environments and two test-environments).

In Denmark, the PSAPs are operated by two different authorities, covering different parts of Denmark. In order to have national interoperability of eCalls between these two authorities (who do not have the same PSAP-system), an eCall server is planned to be installed. The specifications for this eCall server have been developed and negotiated among the two authorities during the course of HeERO2 participation.

In addition we have had success with our “minimal change” implementation principle, using experience from a national smart phone 112-app. Few changes had to be made to the PSAP-system, few changes had to be made to graphical user interface and no changes had to be made regarding communications from PSAPs to TMC and ECCs.

7.3.3 Cross border procedures

There have been no new arrangements with Germany and Sweden. The issue of enhancing cross border procedures is an issue to be solved in the coming years.

7.4 Luxemburg

7.4.1 eCall flag

In Luxembourg, three mobile network operators provide their services for mobile phones and data access:

- LuxGSM, a 100 % EPT daughter
- Tango owned by Belgacom
- Orange owned by France Télécom

Currently, the situation regarding eCall is still unclear. EPT planned to implement the eCall flag in 2014. The complete mobile network of EPT was upgraded to the latest Ericsson release until September 2014. First tests of this release showed that the implementation of the eCall flag routing is not implemented correctly in this release. Unfortunately the routing of the calls where the eCall flags bit 6 and 7 of the Emergency Service Category are set is routed to the same destination that is used when no bit in the Emergency Service Category is set. As the standard states that at least one Emergency Service Category has to be set to 1, we thought that this should not be a problem. Unfortunately further test showed that several older mobile phones do not set any bit of the Emergency Service Category when 112 is called. Therefore it was not possible to set the destination of calls with an eCall flag to another destination than 112 as otherwise real emergency calls may be routed to the test server instead to the 112 centre.

A new version with a correct implementation of the eCall flag handling will be available only in 2015. The project team therefore decided to use the test environment of EPT to test the eCall flag behaviour of the IVS.

The test environment consists of all network components needed for a complete network only the antenna of the base station is located in a closed metal box. The test network is only visible in the closed box and the commercial network is not visible in the closed box. This setup allows testing new releases or new features of the system SW in a real environment without jeopardising the commercial network.

As the time of writing the tests are ongoing as configuration issues with the IVS prevented us from executing complete tests.

7.4.2 PSAP

Luxembourg operates one 112 Centre (PSAP) located in the city of Luxembourg.

The IT solutions used in the PSAP are outdated and are not maintained anymore.

In 2015 a complete new PSAP SW will be implemented. This new PSAP SW is in the planning phase and the results of the HeERO project will be included into the specification of the solution.

Therefore no complete integration of the eCall solution into the existing PSAP solution was done. The eCall Server is simulated by an application that is receiving the calls and allows the operator to control the call, e.g. ask for a retransmission of the MSD or call back of the IVS. The eCall solution is implemented on a separate desk in the 112 PSAP allowing the testing of the complete functionality of the eCall solutions. The integration in the PSAP solution will be executed with the implementation of the new Luxembourg PSAP SW in 2015.

PSAP support of eCall

It was planned to implement the eCall infrastructure into the Luxembourg PSAP as shown in the following figure.

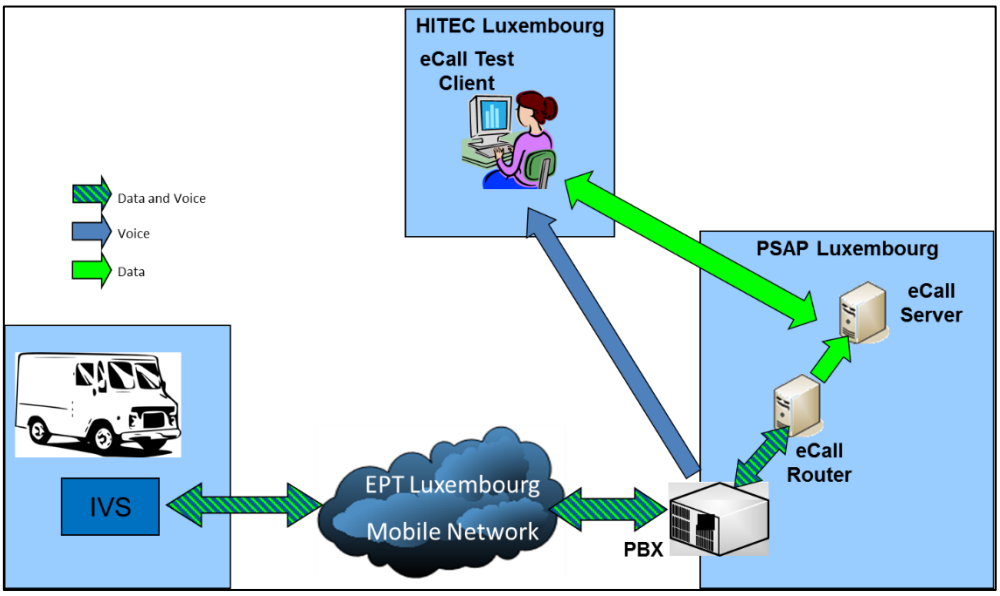

Figure 7: Luxembourg eCall PSAP architecture

The main components are:

- PBX
- Server hosting virtual machines
- eCall router
- eCall server

The tests executed in 2014 showed that this configuration works very well.

Luxembourg therefore plans to update the eCall router with the final operational solution and integrate the client functionality into the new 112 centre solution to be purchased in 2015

7.4.3 Cross border procedures

A big portion of Luxembourg is covered by foreign MNOs. In border areas it is possible to receive signals from the foreign operators such as the Germans ones. Currently calls that arrive to the German operators are forwarded to Luxembourg operators. It is not decided how this will work once eCall services will be implemented.

The solution implemented for eCall in the HeERO 2 project is an interim solution to test eCall and gain first experience. The final solution will be integrated into the new PSAP that is expected to come into operation in 2015.

In discussions about cross border issues with other countries implementing eCall like Belgium it was found that a the main problem is the transmission of MSD information when an eCall is forwarded from a 112 centre of one country to a 112 centre of another country where the accident really happened. The problem of the data transmission is similar to the

problem of call transfer from a filtering instance as it is used in Belgium to the destination PSAP. It is therefore proposed to use this procedure also for cross-border calls.

Unfortunately it was not foreseen in the budget and technically difficult to upgrade the test centre used for testing of eCalls in Luxembourg to interface with the Belgium filtering instance. These tests need to be executed in a following project. In addition the operational procedures have to be defined and adapted to the current procedures. Here a standard set of procedures would be very helpful.

At the moment calls that arrive to the German operators are forwarded as voice calls only to Luxembourg operators. A means that allows transferring also the MSD information would be very helpful.

7.5 Spain

The following table provides an overview on the troll-out as of today and scheduled in Spain.

	Start (mm/yyyy)	End (mm/yyyy)
Member state level political decision to implement eCall (start: start of administrative processing of the decision, end: final approval of the decision)	01/2013	12/2014
Implementation of eCall discriminator in mobile networks (start: first MNO started implementation, end: all MNOs have eCall discriminator implemented)	12/2014	12/2015
Implementation of eCall reception and processing capabilities in PSAPs (start: start of implementation, end: implementation of eCall in all PSAPs has been completed)	01/2015	10/2017
eCall roll-out (start: start of service availability to general public, end: day of the availability of eCall in the whole territory of the member state and including all MNOs)	06/2015	10/2017

Table 3: Deployment of eCall

7.5.1 eCall flag

In Spain there are four MNO's: Telefonica, Vodafone, Orange and Yoigo.

To date none of them has implemented the eCall Flag discriminator, yet. Telefonica is the only MNO involved in the HeERO2.

European recommendation states end of year 2014 for deployment of eCall Flag. Currently it is a task of the Member States to legislate about the obligation to deploy the eCall Flag discriminator. Spain will not take any initiative regarding the eCall flag until the end of the HeERO2 pilot project and the afterwards decision on the final Spanish eCall architecture (whether it will include an intermediate PSAP).

After HeERO2 project ends, with the definitive Spanish eCall architecture agreed with all the relevant stakeholders (including the regional PSAPs that actively participated in the project, but also those that did not), the DGT will agree with the Spanish MNO regulator the protocol to regulate the deployment of eCall discriminator by all the MNOs operating in Spain..

7.5.2 PSAP

Spain technical architecture is based on an intermediate PSAP hosted by the Directorate General of Traffic (DGT) in Madrid operating as a filtering instance for eCall and dispatching centre to the regional PSAP's, with whom it has built direct interfaces.

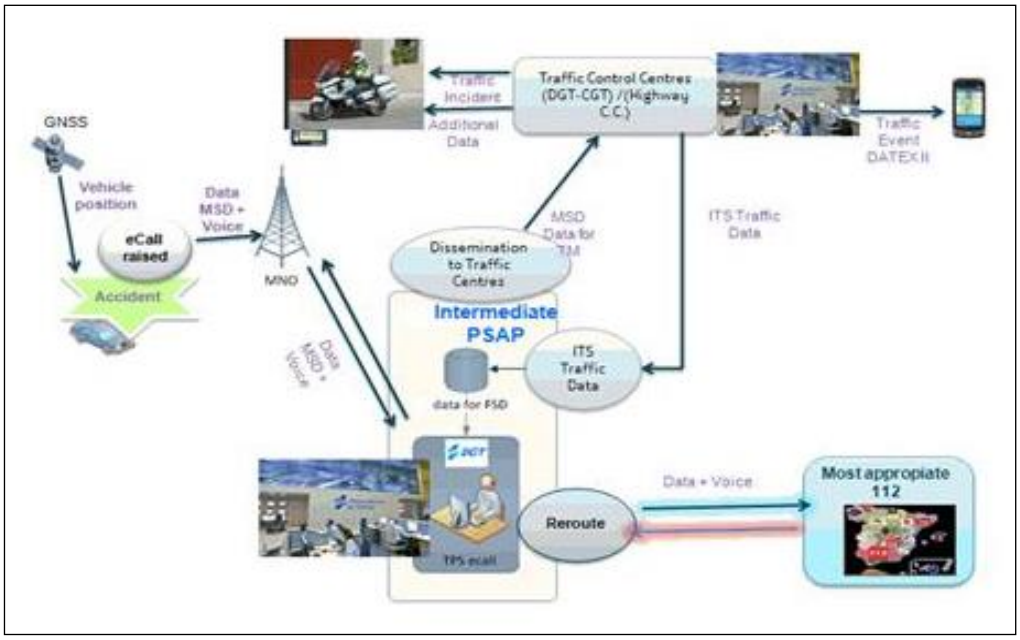

Figure 8: Spain eCall PSAP architecture

The full (data and voice) integration between DGT intermediate PSAP (based on Telefonica's "Séneca" system) and Madrid 112 PSAP, Galicia 112 PSAP and Castilla y León 112 PSAP is achieved using the interoperability bus contained in the "Séneca" emergencies platform, which is developed following EENA standards.

The filtering instance at the DGT PSAP accesses a proprietary database of vehicles through the VIN (decoded from the MSD). There is a limitation with this database, as it only contains information from Spanish cars. To overcome this limitation, the Spanish pilot has already started the work to gain access to EUCARIS as a further step towards full deployment of eCall at European level.

The final implementation of eCall needs specification of protocols or guidelines / recommendations for eCall management. DGT is working together with the regional 112 PSAP's across Spain to specify a specific protocol for the eCall management.

There is no political decision yet taken that Spain will finally adopt an eCall technical architecture that fully deploys interfaces from the intermediate PSAP hosted at the DGT and all Spanish regional 112 PSAP's (especially with those that did not take part in HeERO2 tests). Final roadmap for deployment in Spain will be decided during 2015, and will consider the feedback already being gathered from the implied stakeholders at Spanish level (i.e. regional PSAP's and the DGT) and the lessons learned from the tests in the other pilot sites.

7.5.3 Cross border procedures

Spain has not performed cross border tests with other countries. The next steps are going to be included in the National eCall implementation plan.

7.6 Turkey

7.6.1 eCall flag

There are 3 mobile operators in Turkey: Turkcell, Avea and Vodofone. Among them only Turkcell was included in the Turkish pilot. Tests were executed in Antalya City and MNO has updated its central switching software in Antalya for the tests. Turkcell uses Ericsson switches in their infrastructure. In order to route the eCall flagged emergency calls to the related eCall PSAP, new switch configuration has been implemented. SW updates and configurations have been performed for this purpose. Turkcell's current test system in Istanbul has also been used for eCall flag related IVS-MNO-PSAP integration tests, before field tests took place in Antalya.

According to Turkcell, it was not an official update and an official update must be released by switch manufacturer for nationwide deployment. Other two operators Avea and Vodafone are not included in the pilot. Their technical solutions and decisions will be taken before national deployment, but they have announced their interest and willingness to the project.

In the Turkish Pilot field tests, eCalls are made using 112 as the emergency number. ECall flag detection software is implemented in the MNO's central switch in Antalya. In the tests, the KPI_002 which measures the "success rate of completed eCalls using 112" is measured as 98 %. This KPI shows the good coverage area of GSM network and also the stable structure of the eCall HW/SW.

7.6.2 PSAP

In the Turkish Pilot, eCall PSAP has been implemented in Antalya 112 PSAP which is one of the new models 112 PSAPs in Turkey. The new 112 model brings together all the emergency service organizations into the same location. This model is implemented in 12 provinces. There is a plan to install 81 integrated "112" PSAPs (one dedicated PSAP per province) by 2018.

The pilot eCall system is operated under the same roof and it has an interface with legacy 112 system in order to transfer the incidents to the 112 operators. eCall PSAP and 112 PSAP use some system components in common. A dedicated eCall operator PC is used in Turkish pilot. ECalls are answered by the eCall operator and eCall operator filters the hoax/false calls and directs them to the 112 operators in the same roof. ECall PSAP software will also be used for nationwide deployment. In nationwide deployment, all eCall requests around Turkey will be directed to the Antalya eCall PSAP. Antalya eCall PSAP will take the calls, solve the MSDs, speak with the people in cars and redirect the incidents as a kind of system alarms to the related 112 PSAPs. In this wise, nationwide eCall deployment will be completed in parallel with the new model 112 PSAPs under the control of Turkish Ministry of Interior.

In the field tests, the performance of the PSAP is measured in several KPIs. Below is a list of related KPIs with the measurement results:

KPI_003: Success rate of received MSDs: 98 %

KPI_004: Success rate of correct MSDs: 99 %

KPI_005: Duration until MSD is presented in PSAP: 35 seconds

KPI_006: Success rate of established voice transmissions: 98 %

7.6.3 Cross border procedures

Cross border tests have not been performed yet.

8 Standards

The following list refers only to those standards which are relevant to the mentioned technical aspects mainly eCall only USIM and roaming.

EN ISO 24978; Intelligent transport systems — ITS Safety and emergency messages using any available wireless media — Data registry procedures

EN 16072; Intelligent transport systems — eSafety — Pan European eCall operating requirements

ETSI TS 122 101; TSG Services and system aspects: service aspects; service principles

ETSI TS 124 008; TSG core network and terminals: mobile radio interface layer 3 specification; core network protocols; stage 3

ETSI TS 126 267; TSG services and system aspects; eCall data transfer – in-band modem solution; general description

ETSI TS 126 268; eCall data transfer – in-band modem solution; ANSI-C reference code

ETSI TS 126 269; eCall data transfer – in-band modem solution; conformance testing

ETSI TS 122 003; Digital cellular communications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; Circuit Teleservices supported by a Public Land Mobile Network (PLMN). (Teleservice 12/TC12) /E12)

ETSI TS 122 011; Digital cellular telecommunications system (phase 2+); Universal mobile telecommunications system (UMTS); LTE; Service accessibility

ETSI TS 127 007; Digital cellular telecommunications system (phase 2+); Universal mobile telecommunications system (UMTS); AT command set for user equipment ETSI TS 102 164;

Telecommunications and internet converged services and protocols for advanced networking (TISPAN); Emergency location protocols

ETSI TS 151 010; Digital cellular telecommunications system (Phase 2+); Mobile Station (MS) conformance specification; Part 1: Conformance specification

ETSI TS 124 123; Universal Mobile Telecommunications System (UMTS); User Equipment (UE) conformance specification; Part 1: Protocol conformance specification

ETSI TS 121 133; Universal Mobile Telecommunications System (UMTS); 3G security; Security threats and requirements;

ETSI TS 122 071; Digital cellular telecommunications system (phase 2+); Universal mobile telecommunications system (UMTS); LTE; Location services (LCS); Service description; Stage 1[

ISO/IEC 9646; Information technology — Open Systems Interconnection — Conformance testing methodology and framework