D6.2 eCall Deployment enablers and opportunities and challenges: final report

Version number: 0.7
Main author: VTT
Dissemination level: PU
Lead contractor: ERTICO – ITS Europe
Due date: 31/12/2013
Delivery date: 14/02/2014
Delivery date updated document
Control sheet

### Version history

<table>
<thead>
<tr>
<th>Version</th>
<th>Date</th>
<th>Main author</th>
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<tr>
<td>0.1</td>
<td>23.10.2013</td>
<td>Davide Brizzolara</td>
<td>ToC</td>
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<tr>
<td>0.2</td>
<td>28.11.2013</td>
<td>Davide Brizzolara</td>
<td>Contribution to Chapter 4 and Chapter 5</td>
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<tr>
<td>0.3</td>
<td>05.12.2013</td>
<td>Risto Öörni</td>
<td>Updated ToC, Chapters 3, 4, 6 and conclusion</td>
</tr>
<tr>
<td>0.4</td>
<td>20.01.2013</td>
<td>Davide Brizzolara</td>
<td>Modification in Chapter 5</td>
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<tr>
<td>0.5</td>
<td>20.01.2014</td>
<td>Andy Rooke</td>
<td>Review</td>
</tr>
<tr>
<td>0.6</td>
<td>21.01.2014</td>
<td>Risto Öörni</td>
<td>Management summary</td>
</tr>
<tr>
<td>0.7</td>
<td>10.02.2014</td>
<td>Risto Öörni</td>
<td>Updated after internal peer review</td>
</tr>
<tr>
<td>0.8</td>
<td>10.06.2014</td>
<td>Risto Öörni</td>
<td>Results of Greek pilot</td>
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### Circulation

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<tr>
<td>Project partners</td>
<td>14/02/2014 25.06.2014</td>
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1 Management Summary

This report provides a summary of the barriers and enablers for deployment of eCall identified during HeERO piloting. The results of the work will be used in preparation for the Guidelines for eCall implementation and operation. The framework used to summarize the challenges for deployment is essentially the same as the one used in the earlier version of the report – HeERO deliverable D6.1b. Using the same framework also in this study is appropriate since this Deliverable is supposed to be a complement and an update of the previous D6.1. The framework can be divided into five layers: policy layer, business layer, operative layer. Technical/technological layer and user layer. This framework was used to identify and classify the challenges encountered by the pilot sites as well as the related enablers.

The work was started by collecting inputs from the HeERO pilot sites. The representatives of the pilot sites were interviewed by email to collect the required information and requested to write a text which would answer a pre-determined list of questions. The answers provided by pilot sites were included in the deliverable and then summarised using the framework. In addition to inputs from the pilot sites, other information related to enablers and barriers for deployment of eCall was collected with a literature study. This was necessary to get an overview on the current status of eCall regulation, standardisation, other systems providing in-vehicle emergency call functionality, results of the events related to the topic such as the eCall workshops and the opinions expressed by stakeholders related to eCall. Finally, the results were analysed to provide an overview on the enablers and challenges. The analysis was started by summarising the challenges. After a summary of challenges was available, related enablers and solutions were identified on the basis of contributions of pilot sites and other material available.

The main challenge for the deployment of eCall at the policy layer seems to be gathering full support of all stakeholders required to deploy eCall at the member state. This applies to both private sector and public authorities. The progress of European level regulation related to eCall will be an important part of solving this challenge. Another identified policy level challenge present in some member states is the difficulty to assign responsibility for a complex service in a complex administrative environment. A combination of measures on both member state and European level will likely be required although defining a solution to this challenge is out of the scope of this study.
The eCall tests carried out in the HeERO project have had certain limitations. For example, the eCall discriminator (‘eCall flag’) and a real PSAP used to handle emergency calls were not available at many of the pilot sites. This fact has an impact on the way how the results of the tests carried out in HeERO should be interpreted and on the conclusions on the further tests required after HeERO has ended. The tests carried out in HeERO should be continued at member state level to ensure the reliable operation of eCall since the start of its availability.

Current standards of eCall do not mandate the eCall IVS to support UMTS (3G) or any other mobile network technology introduced after GSM. However, complete shutdown of GSM in Europe or fast reduction in its geographical coverage does not seem likely. In other words, this has no immediate effects on the deployment or operation of eCall. Instead, it is related to the long-term evolution for eCall and other in-vehicle emergency call services. Further research and related road-mapping work on the long-term evolution of eCall, cooperation between stakeholders in the context of the EeIP and standardisation will likely have important roles achieving an optimal solution. Close attention should be paid to the results of the ETSI specialist task force studying possibilities for implementation of eCall in LTE (4G) networks and the work of IETF working group ECRIT.

The experience from the HeERO pilots has shown that the PSAPs in member states need updates which may be difficult to complete at least in all EU member states until 1st October 2015. This can expected to delay the implementation of eCall in some member states but not to prevent it. It is also expected that the continuity of service in Europe will be realised gradually rather than at once.

Challenges related to deployment of eCall may also be related to the operation of eCall or PSAP services in general. There are several operational issues in call handling such as silent calls, calls with noise, queuing of calls and answering of eCall with a failed MSD transmission. First, countries intending to implement eCall in their PSAPs have to develop guidelines for handling of eCall in their PSAPs. Second, recommendations can be provided on European level for typical issues related to call handling.

Three challenges on the user layer were identified for the deployment of eCall: possibility that consumers or the media confuse eCall with other in-vehicle emergency call services, misuse of eCall and users’ concerns of privacy violations and risk of supervision and tracking of individual vehicles. Educating the car users on the functionality and correct use of eCall has an important role in solving these challenges. Public awareness campaigns to communicate
eCall to car users have been discussed by the EeIP task force CAMP. The public awareness campaigns will likely be organised by member states with the support of the EeIP and EC.

Several of the HeERO pilot sites reported weaknesses in IVS implementation. They are a group of limitations of IVS used by the pilot sites and deficiencies in their implementation which have been identified and reported by the pilot sites. Many of the weaknesses in IVS implementation have already been solved during the project. However, some of them are still being discussed or have been identified but not corrected within the timeframe of HeERO. Certification of the IVS and the components providing the in-band modem functionality will likely be at least a partial solution to the weaknesses of IVS implementations. The causes of some of the identified weaknesses should be analysed further.

The results achieved by the pilot sites have showed that the MSD transmission is not always successful. In case the MSD transmission in the beginning of the connection fails, the PSAP may either decide to use the voice connection to obtain information from the vehicle occupants or request a MSD retransmission as defined in EN16062. The correlation between the outcomes between successive MSD transmissions during the same call has not been analysed in HeERO. The correlation between the outcomes of successive MSD transmissions and the reliability of the MSD retransmission including retransmissions should be analysed using statistical techniques. The factors contributing to the MSD success rate should be further investigated to provide recommendations how to achieve a reliable implementation of eCall MSD transmission. The possibility that the MSD transmission occasionally fails for some reason or other should also be taken into account in operation of eCall and related guidelines.

The voice channel blocking time has been longer than expected until the HeERO project. The MSD transmission times measured in HeERO were also longer than the 4 s set as the target value for eCall in ETSI TS 122 101 at least at some pilot sites. However, detailed analysis of the causes for transmission times longer than values measured in laboratory environment until HeERO was not possible within the information and time available. The possibilities to reduce the voice channel blocking time by optimising the acknowledgement mechanism related to the MSD transmission and by using the network echo canceller disabling tone should be analysed further.

The approach used in the study is based on systematic identification of challenges identified by the HeERO pilot sites and documented in deliverables of HeERO project and other material. Therefore, it is likely that the most important challenges related to the implementation and operation of eCall have been identified and documented. However, the
challenges identified in the report have not been analysed in terms of their likely consequences, impacts on eCall deployment and expected level of criticality. This has to be taken into account when preparing the recommendations for eCall deployment. Some of the enablers identified may look like recommendations even though they are not necessarily intended to be interpreted as recommendations at this stage – further analysis and information will be required to produce a set of recommendations for implementation and operation of eCall in Europe.

The challenges and enablers identified in the deliverable can be used as inputs for drafting of guidelines for eCall deployment and preparation of recommendations. It is likely, that more enablers and solutions could have been identified with a combination of in-depth theoretical analysis of the results of HeERO pilots and a carefully selected set of new measurements. Therefore, the list of the potential enablers for eCall deployment and solutions to challenges has to be understood as non-exhaustive. For example, in-depth analysis of the factors which contributed to successes or failures of MSD transmission at pilot sites, theoretical analysis of the in-band-modem solution and its potential improvements were not possible within the timeframe and resources of HeERO WP6.

The results indicate that the stakeholders working with the HeERO pilots have been able to solve many of the challenges identified during the project although the effort for preparation and testing was far higher than estimated beforehand. The tests carried out in HeERO provided important information, prepared ground for deployment of eCall but also had certain limitations in most HeERO countries. The in-vehicle systems used by the pilot sites were mostly prototypes. It should also be noted that most of the pilot sites were not using the common European emergency number 112. It is possible that the routing of the call and the signal processing along the call path would have been different if the tests had been performed with the emergency number 112. These limitations had to be taken into account when interpreting the test results.

It seems likely that the progress of the European level regulation will have an important role in ensuring the timely deployment of eCall in PSAPs and mobile networks. For example, some public authorities on member state level may be reluctant to act or commit any resources unless there is a legal obligation to do so. The study found no evidence of technical challenges which would prevent the eCall from functioning in the EU member states where the national HeERO pilots were implemented. However, close attention should be paid to technical challenges related to the level of service quality and the reliability eCall is expected to provide. eCall is a safety-relevant and safety-critical service, and the
expectations for its reliability may be high even though there are no formally set target values or standards for acceptable level of reliability.
## 2 Terms and abbreviations

<table>
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<tr>
<th>Abbreviation</th>
<th>Definition</th>
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<tr>
<td>API</td>
<td>Application Programming Interface</td>
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<tr>
<td>CEN</td>
<td>Comité Européen de Normalisation</td>
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<tr>
<td>CIP</td>
<td>Competitiveness and Innovation Framework Programme</td>
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<tr>
<td>DoW</td>
<td>Description of Work</td>
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<tr>
<td>EC</td>
<td>European Commission</td>
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<td>ENT</td>
<td>Ericsson Nikola Tesla</td>
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<td>ERC</td>
<td>Emergency Rescue Centre</td>
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<td>ETSI</td>
<td>European Telecommunications Standards Institute</td>
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<tr>
<td>EUCARIS</td>
<td>European CAR and driving license Information System</td>
</tr>
<tr>
<td>FIA</td>
<td>Fédération Internationale de l'Automobile</td>
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<tr>
<td>GIS</td>
<td>Geographic Information System</td>
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<tr>
<td>GLONASS</td>
<td>Global Navigation Satellite System</td>
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<td>GNSS</td>
<td>Global Navigation Satellite System</td>
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<tr>
<td>GPRS</td>
<td>General Packet Radio Service</td>
</tr>
<tr>
<td>GPS</td>
<td>Global Positioning System</td>
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<tr>
<td>GSM</td>
<td>Global System for Mobile Communications</td>
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<tr>
<td>HAK</td>
<td>Croatian Automobile Club/Hrvatski autoklub</td>
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<tr>
<td>HGV</td>
<td>Heavy Goods Vehicle</td>
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<tr>
<td>HW</td>
<td>Hardware</td>
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<tr>
<td>ICT PSP</td>
<td>ICT Policy Support Programme</td>
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<td>ICT</td>
<td>Information and Communications Technology</td>
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<tr>
<td>In Band Modem</td>
<td>The technology to transfer the MSD from the IVS to PSAP</td>
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In-Vehicle System
Key Performance Indicators
Long Term Evolution (4G mobile network)
Mobile Network Operator
Member State
Minimum Set of Data
National Emergency Number Association (USA)
Original Equipment Manufacturer
Primary Public Safety Answering Points
Public Safety Answering Points
Public Switched Telephone Network
Periodical Technical Inspection
Subscriber Identity Module
Software
Transmission Control Protocol/Internet Protocol
Traffic Management Centre
Third Party Services
Third Party Service Provider
Universal Mobile Telecommunications System
Vehicle Identification Number
Voice over Internet Protocol
Wireless Area Network
Yokosuka Research Park
3 Introduction

3.1 Objectives

This report aims to provide detailed results on the barriers and enablers for deployment of eCall identified during HeERO piloting and to summarise them in one report. The results of the work will be used in preparation for the Guidelines for eCall implementation and operation.

When identifying eCall deployment barriers and enablers, the study also aims to take into account the pilot results related to the use of the eCall on open platform for additional private or public services.

The barriers for eCall deployment are referred to as challenges in this document. This choice was made to be able to identify also factors which do not necessarily have the potential to block eCall implementation completely but have potential to delay it or have other adverse consequences such as reduce user acceptance for the service, service benefits or service quality or increase the cost of implementation. In other words, the challenges for deployment can be understood as factors which have the potential to have adverse effects on eCall deployment.

The enablers for deployment can be understood as solutions to the challenges. In practise, the enablers can be understood as measures, institutions and other factors which remove the challenges for deployment or reduce their impacts.

3.2 Structure of the document

Chapter 3 provides introduction to the topic by presenting the objectives of the study, the structure of the document as well as contractual references related to the report. Chapter 4 describes the methods used to collect information on enablers and barriers for the deployment of eCall and the overall framework used to classify and analyse them. Chapter 5 presents the information collected from the pilot sites and with other means such as with a literature study on material available on the topic. Chapter 6 provides a summary of the identified enablers, opportunities and challenges, and Chapter 7 presents the discussion of results. The conclusions are presented in Chapter 8.
3.3 HeERO Contractual References

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

The Grant Agreement number is 270906 and project duration is 36 months, effective from 01 January 2011 until 31 December 2013. It is a contract with the European Commission, DG CONNECT.

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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:
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4 Methods

4.1 Framework for systematic identification of enablers, opportunities and challenges

The framework presented in this Chapter is essentially similar to that proposed in D6.1. Using the same framework also in this study is appropriate since this Deliverable is supposed to be a complement and an update of the previous D6.1.

The framework for HeERO can be divided into five layers:

1. Policy layer
2. Business layer – Administrative layer
3. Operative layer – PSAPs, service providers etc.
4. Technical/Technological layer – including hardware software, applications, and communication
5. User layer – end users

This framework was used to identify and classify the challenges encountered by the pilot sites as well as the related enablers.

4.2 Analysis process and collection of information

The work was started by collecting inputs from the HeERO pilot sites. The representatives of the pilot sites were interviewed by email to collect the required information and requested to write a text which would answer a pre-determined list of questions. The Greek pilot site was given an opportunity to update its contribution after piloting activities in Greece had been concluded. The list of questions sent to pilot sites is presented below:

1. Was the whole chain (vehicle IVS – MNO network – PSAP) tested, if not why?
2. Were there cross-border activities already? Will there be in the next phase?
3. Where were the main focuses and efforts in the piloting (in percentages) and why?
4. PSAP
   a. Technical performance – problems and solutions?
b. Any issues related to standards?

c. Any issues related to stakeholders and operational issues?

5. Technical performance – problems and solutions (MNO)?

a. Technical performance – problems and solutions?

b. Any issues related to standards?

c. Any issues related to stakeholders and operational issues?

6. Technical performance – problems and solutions (PSAP)?

a. Technical performance – problems and solutions?

b. Any issues related to standards?

c. Any issues related to stakeholders and operational issues?

7. New material or links to relevant information?

The answers provided by pilot sites were included in the deliverable and then summarised using the framework specified in the previous chapter. In addition to inputs from the pilot sites, other information related to enablers and barriers for deployment of eCall was collected with a literature study. This was necessary to get an overview on the current status of eCall regulation, standardisation, other systems providing in-vehicle emergency call functionality, results of the events related to the topic such as the eCall workshops and the opinions expressed by stakeholders related to eCall.

Finally, the results were analysed to provide an overview on the enablers and challenges. The analysis was started by summarising the challenges. After a summary of challenges was available, related enablers and solutions were identified on the basis of contributions of pilot sites and other material available.
5 eCall and current development activity

5.1 European Parliament

A specific webpage is constantly updated for the decision for deployment of eCall in all member states\(^1\).

The 17/12/2013 the European Parliament's transport committee has approved a proposal requiring automatic post-incident emergency calling in new EU vehicles.

The Indicative plenary sitting date, 1st reading/single reading, is planned for the 24/02/2014

The “rapporteur” for the TRAN transport and tourism committee (Philippe De Backer) already published the draft report, with some amendment and a request to the member states to organise awareness-raising campaigns for the free and public eCall.

European Parliament gave a resolution on July 3\(^{rd}\) 2012 concerning eCall. All new cars must be fitted by 2015 with eCall devices to alert the rescue services to road crashes automatically, using the 112 public emergency call system, the MEPs state in their resolution. “This system will enable rescue services to arrive faster, saving lives and reducing injuries”. The non-binding resolution adds. "The European Parliament has given its clear support for all motorists in Europe to benefit from an emergency call system free of charge.

Since the voluntary approach has failed, we urge the Commission to propose legislative measures as soon as possible to ensure the eCall system will be mandatory in all EU countries by 2015", said co-rapporteurs Olga Sehnalova (S&D, CZ) and Dieter-Lebrecht Koch (EPP, DE).

The resolution regrets delays in the voluntary deployment of eCall to date and the small proportion of cars fitted with it (only 0.4%). It urges the European Commission to table legislation to make the eCall system mandatory by 2015. MEPs also call on the Commission to consider extending this system to other vehicles, such as motorcycles, buses, coaches and trucks in the near future.

MEPs believe that the public eCall service should be mandatory and available free of charge to all drivers in Europe, irrespective of the make of their vehicles. MEPs point out that the necessary technology is available and common EU-wide standards have been agreed upon.

They therefore call on the Commission to table legislation requiring EU member states to upgrade their emergency response service infrastructure so that it can handle eCall by 2015.

5.2 European commission

The current situation (4Q 2013) of the eCall Memorandum of Understanding\(^2\): it has been signed by 24 Member States (and two Member States who signed a formal Letter of Support), five Associated Countries and more than 136 public and private organisations, including representatives of all stakeholders in the eCall rescue chain. The number of signatories has clearly reached a critical mass, which justifies and supports the implementation of the service at Pan-European level, which will be based on the Pan European Single number for emergency calls 112.

HeERO 2 started in 2013 with six new countries: Belgium, Bulgaria, Denmark, Luxembourg, Spain, Turkey and five associated countries: Cyprus, Iceland, Israel Hungary and Slovenia, who will implement eCall with the support of the HeERO project, but without European Union financial support. At the time of the submission of this report Ireland as a Member State and ERA GLONASS (Russian eCall system) are now also associate members of the HeERO project.

HeERO2 Objective and Aims are to extend HeERO to new Member States or Associated Countries to demonstrate the scalability of the HeERO solution and to widen the acceptance of eCall. The supporting aims include preparing the necessary infrastructure to realise pan-European "eCall", boosting Member States investment in PSAP infrastructure and ensuring interoperability of the service by 2014 (Roadmap) and a wider adoption across Member States to test the proposed solution. Also new vehicle types are involved: Heavy Goods Vehicle eCall powered 2 wheeled vehicles. The retrospective installation of eCall to older vehicles is now a topic (including nomadic devices, smart phone type devices, navigation etc.). E.g. the IMobility observers were informed of the interest in the pilot described above.

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\(^2\) Additional information can be found at the following link: http://ec.europa.eu/digital-agenda/en/news/ecall-%E2%80%A2-memorandum-understanding-realisation-interoperable-vehicle-ecall-%E2%80%A2-document-and
Figure 1: Member State involvement in eCall

The activity for eCall deployment involves 3 different European Commission – Directorate General: DG Communications Networks, Content and Technology (CNECT), for MNOs, DG Mobility and Transport (MOVE), focusing on PSAPs, DG Mobility and Transport (MOVE), focusing on IVSs:

- **In-Vehicle Systems (IVSs)**

  Regarding the activity for the Type Approval Regulation the following steps have been followed:

  eCall in the WP 2011 of MVWG

  1Q 2011: Start of drafting

  3Q 2011: Consultation with experts and stakeholders

  2Q 2012: Adoption of Proposal by EC

  3Q 2012: Ordinary Procedure (EP and Council)

  4Q 2013: Adoption & Publication
More detailed information is available on the web site of the European Parliament:\(^3\):

Concerning the type-approval requirements for the deployment of the eCall in-vehicle system, amending Directive 2007/46/EC 2003/0153(COD), see also 2013/0166(COD), a proposal for the deployment of the eCall in-vehicle system and amending Directive 2007/46/EC has been published recently\(^4\).

The legislative process supporting the mandatory for deployment of eCall in all member states is on-going as detailed on the parliament website.

The “rapporteur” for the IMCO committee (Olga Sehnalova) already published the draft report, which includes some significant amendments such as:

- mention of assessment of potential extension of the eCall service to HGV, buses, coaches, PTW
- clear statement that all vehicles should be equipped with 112-based eCall service, even if also equipped with TPS eCall;
- invitation to the EC to assess with stakeholders the technical and legal possibilities to ensure an open-access platform, to avoid any further delay;
- deletion of the mention “OEM should be allowed sufficient time to adapt to the technical requirements of this regulation"
- specifically require from OEMs that the eCall IVS should be embedded, and that the purpose of the type-approval shall be the embedded systems
- clarify that in the case of TPS eCall, following EN 16102, it is the responsibility of the OEM or the service provider to demonstrate that only one eCall will be triggered, and that the public 112 based eCall will be triggered automatically in the event that the private solution is not operational
- addition of a warning in case a test shows that executing an eCall will not be possible, following a system failure

No changes are reported regarding Galileo and EGNOS.

1Q 2014: Drafting detailed rules and technical requirements

Mandatory in 2015 New Type Approved models


Mobile Network Operators (MNOs)

Regarding Mobile Network Operators (MNOs), the Commission Recommendation C (2011) 6269 was adopted on 08/09/2011 to support an EU-wide eCall service in electronic communication networks for the transmission of in-vehicle emergency calls based on 112 (“eCall”).

The following activities have been promoted:

A) Member States  
- Define Emergency Call infrastructure to receive the eCall  
- Meet MNOs to jointly agree on deployment roadmap  
- Report to the EC on the implementation status by 31 March 2012

B) Mobile network operators  
- Handle eCall like any other 112 (TS12 emergency call recognised by 3GPP networks) call:  
  - Free of charge  
  - Priority in the networks  
  - “national roaming” if applicable  
- Meet MS to jointly agree on deployment roadmap  
- Implement eCall flag in their networks before end 2014

C) Public Safety Answering Points (PSAPs)

The European Commission published on the Official Journal of the European Union (03/04/2013) the Commission Delegated Regulation (EU) (No 305/2013) of the 26th November 2012. This delegated act, supplementing Directive 2010/40/EU of the European Parliament and of the Council with regard to the harmonised provision for an interoperable EU-wide eCall, constitutes the part related to the Public Safety Answering Points (PSAPs) infrastructure of the Commission strategy on eCall, based on a 3-prong regulatory approach addressing the in-vehicle system, the telecommunications networks and the PSAPs.

The Commission wants the Pan European eCall system to be fitted to all new models of cars and light vehicles (Class M1 and N1) from October 2015 and therefore this measure establishes the conditions under which the emergency call response centres will be capable of properly receiving and handling of 112 eCall.

Commission Vice-President Siim Kallas’ comment clarifies the content of regulation: “These measures are the first adopted under the Intelligent Transport Systems Directive. They address the upgrading of emergency call response centres, to receive and process 112
eCall, including calls from vehicles registered in any EU country. Together with my colleagues responsible for Digital Agenda and Industry Vice Presidents Neelie Kroes and Antonio Tajani, I will pursue our joint efforts to ensure that by 2015 the introduction of the eCall service in the whole European Union will be effective." The Commission’s aim is for a fully functional eCall service to be in place all over the European Union (as well as Croatia, Iceland, Norway and Switzerland) by 2015. The common measures for emergency call response centres (also known as Public Safety Answering Points (PSAP)) will ensure the proper handling of 112 eCall and the EU-wide interoperability and continuity of the service. A legislative proposal will follow on the deployment of these measures as well as a proposal for a Regulation to require eCall devices to be fitted to all new models of passenger cars and light vehicles from 2015 in order to obtain EU-wide type approval. (EU Commission 2012) A proposal for a decision on the deployment of the interoperable EU-wide eCall COM (2013) 315 has been published the 13 June 2013.
5.3 Status of the Standardization

In the table below the status of standardization of eCall within ETSI and 3GPP is illustrated.

**ETSI eCall specifications stable**

- Proposal for an ETSI Special Task Force (STF) on migration of eCall transport
- Technical specification – 3GPP; last versions available from www.3gpp.org from 8th April 2011
- Conformance testing – 3GPP
- eCall Network Access Device testing - ETSI STF399

3GPP specifications: The following eCall related TSs (Technical Specifications, normative documents) and TR (Technical Report, informative documents) are approved in Release 8:

http://www.3gpp.org/ftp/Specs/latest/

- TS 22.101: Service aspects; Service principles
- TS 24.008: Mobile Radio Interface Layer 3 (incl emergency call set up procedures)
- TS 26.267 eCall Data Transfer - In-band modem solution; General Description
- TS 26.268: In band modem ANSI-C Reference Code
- TS 26.269: In band modem Conformance testing
- TR 26.969: In band modem Characterisation Report
- TS 34.123: UE conformance specification (UMTS)
- TS 51.010: MS conformance specifications (GSM)

**CEN eCall Application level Standards**

- CEN Standards approved:
  - EN 15722 MSD
  - EN 16072 eCall Op. Reqts
  - En 16062 App. Protocols
  - CEN TS 16454 eCall End to End Conformance Tests - voted
- eCall via TARV successfully tested
  - ISO 15638-10 (Telematics Applications for Regulated Vehicles- emergency Message system)
  - 1 of the messages is MSD
  - Including HGV eCall Optional Additional Data
  - Tested using 2G,3G,5G, Mesh Wi-Fi (from vehicle to Application Service provider) using CALM/CVIS protocols
  - At InnovITS Test track output to UK and Australian IP addresses.
- Upcoming eCall CEN TC278 WG15 meeting
  - 16454 comment resolution process
  - Revisions proposed by HeERO 1
  - ERA GLONASS Request for an OID (Object Identifier)
5.4 European eCall Implementation Platform (EeIP)

The European eCall Implementation Platform (EeIP) is the coordination body bringing together representatives of the relevant stakeholders associations and of the National Platforms supporting the implementation of a pan-European in-vehicle emergency call in Europe. It aims to guide, coordinate and monitor the progress of the implementation of the eCall service across Europe to ensure a timely, effective and harmonized deployment of the European-wide eCall service based on 112.

The EeIP builds on the previous work achieved by the eCall Driving Group, PSAPs Expert Group on eCall and the European Standardisation Organisations - ETSI-MSG and CEN TC 278 WG 15.

The 11th meeting of the European eCall Implementation Platform (EeIP) took place in Brussels on 2 October 2013. Mr Juhani Jaaskelainen, representing EC DG CONNECT and Chair of the EeIP, presided over the meeting and underlined the main policy developments of eCall in the areas of vehicle, telecommunications and PSAP and in the Member States.

High level representatives of the EC emphasized the common EC approach of the eCall implementation with the involvement of the EC DG CONNECT, DG MOVE and DG Enterprise.

The EC representatives made statements on the EC reports regarding the open platform, the obligatory use of EGNOS and Galileo, the progress in technical regulation (UNECE – United Nations Economic Commission for Europe), and eCall and the relationship with TPS.

The implementation of eCall is seen as a major step for road safety, bearing in mind that the proposal was also foreseen by the Strategic Action Plan “cars 2020” with the objectives of strengthening competitiveness and meeting technology. An MEP stressed the fact that EeIP is a crucial instrument helping at solving the technical problems related to the deployment of the eCall technology.

Representatives of the 3 DGs involved also reported on the EC regulatory activities. DG CONNECT reported that some coordination on local regulation remains to be done. DG Enterprise confirmed that regarding the in-vehicle part, it is important to work in the
framework of the UNECE (Working with UNECE is key to develop a harmonised solution valid outside the EU.

The EelIP activity is organised around a number of Task Forces, as detailed in the following paragraphs. In the following paragraphs a short report on the activity of each Task force.

**EelIP Task Force GUID**

The Task Force GUID (chair: iCar Support and EC-DG CNECT) has dealt with and gathered the relevant aspects in the context of pan-European eCall deployment. It has provided guidelines addressing the national implementation platforms and different stakeholders on the design and planning of the infrastructure needed to implement the pan-European eCall service in the European Union and countries associated to the initiative.

The pan-European eCall implementation guidelines address in particular the main involved stakeholders in the pan-European eCall implementation like the national platforms, PSAP organisations, mobile network operators, vehicle manufacturers and in-vehicle system suppliers. Not limited to the pure eCall service chain, the guidelines also consider potential (positive) effects of eCall on road operation and traffic management. Furthermore, the possibilities of the use of the eCall system for other value-added services and the use of private third-party services supported eCall (TPS eCall) were covered.

All available data related to the implementation of the eCall service have been gathered into one single document and the different parts of the value chain have been separated in order to facilitate the implementation.

The pan-European eCall implementation guidelines were approved by the EelIP members in 2011 and are publically available.⁵

**EelIP Task Force PILO**

The aim of the Task Force is to report the progress of the pilot at every EelIP platform meeting this specifically includes HeERO 1 and 2. It will stay active until the end of the HeERO Projects.

**EelIP Task Force VIN**

The aim of this task force is to define tools and procedures to extract relevant information from VIN decoder. A study regarding the activity of this Task Force has been presented at

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⁵ See http://www.icarsupport.eu/assets/Uploads/Documents/eCall/eCall-Implement-Guidelines.pdf
EeIP meeting of 19th October 2013 and the use of EUCARIS network has been confirmed as preferred solution. The activity of this Task Force has been completed.

**EeIP Task Force EXCH**

The aim of this Task Force EXCH is to support the sharing of best practices for eCall deployment. New best practices will be available as results of the eCall Pan-European pilot projects HeERO 1&2. The activity of this Task Force has been completed.

**EeIP Task Force CAMP**

The aim of the Task Force is related to the design of awareness and education campaign. Several eCall demos have been proposed done for decision makers in several European Member States. This Task force is on-going.

During the latest EeIP Meeting achievements have been illustrated. In particular the eCall activities at the IMobility Challenge day in The Hague (11th September 2013) were presented. This event saw 1,250 participants and more than 50 exhibitors: an eCall demonstration has been proposed in the Valkenburg Airport (The Hague) including an emergency rescue demo with a car crash, PSAP message, emergency services (including a trauma helicopter).

In the contest of the activity of the Task Force CAMP also it’s worth mentioning also the following events: the activity of the “Village de la mobilité” in Strasbourg, France and the FIA General Assembly & Prize Giving Event (Paris) in December 2013.

**EeIP Task Force CROSS**

The aim of this Task Force is the definition of cooperation procedures/protocols for the allocation of calls from places near the boundaries of PSAPs area. The activity of this Task Force has been completed.

**EeIP Task Force DISC**

The aim of this Task Force was related to the eCall discriminator implementation guidelines. The activity of this Task Force has been completed.

**EeIP Task Force INC**

The aim of this Task Force was to explore the possibility of using incentives. The final report was presented at EeIP meeting of 19th October 2012. The activity of this Task Force has been completed.

**EeIP Task Force OPEN**
The scope of the Task Force OPEN (chair: ARC Europe and ADAC) was to examine whether the in-vehicle platform for eCall can be used for other services (private and public). The aim was to define a positive business model through the common use of the eCall platform. The work was conducted in two stages: The first step was a questionnaire among different stakeholders of eCall, both private and public. The second step comprised of the analysis of replies from the stakeholders and the preparation of a final report with the results, a conclusion and recommendations.

The work of the task force has received a great deal of attention from several parties. This is due not only to the rich possibilities that the eCall ecosystem provides to both areas of application, in-car provision of other services and potential enhancements of public services – but also due the fact that there is great potential for using the eCall in-vehicle system for other services. This concerns not only the car manufacturers and their business partners but the automotive aftermarket as a whole and naturally the users as well.

The conclusion of the final report shows that there is no business case for stand-alone eCall, except for the national economies of the supporting states. Value-added services, either free of charge or commercial, can potentially be added to in-vehicle systems initially designed for pan-European eCall. Some services will be new, but some existing services will come into the vehicles by new access means. The report states further for the moment proprietary in-vehicle systems dominate the market and it explains why open in-vehicle platforms provide a higher service variety, more innovation and more choice for customers.

The report recommends that the development and dissemination of open in-vehicle telematics platforms should be fostered by all stakeholders and the findings of the task force will be used in HeERO and other related European projects. The report has been approved by the EeIP members in 2011 and is publically available.\(^6\)

Following the OPEN final report there are several discussions going on concerning additional services besides eCall and regarding the fact that fair competition in the automotive aftermarket needs to be safeguarded by EU legislators.

**EeIP Task Force PTI**

The aim of this Task Force is related to the procedure to check the operation of the eCall system throughout the lifetime of the vehicle. The activity of this Task Force is now completed and the recommendations were discussed during the EeIP meeting in May 2012, however the GSMA have now requested that this final report be re-opened for comment.

**Task Force: SILENT**

The objectives of the Task Force are to analyse the causes of Silent eCall, to propose solutions on how to reduce Silent eCall, to produce recommendations on procedures for handling of Silent eCall. Recommendations are:

- Link in the MSD (optional field) to additional set of data (if available and if requested by the PSAP)
- Equip the PSAP with appropriate software to aggregate calls from the same incident
- Promote the coordination among different actors receiving notifications of the incident (i.e. PSAP, police, medical, fire brigade, road management centres)
- In case of doubt, request a new MSD
- Conduct awareness education on eCall to inform citizens
- Promote the use of pairing the eCall in-vehicle embedded system with mobile phones to allow vehicle occupants to communicate when outside the vehicles
- Design the Human Machine Interface to avoid misuse and unintentional triggering of eCall

The activity of the Task Force is now completed.

**EeIP Task Force Location (LOC)**

LOC have published a report which contains the location requirements for eCall, list of relevant location technologies, their benefits and costs, GNSS buyer’s guide and GNSS performance and trials (optimum GNSS location performance and at no extra cost to users or industry). The contents of this TF report will be approved and its findings and recommendations incorporated into the overall EeIP implementation guidelines as soon as possible. All EeIP participants should note that according to the LOC recommendation the emerging GNSS capability is available from commercial products and that such capability is available for no extra cost to the vehicle manufacturing industry. Member States and PSAPs should therefore note the performance advantages of these new capabilities and the need to deliver maximum benefits to PSAPs and citizens. Vehicle manufacturers, when specifying system requirements, should consider the incorporation of these emerging capabilities into early generation eCall products.

The activity of the Task Force LOC has now been completed.
**EeIP Task Force RETRO**

The creation of this Task Force was approved in November 2012. The Task Force focuses on the following activities:

- Identify core areas for development - thematic title Safety and Security
- RETRO focused on 112 based eCall incl. specified MSD
- Observatory on technical development in this area
- Investigate and define opportunities in-line with published standards
- link with the current standards refinement work within HeERO
- Examine how certification should be regarded with retrofit devices
- Coordinate with existing TF – LOC. Silent, PTI and PILO

The activity of this Task Force is on-going.

**EeIP Task Force TPS**

This task force has been recently formed at the request of the Netherland EeIP representative. The purpose of the TF is to examine and refine existing and future TPS eCall activity with a view to harmonizing the impact on each MS from the TPS providers, in both the approach the transfer of data, and methods of contact. Whilst this TF is not strictly within the ToR of the EeIP the issues raised have a direct impact on the effectiveness of the PSAP in eCall operation, this TF has been completed and the report submitted to the Chair of EeIP for review.

**Task Force «TPS to PSAP»**

Established by EEIP in April 2013, Time frame: To be completed within November 2013.

3 working groups: Access to PSAPs; Organisational issues between TPS and PSAPs and Technological issues

Main Challenges:

Demand for clarity on the status of TPS, «Advanced shaving machine» vs. competitive edge, not wide enough participation on the side of emergency services, Member States.

Findings so far:
• Member States’ sovereignty needs to be taken care of the organisational differences between Member States mean that there is no «one size fits all»;

• There is a genuine wish among all stakeholders to provide a service which is of benefit to the citizens;

• The limitations in terms of technological opportunities can largely be overcome

5.5 eCall interoperability event in 2012 and 2013

A Test-fest\(^7\) aimed to verify the interoperability between different manufacturers of solutions for eCall IVS and PSAP devices, as well as operational eCall PSAPs from different countries, was held in May 2012 and September 2013.

More details will be provided in a deliverable in the context of the HeERO2 Project.

5.6 eCall workshops

5.6.1 Second HeERO International Conference

The Second HeERO International conference presents the results of the implementation of the pan-European in vehicle emergency service - eCall, deployed in the framework of the HeERO (Harmonised eCall European Pilot) project. The event takes place as a contractual obligation of the HeERO 1 and 2 contracts.

ERTICO (project coordinator), and the European Emergency Number Association (EENA) were responsible for the organization, in conjunction with the host Country Romania. In case of an incident, eCall is an in-vehicle system able to automatically dial the European emergency number 112 and transmit relevant information regarding the location and technical data of the vehicles involved to the emergency services. This allows rapid intervention in the unlikely event that passengers are no longer able to speak. The system also allows manual dialling from the vehicle. eCall is free to the public and it will be compulsory in the European Union as from October 2015.

ERTICO – ITS Europe’s Senior Project Manager and HeERO Project Coordinator Andy Rooke confirms: “Though all new types of passenger cars and light commercial vehicles (categories M1 and N1) will be equipped with eCall by 2015, its development must not stop at this level. eCall has to constantly adapt to new technologies and to the needs of the

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\(^7\) Details and contacts related to this activity are available at the following link: http://www.ertico.com/2nd-eCall-interoperability-event/
population in order to save lives, while preserving confidentiality and personal data protection. The implementation and operation of the harmonized EU-wide eCall will contribute each year to saving hundreds of lives, to reduce the severity of injuries and trauma caused by road incidents."

The conference is attended by more than 300 delegates from emergency services, industry, mobile network operators, standardisation bodies etc. from over 60 countries in Europe, North America and Asia, officials of the European Parliament and of the European Commission as well as the Romanian institutions in charge.

The topics were focused on the eCall implementation in the pilot sites, the interoperability between the eCall equipment to be installed in the vehicles, the various emergency calls centres and on the European standards revision.

Live practical demonstrations were performed by the Special Telecommunications Service (Romania) engineers (Romanian PSAP), with calls generated in Bucharest and across Country, and with several eCall-equipped cars moving in traffic.

5.6.2 eCall Days Germany 2013

The eCall Days as the largest conference on Pan-European eCall in Germany. This was the third eCall day held and took place in Berlin. During the two days conference, the event gave a European-wide overview on the situation of eCall deployment and implementation.

The topic of the first day was the current status of the upcoming implementation of eCall and Third Party Services in Europe. Political representatives of the European Commission, the federal governments of Germany and Czech Republic, the federal state governments and other stakeholders took a stand and presented their agenda on eCall implementation, interoperability and additional services. After the lectures the participants had the opportunity to network during the evening reception.

On the second day, the conference focused on the view of component suppliers and the entire range of services, aiming to present the on-going technical process of implementation and observing the developments in the area of powered two-wheelers.

The event was rounded out by an exhibition with an eCall simulation, a Rider eCall demonstrator and a Car-to-Car communication demonstration.
5.6.3 Round table 112 in Turkey

The debate allowed Turkish stakeholders to discuss issues and challenges and to benefit from European best practices and international experience. The Roundtable aimed at providing Turkish emergency services and related public authorities with some inspiration and strategic vision on how to best tackle the challenges related to the functioning of the European emergency number 112 and emergency services in general.

The event gathered about 150 participants, including Turkish stakeholders as well as emergency services, European and national public authorities and industry representatives from all over Europe.

5.7 ITS World Congress

The ITS World congress rotates between Europe, the Americas and the Pacific Countries. In 2013, the congress was hosted by Tokyo. As you would expect the event attracted significant numbers of delegates from across the world, though the numbers were slightly reduced by the political situation in North America.

The HeERO project had submitted a Special Interest Session proposal to the congress organisers that had been accepted. The title of the session was, SIS19 - Advancing eCall to Deployment - Global Perspectives Wednesday 16th October 2013. The session had attracted speakers globally to represent the state of the art in terms of eCall globally the session was sponsored by the European Emergency Number Association (EENA), and moderated by HeERO Project Coordinator.

In previous years this is one of the most popular sessions which are staged, and this year with the imminent deployment of ERA GLONASS and Pan European eCall. However the weather in Japan intervened, a typhoon was scheduled to strike the conference site on the morning of the eCall session. As a result the conference organisers cancelled the entire morning session: the organisers were unable to reschedule the event owing to the high number of sessions taking place. The Organising Committee have decided to re-stage the event during the next World Congress in Detroit USA. All speakers in Tokyo have committed to return to Detroit in 2014.

Furthermore, during the Congress, on the 15th October, the HeERO project Coordinator escorted and briefed the High Commissioner for Luxembourg around the World Congress. Luxembourg as a HeERO 2 Pilot Site staged an eCall demonstration at the congress in conjunction with HeERO Associate Partner Fujitsu 10. The event was hosted by the Fujitsu
President. The Commissioner was briefed on the HeERO Pilot Projects and took part in a live demonstration of eCall on the Fujitsu 10 stand.

5.8 Russian eCall project ERA GLONASS

Russian ERA GLONASS project is preparing eCall for the State of Russia. The project started in 2010 with system planning and the implementation is planned to take place in 2014 (for certain type of vehicles). The current consortium (from May 2012 onwards) preparing the service is named GLONASS Union, appointed to be National Navigation Services Provider, and the sole contractor for ERA GLONASS infrastructure deployment. GLONASS Union is a partnership made up of JSC MTS, JSC Vimpelcom, JSC Megafon, JSC RTComm.ru (Rostelecom), LLC Yandex, JSC Navigation-Information Systems, GLONASS/GNSS-Forum Association, and LLC Summa-Telecom. GLONASS Union is mandated by the Russian government to develop and implement the ERA GLONASS system. It is envisioned that further extensions to ERA GLONASS will be developed by GLONASS Union in the future, but that GLONASS Union does not intend to provide services directly, but rather provide a platform for other service providers to utilise. (ERTICO 2012)

The main aim of the project is to deploy State owned System for Emergency Response Service (ERA GLONASS). It functions similarly to European eCall. All new vehicles in Russia will be equipped by ERA GLONASS OCUs, at the same time, ERA GLONASS land infrastructure will be completed and fully deployed by 2013. Besides eCall, the service in Russia is expected to boost the development of navigation, telematics and communications markets in Russia.

The Government decision to change the company that holds the role of National Navigation Services Provider was due to the necessity of attracting off-budget investments into that market sector and ensures equal access and usability rights for ERA GLONASS infrastructure for different market players.

On October 8th 2012 the Ministry of Transportation of the Russian Federation signed a Contract with GLONASS Union, which will serve as National Navigation Services Provider for the deployment and operations of ERA GLONASS Emergency Response System.

Given the schedule for outfitting vehicles with ERA GLONASS defined on April 9th 2012 the Government regulation which was distributed to project stakeholders in Russia:

- 01 Oct 2014 – new vehicles of categories М2, М3 intended for passenger transportation and new vehicle of category N1 (weight > 2.5 tons), new vehicle of
categories N2 and N3 intended for dangerous cargo transportation (assessment of compliance in the form of vehicle type approval at first time)

- 01 Jan 2015 – new vehicles of categories M1, N1 (assessment of compliance in the form of vehicle type approval at first time); new vehicles of categories N2, N3 not intended for dangerous cargo transportation; new vehicles of categories M2, M3 not intended for passenger transportation (assessment of compliance in the form of vehicle type approval at first time)

- 01 Jan 2016 – vehicles of categories M2, M3 intended for passenger transportation and vehicles of category N1 (weight > 2.5 tons), vehicles of categories N2 and N3 intended for dangerous cargo transportation that will put in circulation at first time (as new vehicles as well as all vehicles not previously in use in the territory of the Russian Federation which will be imported to Russia)

- 01 Jan 2017 – all categories of vehicles that will be put in circulation at first time (as new vehicles as well as all vehicles not previously in use in the territory of the Russian Federation which will be imported to Russia)

Besides the principle aim of ERA GLONASS Project – to increase safety in automotive transportation environment, the capabilities of ERA GLONASS infrastructure reach much further. They can facilitate the development of interoperable telematics systems establishing the ground base for a multitude of different services, such as fleet management systems for transportation transit corridors, passenger transportation, heavy, hazardous cargo forward and deliveries, tolling systems, stolen vehicle recovery service, digital tachograph.

Additionally, the capabilities of ERA GLONASS infrastructure make it possible for Insurers to introduce new products based on Insurance Telematics Services. These include road traffic incident reconstruction Service for Compulsory Insurance and Pay-as-You-Drive/Pay-as-You-Use Insurance Programs for Voluntary Insurance (Domaratsky 2012).
5.9 HeERO Piloting Experience: overview

The main elements of eCall *technical and operational functionality* can be divided in three parts: the in-vehicle system functionalities, the mobile phone network functionalities (communications) and the PSAP functionalities and operations. The verifications of successful functioning of all these main elements are gathered in HeERO project in its many subtasks: in WP2 (specifications for the testing implementation), in WP3 (operational issues) and in WP4 (test results and the KPIs). WP6 summarises the experiences and will mould them into Guidelines (D6.4) for the future and new stakeholders.

The important *non-technical elements* of eCall deployment are legislative, administrative and business model levels with the stakeholders as well as the end-users involvement and privacy issues, which should be also taken into account while writing the Guidelines.

The HeERO partners are gathering important piloting experiences and materials in several WPs: in WP2 there is a comprehensive framework for writing down each piloting detail in deliverable D2.4 (System test cases and verification report) for issues like “Functional test of IVS”, “GSM module test”, “Integration test: PSAP modem – PSAP application” etc. The expected results and actual results and possible problems are written and gathered in the D2.6 (Final system test cases report). In WP3 the deliverable D3.2 (Operation Preliminary results) presents inputs from the first piloting round and D3.3 Final Operation results, which include issues related to e.g. MSD, VIN, exchanging needed information through the interface with traffic management centres and interconnections with 3rd party etc.

There is a need to highlight issues that are already visible, problems and solutions which were confronted during the first pilots, in order to provide important feeds for the next eCall projects like HeERO2 and for other future eCall related activities with Members States and stakeholders.

In the next chapters issues brought up by the HeERO partners in Member States pilots are described in order to sum up the project common Guidelines and Recommendations. The chapters present both Problems found in implementation and operation of the pilot scheme as well as solutions innovated for tackling the problems.
5.10 Piloting in Croatia

5.10.1 General

The Croatian eCall Pilot Architecture comprises the following components: IVS\(^8\) units (both the IVS simulator and commercial-grade units), Mobile network and PSAP\(^9\). These components were implemented both at test-bed and in real environment.

The components of the Croatian eCall Pilot Architecture are presented on Figure 9.

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\(^8\) In-Vehicle System
\(^9\) PSAP- Public Station Answering Point

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![Figure 2: Croatian eCall Pilot Architecture](image-url)
• *Was there already cross-border activities? Plans for the next phase?*

Cross border activities were conducted via remote tests with HeERO partners from Czech Republic, Sweden, Germany, Italy and Romania.

The second part of cross-border activities were performed at the 1st International HeERO Conference where various IVS units were tested against Croatian PSAP and MNO with eCall flag.

Several scenarios in WP3 have included testing with foreign SIM card in roaming.

Plans for next phase include extensive testing with other HeERO partners and are to be agreed.

• *Where were the main focuses and efforts in the piloting (in percentages) and why?*

  o in IVS 25 %
  o in MNO / Communications 25 %
  o in PSAP environment 20 %
  o getting the test results (KPI) 25 %
  o or other 5 %?

• Gathering full support from all stakeholders due to the lack of legislation framework.

This distribution shows that every aspect required extensive effort to be undertaken to perform a full chain testing, and to consolidate data and provide test results. At the very beginning of the project major issues were related to IVS due to the lack of such devices on the market. MNO upgrade and PSAP upgrade were flawless due to excellent support from all involved parties.

**5.10.2 IVS**

• *technical performance – problems and solutions*

The first commercial grade IVS units had limited capabilities since they came with predefined MSD content but in new version manufacturers have enabled features which create MSD using real data from sensors.

As these devices were developed after the project had already started, several issues were addressed to manufacturers and all of them have been successfully solved.
Due to the fact that all operators have to interconnect with fixed-network operator interconnectivity regulations have to be defined.

Network coverage problems were detected in certain geographical areas, and therefore tests were performed at areas with satisfying GSM signal.

No special issues related to PSAPs

A time synchronisation issue between IVS and PSAP was resolved by adding additional equipment (GPS Time Sync) to the PSAP side.

Increased MSD & eCall initiation times for vehicles in motion due to poor network coverage – tests performed for stationary vehicle in the area of good coverage + additional scenario for vehicle in motion to be conducted in Phase II.

Consolidated data quality control – detailed manual of data consolidation will be prepared, and consolidated data quality check procedure will be put in effect in Phase II.

According to current experiences from the pilot, eCall has proven to be a mature technology which might be deployed and use for commercial use. Several shortcomings which were identified were solved with additional effort from all stakeholders.

Problems have been identified in real environment testing and during real eCall crash test, because in these exercises weaknesses of the every element of eCall chain could be identified. Due to this reason real crash test have been continued.

Due to the number of stakeholders involved; mutual cooperation and proper technical support are critical prerequisites to success in this kind of project. This is one of the key messages that should be communicated.
5.11 Piloting in Czech Republic

5.11.1 General

- **Figure 3: Piloting process of Czech**

  - *Was the whole chain (vehicle IVS - MNO network - PSAP) tested, if not why?*

We tested whole eCall chain (Figure 3). eCall solution was first tested in the beginning of 2012. Identified bugs on both IVS and PSAP level were then fixed and were ready for IVS implementation to the test car fleet in May. We have also discovered a false eCall issue so we had to reconfigure IVS and MNO for usage of short number 162 instead of 112+eCall flag. Since May 2012 we have implemented TMS interface allowing us to send incident data to the National Traffic Mgt Centre. TPS interface has been recently implemented and some tests have already been conducted. Intensive drive tests proceeded in September 2012 (2 weeks testing) and focused mainly on KPIs evaluation. We were testing the complete eCall
chain – eCall generated by IVS goes through mobile and fixed network of Telefónica to the testing PSAP. PSAP modem receives MSD and after the basic check it sends data to the application superstructure. In parallel, free operator is found and eCall voice + data are then distributed to his/her workplace. eCall handling is done either manually by operator (not real staff, people from 112 test-bed) or by automated script allowing reception, processing and closure of eCall session.

- *Were there cross-border activities already? Will there be in the next phase?*

In September 2012 we performed first interoperability test between Czech Republic and Germany. Czech eCall testing car equipped with both types if IVS successfully communicated with German PSAP. MSD reception and Resend MSD passed without any problems. Another cross border test was performed in November against Croatia PSAP, again with positive test result, but only pure eCall, no Update MSD was tested.

The Czech HeERO consortium tested interoperability with one IVS from Telematix and one IVS from Sherlog during 2013. The only different setting for each IVS was short/long number for PSAPs in concrete country. HeERO deliverable D4.4 contains detailed test results of KPI 5 and KPI 7 and detailed statistics for testing in Finland, the Netherlands, Sweden and Germany.

It can be concluded, that value for KPI 7 is quiet independent on place of testing, but KPI 5 is from 5 to 23 seconds for different countries. It is obviously caused by different architecture of whole eCall chain in each member state, where have been IVS tested.

- *Where were the main focuses and efforts in the piloting (in percentages) and why?*
  - in IVS 40 %

We have tested two types of IVS and each of them has his own issues to be solved. Fixing bugs, upgrade Firmware and consequent retesting of basic IVS functions. Stability of IVS, audibility and voice clarity had to be solved. The major issue was to unify logging procedure for future KPI measurement.

There has been issued second generation of Telematix IVS for second round of HeERO testing in 2013, which has been significantly more reliable compare to previous version. The eCall testing brought expected results for Czech test-bed and more efforts were focused on interoperability testing.

  - in MNO / Communications 5%
eCall flag evaluation was configured, tested and implemented to all Telefónica MSCs. Afterwards only configuration of new test number 162 had to be ensured in the network.

No major development was needed for MNO for second round of testing in 2013

- in PSAP environment 25 %

The main focus was to the proper functionality of implemented In-band modem and related issues. We had to develop automatic handling of eCall in PSAP operator application to ensure unmanned PSAP operation during Field testing phase. We also implemented interface towards Traffic Mgt Control system.

- getting the test results (KPI) 30 %

First of all we had to identify concrete points in the entire chain to obtain proper values to be mapped to the time stamps for KPI calculation. All units in the testing chain had to be time synchronised. During the testing itself we had to ensure logged data integrity and their call per call consolidation.

5.11.2 IVS

- technical performance – problems and solutions

Several issues had to be solved during functional and field testing:

- MSD update – solved by new Firmware of GSM module vendor
- Unit freezing – solved by IVS provider
- eCall status visualization – solved by IVS provider
- GPS freezing - solved by IVS provider
- Incorrect values in the field of N-1 and N-2 position – solved by IVS provider
- MSD ID increment, MSD update/resend and position update – still in discussion, because standards don’t offer unambiguous interpretation

- any issues related to standards

The main standard related issue is correlation between MSD update, MSD ID increment and position update – time stamp of generation and content of these MSD parameters. The problem is: when should be MSD updated to achieve the most actual MSD for PSAP (if needed)? Specification standards are lacking in this regard. Terms like "new MSD", "resend
request”, "the latest version", etc. are ambiguous and should be probably clarified and unified in the standard (HLAP - EN 16062).

Original discussion started by questions like:

- when PSAP pulls MSD, it can be received either "old" or "new" version
- should message ID be changed only when "feeding" with "new" MSD?

Our team decided that the most effective solution would probably be when PSAP pulls MSD, because without it we have to update MSD periodically with all its problems. It is up to the application layer of IVS to decide when to send "new" data to In-band modem (and it is possible only when restarting In-band modem). When application layer doesn’t not decide to "feed" In-band modem for any reason, then the In-band modem transmits "old" data with the same message ID as the last one.

**5.11.3 MNO – Communications**

- technical performance – problems and solutions

In October 2011 eCall flag routing in Telefónica mobile network was introduced. It allowed us to distinguish between eCall and ordinary 112 call. eCall was routed to the eCall testing PSAP. In the beginning of this year we registered, besides testing eCall from IVS, some suspicious calls without MSD transfer in the testing PSAP. After deeper analysis we found that these are false eCall generated by mobile phone. Normal 112 calls were identified as eCall since mobile phones - without any reason and contrary to the ETSI 3GPP TS 24.008 standard - beyond the control of the caller generated eCall flag.

First analysis showed that the majority of false eCall came from LG mobile phones (LG - T310, T300, A200, A250…). Some of the LG mobile phones inserted into the Setup message Emergency Service Category field with non-zero values. We tested several samples of LG phone in Telefónica mobile network lab. This test confirmed that under certain conditions (emergency setup immediately after phone activation) mobile phone generates randomly Service Category with non-zero values and thus it can simulate even eCall.

We consider this as a serious problem if the eCall is routed to the testing environment where no call taker is present. Fortunately, in most cases these calls are mistakes or malicious calls; nevertheless the serious problem can occur if it is a real call of the people in distress.
This is definitely mobile device vendor problem. As a temporary solution we have taken immediate measure consisting in the change of eCall test number. Instead of 112 with flag we are using short number 162.

- Any issues related to standards?

See problem described above.

- any issues related to stakeholders and operational issues?

No problems relating to stakeholders and operational issues.

5.11.4 PSAPs

- technical performance – problems and solutions

Several issues had to be solved during functional and field testing:

  o repeated MSD update not possible - solved in Telco part of PSAP

  o MSD data mismatch in case of two parallel eCall - still in progress

5.11.5 Other issues

- new material or links to relevant new information?

In the new document of European Commission on PSAP regulation Article 4, Conformity assessment states: “Member States shall designate the authorities that are competent for assessing the conformity of the operations of the eCall PSAPs with the requirements listed in Article 3 and shall notify them to the Commission. Conformity assessment shall be based on the part of the standard ‘Intelligent transport systems - eSafety - eCall end to end conformance testing’ (EN 16454) that relates to PSAPs conformance to pan-European eCall”. Based on a quick evaluation of a.m. standard we recommend incorporating this specification into HeERO testing activities. The document focuses on all parts of the eCall service chain and each country will have to prove conformance with this standard prior eCall launch. (EU Commission 2012)

5.11.6 Conclusions and recommendations

Towards HeERO:

- Be very diligent in the KPI comparison between HeERO pilot sites due to the possible different approach in measurement of certain timestamps
- Initiate impact analysis of eCall standard new releases – EN 16062, EN 15722, and EN 16454
- Initiate analysis of GSMA proposal to use eCall dormant mode

Towards Czech Republic MS leader:
- Prepare design of eCall solution implementation into the real PSAP infrastructure in Czech Republic
- Initiate analysis of possible impact of echo cancellers in mobile network of each MNOs

Interoperability tests:
- Objective measurement and final evaluation is possible only in the situation when all members respect rules and calculations defined in the document D4.2 KPIs, test specification and methodology Final, chapter 3.2.1. Due to that fact we recommend detail comparison of definition and final data evaluation (D3.3, D4.4) across the member states outputs.
- We recommend omission of remote tests and generate eCall during testing in the foreign country with own IVS against different PSAP (on-site tests).
- With the purpose to increase a quality of final data we recommend to add in the interoperability test another sets of KPI measurement: KPI_002a: Success rate of completed eCall using 112 or KPI_002b: Success rate of completed eCall using long number, KPI_003: Success rate of received MSDs

IVS and PSAP bug fixing resulting from phase I testing was successfully proved by tests in the phase II.

The way of PSAP modem implementation in the Czech 112 environment doesn’t require any eCall timer (T3, T4) modification.

Values of key KPIs are in the recommended interval and very similar to the KPIs in the phase I testing.
No significant KPI differences recognized between IVS dialling short number (162) and IVS dialling 112 + eCall flag.

Nevertheless statistical evaluation, especially Variance and Standard deviation, shows significantly better values in comparison with phase 1 testing (mainly due to the IVS bugs fixing).

While call establishment phase is quite stable as far as time value dispersion is concerned, there are still some peaks in duration of MSD transmission. This is to be analysed prior final recommendation for eCall implementation in the real environment.

We assume that some of the results interoperability tests (not all) are less objective because of:

- different interpretation of time instance TX for KPI calculation across member states
- in some cases, time of MSD visualization and routing to operator doesn’t contain time of routing to operator and PSAP application overhead for visualization
- remote tests can’t exactly simulate real interoperability conditions, results may be confusing

All these facts can significantly affect the results of the values obtained.

5.12 Piloting in Finland

General

The system for eCall piloting in HeERO project in Finland was built to simulate the straightforward one-number emergency handling. The testing was done with a simulated PSAP environment in HeERO tests. PSAP (Emergency Rescue Centre Administration) in Finland is currently renewing its central system, the provider has been selected and the development of the system is in progress. The new system will be functional at the same time as the organisational consolidation from 15 ERCs into 6 is underway.

The entire chain (vehicle IVS - MNO network - PSAP) was tested in Finland, but there were a few problems especially with the eCall IVS prototypes. Interoperability tests started with tests with Russian IVS in Finland in 2012 and in the 2nd phase interoperability tests were done also with Sweden, Germany and Czech Republic. Figure 4 describe the test data handling process in the HeERO 2nd phase tests in Finland.
Main focuses and efforts in the piloting were quite even in all following areas:

- **in IVS 30 %** - few functioning problems with IVS prototypes
- **in MNO / Communications 15 %** - all three main mobile operators were included, but tests done with long number
- **in PSAP environment 25 %** - simulated test-bed environment, no real PSAP available
- **getting the test results (KPI) 30 %** - testing and KPI gathering was important area

There have been news and articles in Finnish motor-magazines which confuse commercial bCalls and Third Party Services with 112-eCall. E.g. one Magazine “Tuulilasi” declared that eCall starts to operate in Finland in January 2013, in reality what was starting was a commercial premium service of one car model. (Tuulilasi 2013)
5.12.1 IVS

The main problem was the lack of good IVS. In the first HeERO testing phase all used IVS were prototypes and those did not function perfectly. The first of them (Gecko) implemented only transmission of MSD but provided no voice connection. However, it has features for automatic activation of MSD transmission. The second prototype used in Finland (Indagon) provided both voice connection and transmission of MSD but no features for automatic activation of eCall. While the Gecko prototype has external GSM and GNSS antennas, the Indagon prototype has internal antennas mounted within its plastic enclosure. Both prototypes provide interfaces suitable for data logging at IVS side. However, the data logging interfaces as well as the formats of log files are different for the two prototypes. Therefore, both prototypes required their own tools for post processing of log files.

In the second HeERO testing phase two IVS prototypes were used. First one was updated version of Gecko eCall IVS and another IVS was VTT mobile eCall running on Nokia N9 smartphone. Both prototypes support all main features of eCall including voice connection, transmission of MSD, registration/deregistration to GSM network, MSD retransmission requested by PSAP, call back from PSAP and automatic activation of eCall and MSD transmission. Gecko prototype provides interfaces suitable for data logging at IVS side and VTT mobile IVS has internal logging software.

The main issue with IVS development is the uncertainty of Finnish IVS producers whether there will be a business case for them or not, so the commitment for the development was perhaps not the best. They either would want to see a real market ahead especially with retrofit/aftermarket IVS or subsidies from state.

PTI (Periodical Technical Inspection) makes the initial registration and approvals. There is a European WVTA database (type approved) for vehicles. Cars imported to Finland do not have a registration inspection. The procedure is that the vendor makes the prior notification of a new car into the registry. This means that by default, and the current view of the OEM eCall devices come to Finland as part of the type-approved cars "as it is" (unless the importer / manufacturer come up with some other solution). The so-called facelift changes are often made of type extensions. The first inspection of a vehicle should happen in the third year of use in Finland. (With eCall that means 2017-18). As an exception to this rule, taxis are inspected also in the first year as professional service fleet. By default, the taxis (new type-approved vehicles) also have eCall so they are therefore the first in inspections. There is no information available yet of aftermarket devices.
5.12.2 MNO – Communications

One of the three main mobile operators of Finland (Elisa) was actively involved with HeERO testing. Elisa built an eCall testing environment to their lab and saw no special hinders in MNO performance for eCall process. The other MNOs will follow in 2013. Finnish Communications Regulatory Authority (FICORA) is in charge of service demand for eCall from the Mobile Operators. FICORA made a decision in October to use the following control numbers for eCall:

- Manually initiated eCall 112 - will be routed to special number OX(Y) OC abc 115
- Automatically initiated eCall 112 - will be routed to OX(Y) OC abc 116,

so that the PSAP operators can handle them accordingly.

Some issues have been noted for testing: there have to be nationwide tests to get a picture of how the mobile network service functions e.g. in Lapland, the MNOs all operate nationwide but there are some “white spots” in the service. Field tests of eCall Flag needs special arrangements: there is a need to indicate the eCall Flag testers SIM-cards to separate them from others, because there may be real 112 calls, even eCall with Flag around (there have already been real eCall cases and also some Asian smart phones have sent eCall with Flag in error!). Another possibility is to carry out the Flag-test in a very short time period with restricted amount of test calls. Some issues that the MNOs highlighted: e.g. mal-functioning of smart phones (see previous) - there are no standards for end-device coding, they can “simulate” eCall devices; 2G must be kept alive because of eCall. To find a solution for these issues there should be more discussions with stakeholders and also statistics of malfunctioning and false alarms should be kept for further analysis.

5.12.3 PSAPs

The receiving of eCalls was conducted according to standards in PSAP test-bed. Output was stored to result database and error logs. In the HeERO 1st phase, about 100 test calls were made with a IVS prototype and analysed during January – February 2012 in lab tests. During June and September 2012, field tests were done in the test route, which was driven three times (three different days). All test routes were in Southern Finland in urban, suburban, interurban and rural roads containing also motorway. The IVS prototypes were activated in over 300 times during the test route drives.

Both of the tested prototypes had at least some inconsistencies or other problems in encoding of MSD. This underlines the need to verify the conformance of the test-bed MSD
decoder to the specification in EN15722 and to make the required changes to IVS prototypes to ensure the correct encoding of MSD. VTT made the finding of an inaccuracy in MSD-standard into a presentation in EN15722, which standardisation organisations have been informed of. Also the operation of eCall In-band modem in different situations needed further research.

During the HeERO eCall tests the Finnish PSAP is under renewing process. The new emergency response information system will be functioning in the end of 2015 and because of renewing process there were no possibility to use real PSAP for HeERO eCall testing. Also the second phase tests were done to the PSAP test-bed.

The main focus for the 2nd Phase tests in Finland during 2013 was the success rate of eCall sessions, MSD transmissions and interoperability tests. The number of measured KPIs was increased from the Phase 1. However, the number of KPIs were limited according to the eCall implementation plans in Finland, the testing system (including IVS prototypes and PSAP – eCall test-bed) and time constrains (the IVS prototypes for the 2nd phase was not available until April 2013).
During the second eCall testing phase there were controlled and automatic tests: 10 000 test calls were made. Controlled tests included mainly driving tests on predefined test routes, stationary vehicle tests and interoperability tests. Automatic tests included driving tests on non-predefined routes. Driving tests were done with one car and one motorcycle in urban, suburban and rural areas. Tests included all three main mobile operators and tests were done using two IVSs.

**Figure 6: Picture taken from the test route**

Interoperability tests in the 2nd phase were done by calling remotely from Finland with long number to PSAP in another country (Sweden, Germany, and Czech Republic). These tests were done only with VTT mobile eCall IVS prototype. Tests focused on the interoperability of IVS prototype and PSAPs in different countries and only the main KPIs were measured from these calls.

### 5.12.4 Conclusions and recommendations

During the first testing phase, some issues were reported with IVS prototypes. This situation can direct the test efforts too much to the faults and incompleteness of IVS, and away from the other important aspect. In addition, more (separate) development work with retrofit IVS should be conducted (e.g. helping the market entry).
Functioning of the In-Band modem needs more research and nationwide testing of MNO network quality is important. Also issues such as new smart phones causing false eCall alarms may perhaps need further study and reported incidents.

The second Finnish HeERO tests carried out in 2013 revealed the fact that the different stakeholders may understand the basic standards of eCall in a different way. This was evident when the behaviour of IVS A was compared with the 3GPP specifications for eCall in-band modem and EN16062. Discussions have been started with the IVS manufacturer and the in-band modem supplier to improve the IVS prototype and ensure compliance to standards.

The IVS used in the test were prototypes which still had points for improvement when the HeERO tests of year 2013 were scheduled to start. Therefore, the results with improved IVS prototypes would likely be better. This also means that the results obtained in HeERO do not fully reflect the performance which is possible to achieve in Finland with a system based on currently available standards for eCall. The IVS deficiencies showed that there is need for certification process.

The PSAP used in Finnish HeERO tests in 2013 was the Finnish eCall test-bed. At the time of testing, the information system used by Finnish PSAPs was being updated, and implementing eCall functionalities to the existing system to be phased out soon could not be justified. The new information system of Finnish PSAPs is under development but was not available for testing within the schedule of the HeERO project. The eCall functionalities of the new information system should be tested once the system becomes available for testing and evaluation.

Testing of the interoperability between IVS, mobile networks and PSAPs should continue at national level after the European HeERO project has ended. The performance of the whole service chain should also be considered in tests to be carried out. This recommendation has also been given in the national eCall roadmap for Finland published by Ministry of Transport and Communications (Öörni et al. 2013a) and a related conference paper (Öörni et al. 2013b). Further tests to be carried out will reduce the risks related to large-scale rollout of eCall and support the objective to achieve a functional service with wide public acceptance.
5.13 Piloting in Germany

5.13.1 General

Germany is a federal state that has a decentralised structures. Therefore an implementation like eCall, which affects several players, is a substantial organisational issue. Without pressure from the EU the process will take a long time.

In Germany the national ITS Action Plan includes the eCall situation and addresses the problems which need to be solved – focus is to set to the process in the different states and the responsibilities of the governments. In addition to this a national eCall implementation platform is established to inform all stakeholders about the current status and the on-going process. It is chaired is by the Ministry of Transport, Building and Urban Development (BMVBS) in Berlin.

The key problems in implementation process are the different competences of the involved players. Clarification of different point of views will take some more time. Moreover the awareness is not on the same level everywhere. Some players are still waiting for legal binding decisions by the EU or the German government. Only with these binding decisions it will be legal to define a budget in the German government for the implementation of the system and the needed infrastructure.

For VIN and EUCARIS utilisation Germany has discussed and implemented the technical interface between the national PSAP reference system and the EUCARIS network. For this action an extra meeting with the representatives from EUCARIS took place in Braunschweig and the solution was shown in Berlin during the eCall Days 2012. This implementation shall be used for the introduction in Germany as well.

In EU the plans for technical supervision of eCall IVS exist already; within the EeIP there is a task force which is dealing with all requirements of PTI (periodical technical inspection). NavCert is leading this task force.

Regarding the related authorities (road authorities etc.), they are informed and cooperative, but they are waiting for legal binding guidelines to start an official working progress. Germany is discussing the current status through the national Platform, the CeBIT fair and the eCall Days in Berlin as a continuous process.

The German test site consists of 10 Volkswagen cars as test vehicles. Five cars are equipped with the IVS by Continental and the five other cars with S1NN’s IVS. The team member Oecon provided a special server which emulated as a PSAP an eCall test server.
that handles the incoming test data and builds up the base for the evaluation. Because of the missing implementation of the eCall flag in Germany the test systems use a long number instead of 112. No mobile network operator is directly involved in those tests or is part of the team.

For the first test phase the PSAP in Braunschweig is the only involved PSAP. The PSAP Oldenburg as the second intended PSAP will be part of the tests during the next test phase 2013. Cross-border tests with the German test fleet are planned for the next year in close cooperation with the Czech team.

The German test period took place in summer 2012 and generated 10.697 automatic and 248 manual test eCall. The evaluation of test data for Germany is completed.

**Current cross-border activities**
In September and October 2012 cross border tests with the Czech Republic were done, in which 75 Czech eCall reached the German PSAP.

**The main focuses and efforts in the piloting (in percentages)**
- *in IVS* 30%
- *in MNO / Communications* 0%
- *in PSAP environment* 30%
- *getting the test results (KPI)* 40%
- *or other* 0%

**5.13.2 IVS**
- low success rates in the automatic tests (caused by synchronisation timer issue)
- missing time stamps
- problems during dialling a busy number in PSAP
- different formats were used by the different IVS, solution: adapting of formats for the next test phase

**5.13.3 MNO – Communications**
No mobile network operator is directly involved in those tests or is part of the team. So as of now, the eCall flag is supported by no network operator. An escalation took place on
governmental and state level. However the MNOs are not open to implement the eCall flag prior to 2014. The HeERO project team is not involved in this decision. Therefore all tests had to be done with long numbers instead of dialling 112.

An interesting contact to T-Mobile was established in November 2012 during the HeERO conference in Zagreb. This contact may lead the German team to do some testing with the eCall flag in the T-Mobile test centre.

**Technical performance – problems and solutions**

The ten IVS were configured with SIM cards from all German MNOs: T-Mobile (3), Vodafone (3), e-plus (2) and O2 (2). None of them had the eCall flag implemented.

5.13.4 PSAPs

Germany has no consistent organisation of PSAPs. Most of the PSAPs operate in a local area and work for one area municipality. But there are also regional PSAPs that are integrated into several areas. It can be expect that a merger process of smaller PSAPs will take place in the near future.

The eCall handling in Germany with regard to the existing different structures is still under discussion. Germany is working on a special technical solution for the implementation of all PSAPs.

Known or predicted problems in implementing eCall to PSAP system lie in:

- The PSAPs have very different technical infrastructure, so that some PSAPs have to buy new systems and some others need only software updates.

- The PSAPs do not have personnel resources to manage eCall in other languages.

The PSAPs infrastructure must be able to receive the MSD. This is not realised yet. If the technical infrastructure will not be available, the normal emergency call is the fall back solution all over Germany. As for eCall implementation into PSAP system the scheduling of the needed infrastructure and the training will be done during the project and has to be discussed with the BMVBS and the responsible partners of the national government. After this discussion the real budget for the upgrade will be addressed to the related PSAPs and the national governments.

NavCert sees that the main challenge in supranational eCall sending (from country-to-country) from PSAP’s viewpoint is the support of different languages and identifying of the proper language.
ADAC was concerned of the possibility of false alarms from eCall equipped vehicles. This issue was reported to ADAC from the involved German HeERO PSAPs. Already today, PSAPs regularly suffer from automatically triggered false alarms, e.g. from fire detection systems. In ADAC’s opinion, the issue of false alarms needs to be examined in HeERO and it must be clarified who pays for costs arising from false alarms.

First HeERO tests

For the first test phase the PSAP in Braunschweig was the only involved PSAP. The PSAP Oldenburg as the second intended PSAP will be part of the tests during the next test phase 2013.

A certified PSAP-system by OECON was used for the tests and therefore no issues occurred.

5.13.5 Other issues

In 2012, there were some interesting meetings with the involved partners in Germany:

- In March 2012 a first discussion with the responsible regional Ministries of Interior was started. The HeERO team was able to modify a proposal how to handle eCall in Germany. The original proposal would have neglected manual eCall in the PSAP process.

- In August 2012, a meeting between the Ministries of Transport, Interior and Economy was held to discuss the German timeline for the introduction of eCall. However, this meeting was not very successful, because the responsibilities and decisions “what to do when” interdependent. The resulting decision was to ask the European Commission to approve a mandatory date for introduction of IVS to the automotive industry.

- In October 2012 the Emergency call experts group (German “Expertengruppe Notruf”, EGN) held a meeting with several PSAP PBX suppliers and informed them about the necessity to upgrade their systems. Bids for new installation will only be accepted if eCall can be integrated. The companies also promised to identify if, when and how old systems could be upgraded.
### 5.13.6 Conclusions and recommendations

#### Political factors of implementation

The communication among the German federal Ministries and between them and the political subdivisions in the federal states is still suboptimal. The eCall affects the federal ministries of Transport (which signed the eCall MoU), Interior (responsible for the whole emergency system) and Economics (responsible for mobile network operators) that have to solve the question of responsibility. Moreover these Ministries have to define how the implementation could work in the federal states, because federal states and their municipalities have local responsibility for the emergency system. However, there are the open issues of:

- Responsibility
- Financing
- Legal framework

These issues must be solved very quickly. Unfortunately the German HeERO consortium is not directly involved in this process. It could only offer the experience from the project and show potential approaches to the interested stakeholders. On the other hand no German authority is directly involved in the HeERO project.

To hurry up the political process in Germany a legal directive from the European Commission would be very helpful. Such a directive could also make sure that the implementation of the eCall flag will be done earlier than 2014 by the MNOs.

#### Retrofitting

The German team is confident that an early offer of eCall retrofitting modules would accelerate the implementation of eCall. Those modules will increase the public acceptance of the system and will force the car manufacturers to hurry up. Furthermore the retrofitting market will need a legal framework that could be lead to faster decisions in the political sphere. Moreover this would affect the standardisation and certification issue, which is a deployment enabler per se.

#### Test results

In Germany the MSD Presentation Time (KPI 5) and Voice Channel Blocking Time (KPI 7a) were evaluated in detail, because these are the most relevant ones for acceptance of eCall. The Voice Channel Blocking Time is higher than expected and higher than the Czech IVS which called the German PSAP. Therefore there is some room for improvement for the second test phase.
5.14 Piloting in Greece

5.14.1 General

Greece has suffered a number of difficulties in gaining traction to start the eCall upgrade process, these included public procurement for acquisition of hardware and software equipment for the PSAPs and vehicles, the process of starting the project is on-going. Greek MNOs have expressed support for eCall discriminator performance during the piloting. Technical discussions between the Hellenic Telecommunications Organisation (OTE) and the MNOs for the implementation of eCall discriminator through the fixed and mobile networks have been held.

Plans for operation workflow are ready and the emergency services will review the final workflow.

Possible interoperability partners are Romania, the Netherlands, Czech Republic and Croatia to perform common interoperability tests.

Public procurement for the acquisition of hardware and software equipment for the PSAP next steps are the evaluation of the technical features of the offers of participating companies and the evaluation of the financial offers. After that the signing of the contract for the acquisition of hardware and software for the PSAP, proceeding to tender for the tests and the evaluation of results and proceeding to tender for dissemination activities. And then starting the actual piloting which will consist in the whole chain (vehicle IVS - MNO network - PSAP).

The Greek eCall pilot architecture is shown below.

Figure 7: The architecture of the Greek eCall pilot
Two IVS from CIVITRONIC were used, which can initiate an eCall manually or automatically. These were installed in two vehicles for real life testing.

The eCall is received by the PSAP call centre (2. Avaya IP Office) and is forwarded to the in-band modem (3. In-band modem server). There the MSD is decoded and all data are extracted according to specifications. The extracted data are stored in the data base (4. Data Base Server) and are available to the main application (5 PSAP Application Server) for their usage by the PSAP operator together with complementary data related to the geographical position of the vehicle location and other vehicle data from external databases (6. Map Server, 7. 3rd party systems).

During the tests the PSAP operators were answering the eCall and were forwarding them to the emergency centre of the Greek Fire Brigade.

Key questions regarding the pilot are addressed below:

- *Was the whole chain (vehicle IVS - MNO network - PSAP) tested, if not why?*

The whole chain was tested.
• Was there already cross-border activities? Plans for the next phase?

Cross border activities were not conducted. Interoperability testing was conducted with IVS devices from all IVS manufacturers during the eCall TestFest of September 2013. Furthermore, there were eCall from IVS equipped with German SIM cards to the Greek PSAP and they were all successfully processed and handled. During the Phase II tests, interoperability tests were conducted with IVS from Romania and Bulgaria. The eCall were received and processed without problems, even in conditions of low GPS signal in the location of the IVS.

• Where were the main focuses and efforts in the piloting (in percentages) and why?
  o in IVS 5 %
  o in MNO / Communications 15 %
  o in PSAP environment 40 %
  o getting the test results (KPI) 35 %
  o or other 5 %?

• Gathering full support from all stakeholders due to the lack of legislation framework.

At the very beginning of the project major issues were related to the availability of market ready IVS devices and PSAP call centres, mainly in band modems, as well as the eCall discriminator handling software by the MNOs and the fixed line operator.

5.14.2 IVS

• technical performance – problems and solutions

The commercially available IVS devices functioned without problems.

5.14.3 MNO – Communications

HeERO tests were conducted using a long number to avoid interference with the real “112” service. During the Phase I tests, the eCall discriminator software was not implemented by any Greek MNO. During the Phase II tests, the eCall discriminator software was available by one MNO who installed it in the Attica region. Test eCall with the eCall discriminator incorporated were made to emergency number 112 and they were successfully received and recognized by this MNO which forwarded them to the long number where the PSAP operated.
According to experiences from the pilot operation, bad weather conditions may have a corruption effect on the voice communication between the IVS and the PSAP (even if the MSD is received properly). In such situations it was observed that the call back function did not solve the problem, as the voice communication remained corrupted. However, a request for a new MSD by the PSAP operator resulted in most of the cases to a clearance of the voice channel and therefore in the restoring of the voice communication. Similarly, in cases of receiving a corrupted MSD, a request for a new MSD resolved the problem and the PSAP operation station received the correct MSD.

5.14.4 PSAPs

The PSAP in band modem has been configured to send 10 acknowledgment messages (5 AL-ACK and 5 LL-ACK) after receiving successfully an MSD, so as to ensure compatibility with all IVS devices since some devices requested exclusively only 5 LL-ACKs.

5.14.5 Other issues

It was found that some IVS devices do not synchronize in PUSH mode during the initiation phase, probably due to the echo cancellers. The deactivation of the echo cancellers may not be viable since this will affect negatively the quality of the voice communication. Still, according to the new specifications the PSAP in band modem should be operating in PULL mode (mandatory).

5.14.6 Conclusions and recommendations

The conclusions and recommendations reported in this section emanate from the overall piloting experience acquired until now and include knowledge gathered from the workshops and forums on eCall, the relevant eCall guidelines and standards, as well as the experiences acquired from the piloting of the service in Greece. The recommendations take into account the policy layer, the operation and the technological layer, giving some focus also to the user perspective which is considered of major importance.

All eCall stakeholders, including the technology and service providers (e.g. MNOs, fixed line operators, OEMs, etc.), the rescue providers (e.g. PSAPs, rescue and emergency forces), and the administrators (e.g. state authorities), should be involved from the early stage of design and implementation,
At the moment there is in place a proposal for the regulation of the IVS\textsuperscript{10}, a proposal for a decision on the PSAP\textsuperscript{11}, while there is no mandate for a European regulation on the MNO\textsuperscript{12} regarding implementation of the eCall discriminator (widely known as eCall flag). Clear actions are required at a national level in order to enable the implementation and it should be ensured that there is in place a clear regulatory framework for the stakeholders like MNO, PSAP etc. (including possible TPS).

On a national level a transition from the national VIN database to the EUCARIS database is needed. The exact procedure of handling the database queries by the PSAP operator should be established, taking into account possible security and data privacy issues.

Following the introduction of the IVS with the new vehicle models and given the long lifecycles of the vehicles, there will be a need for the formulation of a periodic test inspection procedure for the IVS. Additionally, in parallel to the gradual introduction of the IVS in the new vehicle models, the older vehicles will not be equipped with eCall functionality. The production and deployment of aftermarket IVS should be supported, in order to allow all citizens to enjoy the eCall service.

eCall IVS certification is needed in order to address possible weaknesses in the IVS implementation; for this reason a certification scheme should be established. The MSD transmission and the voice communication through the mobile and fixed-line networks should be reliable and the same is true for the whole service chain; given that there are limitations of the pilots performed within the HeERO project, it is recommended to continue testing and debugging the eCall service at a national level also during deployment of the service in order to identify possible weaknesses and needed enhancements. However, it should be noted that the HeERO test results are transferred already to the project standardisation task force resulting to new suggestions to enhance the eCall standards. For example, as described in the sections above, according to current experiences from the pilot, there should be some adjustments in the in band modem specifications, and the quality of the voice communication in bad weather conditions should be further investigated.

The responsibilities for the execution of the eCall service chain are shared among several public authorities or agencies. The states should have the opportunity to identify possible


\textsuperscript{11} Proposal for a Decision of the European Parliament and of the Council concerning the deployment of an interoperable EU-wide eCall - June 13, 2013

\textsuperscript{12} Commission Recommendation C (2011) 6269 - adopted on September 8, 2011
weaknesses during the execution of the end-to-end tests aiming to the enhancement of inter-agencies cooperation before a full scale roll out of the eCall service.

Training the PSAP operators but also the administrators of the PSAP system is considered essential. The training should take place well before the national deployment of the eCall service and should include clear guidelines on handling silent eCall so as to ensure smooth operation when the service is deployed. Adding to that, the rescue and emergency services should also be prepared for the handling of eCall. It is acknowledged that the handling of eCall should follow the normal 112 procedure; however the responsibilities and the division of the work should be clear to all parties (possibly through a well-defined national eCall administration and handling plan).

Finally, there is a fear of overloading the PSAP with false-initiated and therefore non-emergency calls. First of all lack of user awareness may result to such situations and therefore actions at a member state level should include eCall dissemination activities and citizens education on how to use the eCall service; the latter may be regarded as a similar action to the education campaigns that took place for the introduction of the 112 emergency number. In this track, the member states may also promote public demonstrations of the eCall system. On a second level, there might be a need of managing the incoming calls incidents and validating them before sending the eCall to the PSAP operators for handling. In order to do so there is a need for a well-defined procedure that is zero fault tolerant and guarantees that only the real emergency calls will be sent to the PSAP operator for handling. This issue should be further investigated.

5.15 Piloting in Italy

5.15.1 General

The Italian pilot architecture is based primarily on a full chain realized into a live environment that represents very closely the real situation that we will face after 2015. The consequences that this choice has posed will be reported later below. The full chain is based on three main components:

1. the Varese 1° level PSAP operated by AREU;
2. the TIM mobile network and the 112 fixed network, both operated by Telecom Italia;
3. the IVSs
a. 3 types from different suppliers, integrated by C.R.F. in a FIAT car;

b. 1 type from Magneti Marelli integrated and customized by Magneti Marelli itself; for the 2\textsuperscript{nd} phase of tests this IVS has been modified to host both eCall and bCall on the same board.

The 1\textsuperscript{st} phase of tests has been limited to the eCall, basing the calls strictly on its standards, and has involved a car by C.R.F. equipped with 3 IVSs and a car by Magneti Marelli equipped with its IVS.

The 2\textsuperscript{nd} phase of tests has included, beside the eCall, the bCall (that is based on different standards like GPRS, XML, HTTP) and has analysed the possible coexistence of these two services on the same IVS (the MM one). The bCall tests have been possible thanks to ACI that has involved one of its Service Centre (that is already delivering at present the mechanical assistance to their associates). These tests have involved 10 cars of 10 ACI members, normal drivers that have accepted to host in their private cars the MM IVS box modified for eCall & bCall, and the C.R.F. car with 3 IVSs.

The Pilot has also covered the interoperability tests; some of them were done during the Vienna ITS World Congress (some IVSs not included in the Italian Pilot have successfully made eCall, using a long number, towards the Varese PSAP that has received the MSD and opened the voice channel) and some more during the 1\textsuperscript{st} International HeERO Conference (the MM IVS has successfully made eCall, using a mobile network with eCall flag, toward the Croatian PSAP). More interoperability tests are previewed in the 2\textsuperscript{nd} phase of tests.

5.15.2 IVS

Since the IVSs were not commercial products but prototypes, several issues were addressed during the 1\textsuperscript{st} phase test setup with the direct help of the manufacturer (MSD with predefined and not modifiable data, no VIN number, no eCall flag, presence only of the manual call, and so on). The objective was to have the IVSs completely adjusted to our requirements and fully compliant with the eCall standards.

| Issue 1: This has been a no easy step, due to the fact that the Pilot partners have had to appeal to other resources outside the Pilot to have the proper technical support and, sometime, the plans were not overlapping exactly. |

Before the operative tests, for these reasons, it has been necessary to perform a lot of bench tests. These tests were performed on a short chain composed by the IVS itself and a direct link to a MSD Extractor Box (MEB) that was developed on purpose by AREU:
- C.R.F. tested IVS from Actia, NXP and Denso;
- MM tested its IVS, the Tbox.

For the 2nd phase test, the Pilot has planned to use an eCall IVS modified to host also the bCall on the same board, thanks to the technical support of MM. The purpose of this integration is to analyse the commercial sustainability of the IVS box and the liking of a complete emergency service (for incident and for mechanical failure) by normal users. The coexistence of both eCall and bCall on the same device has resulted in a very careful planning of the timing and priority, standing the fundamental requirement that the eCall function must always have priority over any other activity running on the IVS.

**Issue 2:** as emerged from the test, the management of the eCall priority has generated a delay in the eCall activation, though acceptable.

The interaction with normal users has also required to equip the IVSs with some kind of man–machine interface, in particular MM has introduced on the eCall service a voice prompt and the ability to delete the eCall; these feature were very appreciated by the drivers, but they have introduced a delta time of about 7 seconds on the establishment of the call.

**Issue 3:** the call set-up time is a crucial focal point for the IVS design and must be very carefully addressed not only from the technological point of view but also from the point of view of the interaction with the users, to limit the possibility that the vehicle occupants leave the car before the call is established.

The experience gained, especially implementing the eCall standards, will be useful both for the Pilot partners and for the IVS manufacturers that will be able to move toward the production of commercial products.

**5.15.3 MNO – Communications**

Choosing to operate in a live environment has forced the Pilot to implement the eCall on the EU 112 service already in use into the Varese 1st level PSAP.

The TIM mobile network in Varese was, for these reasons, upgraded by Telecom Italia with a software special release provided with the eCall flag. This was necessary to permit to distinguish between the 112 calls and the eCall calls and to route the latter to the proper queue into the PSAP.
Issue 4: due to the fact that this mobile network was the live Varese TIM network has resulted in a prolonged test campaign before enabling this network for the Pilot tests.

On the other side, now the TIM network, in Varese, is compliant with the eCall requirements and will not need further modifications.

Issue 5: on the fixed network the Pilot had to solve another problem: how to route the eCall to the proper queue linked to the PSAP.

At national level the mobile networks deliver an emergency call to the 112 fixed network using a standard routing format. For the purpose of the Pilot a new routing format has been created taking into account the eCall case, but, since the tests were done in a live environment around Varese, before starting the 1st phase of operational tests, this new format has had to be agreed with all the MNO in Italy. This routing format provides both automatic and manual calls that in the Pilot are linked on two different PSAP queues. This new routing format has been transposed in the national technical regulations during the 2nd phase of operational tests.

At present the Pilot PSAP is reachable by eCall calls using the UE 112 (Varese area) and a fixed long number (national and roaming, only for test purpose).

5.15.4 PSAPs

For the PSAP the Pilot has had to resolve several issues.

Issue 6: a way to decode the MSD and realize the in-band modem;

the solution was to develop an hw appliance (the MEB) linked to the PABX.

Issue 7: the most proper way to manage the eCall, both data and voice, and how to synchronize them with the operator intervention;

The solution adopted was to pass the incoming eCall to the MEB, for the MSD decoding, and to the operator console queue at the same time: if the decoding ends before the operator pick up the call from the queue, the vehicle occupants will hear a voice tone; on the contrary, the operator will hear a music tone.

Issue 8: a way to decode the VIN extracted from the MSD;

The solution adopted was to interconnect the PSAP with the Italian Licence Registry and to send to it the query with the VIN; in case the VIN is an international one, the Italian Licence
Registry will forward the query to the EUCARIS network; this solution simplify the overall architecture and centralize the EUCARIS contact point.

The solutions identified have permitted to integrate the eCall quite smoothly in the PSAP general architecture and in its procedures and routines; in this way, after the MSD decoding and the opening of the channel voice with the vehicle occupants, the call is managed as any other 112 call: the MSD data are displayed inside the event form to the operator together with the geographical localization of the incident and, after the assessment, transmitted to the 2\textsuperscript{nd} level PSAP for the intervention.

Due to the fact that the PSAP is a real one, we noted some important facts:

- a positive feedback from the operators,
- the time to answer to an eCall and to have the MSD decoded is comparable with the time necessary to answer to the other normal 112 calls (5 second to 18 seconds).

5.15.5 \textit{Real Time Traffic Information Centre (RT TIC)}

Among the objectives the Italian pilot had planned, there is the integration with a centre for the traffic information, since in Italy there are several services, as “CCISS Viaggiareinformati”, “Autostrade per l'Italia”, “Infotraffico Autovie Venete”, “Infotraffic”, “Luce Verde” that broadcast this kind of information to the road users by several means (radio, web, TV).

| Issue 9: to create a simulated environment for a Real Time Traffic Information Centre; |

The solution adopted in the 2\textsuperscript{nd} test phase was to activate a RT Traffic Information Centre interface to send incident related data from the 112 PSAP of Varese to an application, provided by ACI, that collects data at the simulated RT TIC. The interface has been implemented using a standard Web Services architecture, so it can be easily integrated with the real services.

The data received are a subset of the data gathered by the PSAP, both form MSD and from the conversation of the operator with the caller and they include: date/time, geographical coordinates, country, city, address and two indexes used for incident classification.

The tests were successful and have demonstrated that the eCall system could give a boost to the evolution of the traffic information services, enabling them to react faster than the actual to an incident.
5.15.6 Other issues

<table>
<thead>
<tr>
<th>Issue 10: live environment.</th>
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<tr>
<td>The choice to install the Pilot test site into a live environment has implied that several variables were not under control by the Pilot team: planned software revision in the mobile network has interfered with the planned test phase; enabling the eCall flag into an operative mobile network has meant to perform repeated telecommunication test campaigns; PSAP upgrades and extensions have implied the revision of the Pilot planning, the setting up of the query system from the PSAP towards the Italian Licence Registry for VIN decoding has been paid for with all the tests with a simulated environment before going to the production database, and so on.</td>
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<th>Issue 11: EUCARIS.</th>
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<td>The access to the EUCARIS network is made through the Italian Licence Registry, but EUCARIS has been tested only with a EUCARIS test database. Testing with the operational database still has to be done in order to assess the EUCARIS performance.</td>
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<th>Issue 12: evolution of the EU112 network and organization</th>
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<td>In Italy the organization of the centres that will answer to the EU 112 will change in the near future and it will not be homogeneous on the whole country; in some cases (starting from Lombardi region) there will be a 1st level PSAP organization that will take the calls and dispatch them to the most appropriate emergency agency (police, Carabinieri, fire brigade or ambulance); in the rest of the country the calls will be taken by police and Carabinieri on a 50% rule and then dispatched to the other two agencies if necessary. This landscape implies that the eCall service must be accurately planned to fit properly into this framework, but the risk that those planning go out of sync is present.</td>
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5.15.7 Conclusions

The Pan European eCall system is working in Italy in the HeERO pilot site, in Varese, with all its features (manual and automatic calls, eCall Flag, MSD & VIN decoding, and EUCARIS interconnection). Moreover it will be exported to the whole Lombardi region with the EU 112 migration to the 2 levels PSAP model (of which Varese is the first example).

It is important to keep distinct the problems related to the eCall service from the problems related to the underlying systems, as the MNO coverage (tunnel, mountain roads, and so on)
or the EU 112 system (localization, multi-language) or the legal framework (privacy, rules of the road, different levels of responsibility in respect of the area or road).

The main way to keep this distinction clear is to realize the eCall architecture as simple as possible, and this for two reasons: the underlying systems that will sustain the Pan European eCall system will evolve in the future and eCall should integrate smoothly with this evolution; second, also eCall will evolve and change, both under technical aspects and service aspects, in a way that should integrate with the private services, realized both into the IVS and by the TPS, to generate sustainable business models.

5.15.8 Recommendations

The example of the Italian Pilot confirms the fact that choosing to install the pilot test site inside a live environment is a very good choice, even if involves some risks. A strong coordination between all actors of the chain (IVS manufacturer, car integrators, mobile network operators, 112 network operators, PSAP operators and their HW and SW suppliers) is essential to mitigate these risks and to successfully integrate the eCall service. The main advantage of this process is that the pilot site can smoothly migrate to the production environment effortlessly even before the 2015 deadline; but, generally speaking, the Pan European eCall service goes across many sectors and for this reason.

Recommend to adopt, since the beginning, win-win strategies, where someone can win more (and only) if he wins with the other; this could be achieved by establishing tables and working groups with all the eCall stakeholders, both public and private, where clear roadmap should be established.

The main outcome of this strategy is that, after the pilot conclusion, the eCall service will remain active in the Varese PSAP and will act as a seed to disseminate the service in the rest of the country. This installation will become the reference one and the experience gained will drive the political and organizational agreements among all the national involved public actors. The maintenance of the current national pilot test after the conclusion of the HeERO contract is recommended as it will allow the execution of other additional tests and the involvement of other national stakeholders not directly involved in the HeERO contract (e.g. other MNOs, etc.). The contractual framework and the related commitments for such possible extensions are still to be identified and agreed among the national involved parties, but some recommendations in this direction have been transmitted to the national authorities responsible for this area. In effect, looking to the time of national deployment of the eCall service, the experience of these years about the setup of the HeERO test site leads us to
Recommend the Public Administrations to adopt a proactive approach and to approve a clear regulatory framework for the deployment of eCall in the country well before the end of 2015.

Moreover, the coexistence of the Pan European eCall, a free service, with a private service, like the bCall, on the same IVS device will give to the private actors and to the stakeholders the opportunity to investigate several business models and different scenarios for the deployment of the eCall service. But this could happen if the private companies start to think "after" the Pan European eCall; this mean study how to integrate this "universal" service with their private services, even if this now mean closing or reducing the investments on their private eCall service. Since now we have seen, on the contrary, the use of the "news" about the future introduction of the eCall to make publicity to private eCall services. To facilitate this process of integration we

Recommend to adopt for the Pan European eCall a centralized architecture, so as it will be easy to design and realize a unique interface to integrate the TPS eCall with the public one.

The experience with real users in the 2nd test phase has also put in evidence the importance of the awareness of the Pan European eCall system, of how it works and how it is organized, starting from the IVS and up to the privacy issues; this aspect is crucial to have the eCall successful and to mitigate the PSAP overloads due to unnecessary manual eCall or misuse of the manual button. For this reasons, we

Recommend to all the stakeholders, both at national and EU level, to define standard behaviours so that they can be adopted by the Public Administrations and become the message of educational public campaigns that must be planned in the second half of 2015; moreover these standard behaviours can be taught into the driving schools and become part of the national rules of the road.

5.16 Piloting in the Netherlands

5.16.1 General

5.16.1.1 The eCall chain

The following graph describes from a high-level perspective the architecture necessary to handle eCall messages by the different actors who together make the eCall chain.
The architecture is designed in a way that makes it possible that:

- eCall can be routed to different PSAPs based on the eCall-flag. This makes it possible to distinguish automatic eCall from manual eCall in order to balance the workload of the different PSAPs.

- The Call Information Service is part of the 1-1-2 PSAP but acts as a central medium for the storage and exchange of information between the different actors of the eCall chain. The Call Information Service stores during the eCall process all the relevant data and provides them on request to an actor and/or notifies actors of changes of these data. Based on the business rules of the actor he can start up or adjust their emergency service processes.

- At present the general impression is that Third Party Services are going to play a role in the handling of eCall. Their processes can be connected to the emergency help chain. The Call Information Service will provide the necessary 'connectors' through which information can be exchanged. At present the TPSPs active in The Netherlands are (under certain conditions) allowed to call directly to the appropriate PSAP in case of an emergency. This is by voice only.

5.16.2 Testing in the Dutch pilot

In Netherlands one vehicle with four IVS's (D-FACTS) and 7 separate IVS’s were used for the field tests. Drive tests took five days and 5378 calls were made. PSAP Test System (CIS)
was used for 112 calls and regional PSAP2 with 4 desks were used for PSAP testing. Three MNO’s were involved with no eCall flag capability.

Other important elements were the connection to RDW EUCARIS database, to road authority communication system (OWBCS) and to Traffic Centre interface (Xpose).

Developing eCall for Heavy Goods Vehicles is part of the Dutch HeERO pre-deployment pilot, and therefore also HGV Transport Company and Fleet management system (Carcube) will be involved in 2nd phase of the HeERO testing.

The whole chain was tested. The Dutch pilot has three kinds of testing:

- **Drive tests** aimed at the technical aspects of the eCall system (performance).
- **Scenario tests** aimed at the operations in the PSAP, the Emergency Control Rooms and the information interchange with the Traffic Management Centre
- **Interoperability tests** aimed at the performance of IVSs’ and PSAPs of the other HeERO pilot sites

In the 1st phase of testing the Dutch pilot was focused on the drive tests. In the 2nd test phase (2013) efforts were on drive tests and scenario tests. In order to test interoperability of the PSAP and the IVSs’ interoperability tests have been done with the other HeERO pilot sites and the Dutch pilot participated in the Test-fest in Essen.

![Figure 10: NL field testing area](image-url)
The driver of the test vehicle drove a predetermined route through the Rotterdam-Rijnmond region. This route was designed so that specific situations would be encountered that might have an effect on the GPS accuracy (urban canyon) or on the mobile reception:

- Low mobile coverage
- Rotterdam Port
- Rotterdam-The Hague Airport
- Rotterdam city centre
- High voltage cables and pylons
- Tunnel

5.16.3 IVS

IVS suppliers did not participate in the consortium. As a result the Dutch pilot made use of the IVSs’ from different suppliers. As a result the testing in the Dutch pilot became an interoperability test per definition.

- 3 types were used; Civitronic, Skymeter, S1nn
- There were different IVS implementations, IVS are still prototypes. Although the IVS modems were up to the present standards, they behaved differently. This resulted in proposed changes of the standards. The HeERO Taskforce on standardisation has been informed and is going to adapt the standards.

5.16.4 MNO – Communications

There are three MNO’s in The Netherlands with national coverage: Vodafone, T-Mobile and KPN-Mobile. New parties are expected to enter the market in the near future. The MNO’s in The Netherlands did not participate in the consortium.

- For the testing SIM cards from the following MNOs were used: KPN, Vodafone, T-Mobile, and Int’l SIMs Telenor
- As the eCall flag is not implemented in The Netherlands yet, tests were performed using a long number (not 112). Dutch MNO’s will have to implement the eCall flag before 2015. This is both EU’s and national ministry’s regulation issue.

5.16.5 PSAPs

- 2 levels were used: national level 1 PSAP (112), regional level 2 PSAP. In the pilot the manual calls were first routed to the national level 1 PSAP for validation before connecting to the level 2 PSAP, and the automatic calls directly to the most
appropriate level 2 PSAP. The rationale behind this is that manual eCall will have a lot more false calls which we do not want to disturb the process of the level 2 PSAP.

- The architecture of the eCall system makes it possible to change the routing of the calls. All calls could be routed to the national level 1 PSAP or to the regional level 2 PSAP. This makes it possible to have a phased implementation of eCall that can be adapted as a result of the experiences with the operational system.

- The PSAP system is still a standalone system. After the HeERO pre-deployment pilot the functionalities of the eCall test system will have to be incorporated in the operational 112 and emergency control room systems.

**5.16.6 Traffic Management Centre (TMC)**

- Also a link with the TMC has been tested. The TMC gets the eCall data directly in the TMC so it can react faster to an incident and it can help in validating an eCall (i.e. the use of road cameras).

- The test system accommodated the option of data interchange between ECR and TMC instead of the present communication by telephone.

**5.16.7 Survey**

Aim of the study was to make an inventory of the acceptance and rating of eCall amongst car drivers, emergency services personnel and hauliers. The results of the current study are compared with the previous study done in 2012. The study gives insights in opportunities and risks in relation to the implementation of eCall? These will be briefly explained below.

Knowledge; emergency services personnel are most likely to have heard, seen or read something about eCall (64%). This percentage is significantly lower for hauliers (30%) and car drivers (5%). Car drivers mainly lack knowledge related to the installation of eCall and how it works.

Attitude; there is a lot of support for eCall amongst all three target groups. Compared to the previous study, support from car drivers has decreased (72% to 65%). Compared to the previous study, car drivers have become more critical about eCall. This may mean that these car drivers are less likely to want eCall in their car.
According to emergency services personnel, eCall has the following advantages for their work: “speeds of arrival of the emergency services” and “exact location”.

The most frequently mentioned disadvantages are: “system may be activated erroneously” and “privacy”.

Potential use; more than half of both the car drivers and the hauliers would like to have eCall in their car. Compared to the previous study, there is a slight decrease for car drivers (66% to 54%). The majority of emergency services personnel believe that eCall will result in an increase of non-urgent reports (62%) and that there will be more reports per incident (60%).

In order to set up eCall properly it is important to increase the knowledge about such things, especially amongst car drivers. It is also desirable to create clarity regarding the costs and the way it may affect privacy. Communication about eCall is most effective through the Internet and work.

A small proportion of car drivers (5%) has heard, seen or read something about eCall. In order to increase awareness it is important to approach drivers via the Internet, newspapers or television. These are the communication channels through which most car drivers learned about eCall. The way the system works and how it is installed is a mystery for many car drivers. Car drivers see the cost and the potential violation of privacy as the most important reasons for not implementing eCall. In communicating about the use of manual eCall clear communication is needed. The majority of users would use the manual eCall in case of a traffic row, while only 39% of the emergency personnel support this.

Around a third (30%) of the hauliers have heard, seen or read something about eCall. The most effective communication channels for this target group are the Internet and work.

Paperless driving is an enabler to retrieve the freight data in a truck incident. A majority of the hauliers is familiar with paperless driving. Almost all of them (97%) would allow their freight data to be analysed digitally by emergency services personnel in case of an incident.

5.16.8 Other issues

- EUCARIS has only been tested with a EUCARIS test database. Testing with the operational database still has to be done in the implementation phase in order to assess the EUCARIS performance.
• In The Netherlands the organisation of the PSAPs will be changed. From 2014 there will be one national emergency control room organisation and the number of PSAPs will be reduced to 10 multidisciplinary PSAPs (police, fire ambulance in one emergency control room). The present emergency control room IT system has reached the end of its lifecycle and will be replaced by a new national system. These two developments coincide with the implementation of eCall but the planning is not in sync.

5.16.9 Conclusions

The main conclusion from the drive tests is that eCall is technically feasible but the results are not as reliable as the present 112 emergency calls yet:

• The variance in performance between the different IVSs is still substantially although the used IVSs are supposed to be according to standards. This implies that the standards might not be specific enough
• IVSs that behave differently will be a menace for PSAP operators when they have to assess the incoming emergency calls
• The variance in performance between the different MNOs is less significant.

The main conclusions from the scenario tests are:

• The possibility of sending and receiving data is a major improvement for the present emergency help process, especially the availability of the exact location.
• An eCall is just another 112 emergency call and should be treated that way. The eCall handling process should be integrated in the normal 112 process.
• The link between the PSAPs and the traffic management centre has proven to be very valuable. Road authorities will be able to react faster to the incidents and this will help preventing secondary incidents and to restore the traffic flow. Also the safety of the emergency workers at the place of the incident will benefit.

The fear of false calls is eminent and real. This fear was also expressed by the emergency service personnel in the survey. However; the only statistics available are the statistics supplied by third party services providers. They offer value added services that go beyond the emergency call (breakdown assistance, repair etc.), so it is hard to predict how valid these statistics are in regard to the Pan-European eCall. However, not all cars will be equipped with eCall from day 1 that will take 15-20 years. So there will be ample time to adapt to the new situation.
A survey performed in The Netherlands showed still limited awareness of eCall among car users (5) but when explained indicated large support for the introduction of eCall. The subject of privacy (being followed) needs careful handling. Explanation on how it works and when to use it is necessary. Paperless transport is an enabler for HGV eCall.

5.16.10 Recommendations

- The implication of the results in the HeERO pilot sites should be aggregated and discussed on European level.
- A distinction should be made between problems specifically related to eCall and more general problems (like i.e. bad coverage) not related to eCall. These are not the scope of the eCall project.
- The definition of additional data in the standard MSD needs to be changed to make it usable. This will also remove the risk that future implementations of the “spare” room in the standard MSD could have negative impact on the deciphering of the standard MSD.
- The technical implementation of the first additional data within the present standard now used by HGV eCall asks for more active involvement of other HeERO members.
- Standardization issue of MSD: use of optional data field for HGV experience should be proposed to standardisation WG15
- Informing and educating the public is a vital issue in making eCall successful (use of eCall, misuse, silent calls etc.).
- The fact that not all cars will be equipped with eCall from day 1 leaves ample time to adept PSAPs to the growing number of eCall. A system architecture that allows changing the routing of calls will help to optimise the handling of eCall tuned to the specific situation of a Member State.
- Investment in public awareness and education on the use of eCall is needed.

5.17 Piloting in Romania

5.17.1 General

For the eCall solution, Romania implemented the pilot in a centralized manner, all eCall (data and voice) are forwarded to a central PSAP located in Bucharest, whose operators will process the call and will contact directly the necessary emergency services (also referred as “agencies”) from the county where the incident has occurred.
The eCall solution is fully integrated in the existing platforms, and was implemented as an additional function, not by modifying the current system, but by adding new functionalities.

Figure 11: Romanian system architecture

For implementing eCall in Romania, two PSAPs received hardware upgrades and other 40 PSAPs and emergency agencies received software upgrades. Both Bucharest and Brașov PSAPs received the same hardware upgrades (marked with yellow in the figure above). Bucharest is designed to be the main PSAP for receiving eCall, but the system will automatically reroute the calls to the Brașov PSAP if anything happens with the one in Bucharest. The Brașov PSAP has the same functionalities as the one in Bucharest.

Besides the hardware upgrades the software in all other PSAPs and emergency agency was upgraded in order to be able to receive the data stored in the MSD.
Was the whole chain (vehicle IVS - MNO network - PSAP) tested, if not why?

For the first phase the whole chain was tested from the vehicle IVS to the MNO to the 112 PSAP.

The entire chain IVS-MNO-STS network-PSAP-Emergency agency was tested with simulated agency operators without disturbing the emergency agencies' activities.
In the second phase, the Braşov backup site was involved in tests and tests were also done with the emergency agencies.

**Figure 13: Operational flow for tests**

Therefore, the eCall operational steps used in the first phase of the project are:

1. Depending on which IVS equipment is used the eCall (Automatic, Manual or Test) is triggered as described below:
   - **T-IVS**: controlled by connecting a laptop on a serial interface. A software application allows MSD content configuration, B-Number used, GPS position etc. The GPS position is entered manually because the equipment doesn’t have a built-in GPS module.
   - **C-IVS** –The equipment has 3 buttons for triggering eCall used for setting the Activation type field to Automatic, Manual or Test. The MSD structure is built automatically when one of the buttons is pressed. The equipment has a built-in GPS module for acquiring the position of the vehicle. The default B-number dialled is 112.
2. The call is picked up by the nearest site GSM PLMN in which the SIM card is registered. If the IVS is equipped with RDS SIM card, based on eCall flag the calls are routed through Romtelecom PSTN to a long number assigned to the Bucharest PSAP modem ISDN input line. If the SIM card used is from another operator than RDS the call will be generated from the IVS to the long number assigned to the Bucharest PSAP modem ISDN input line;

3. From the RTC network, the call is routed to PSAP modem equipment situated in Bucharest site;

4. The eCall modem changes the B-number: **CountyCode<112>** or the long number into **<21199>** and the call is routed to the Bucharest PSAP (A-number=caller number; B-number=199 is associated to eCall PSAP operator inbox);

5. The eCall enters the STS central network (MSS) and based on the **<21>** (prefix for Bucharest) will be routed to the Bucharest PSAP;

6. The call is received and distributed by MD110-PBX to the CXE server (CoordCom VoIP server);

7. The eCall is routed to the 112 VoIP network;

8. The call is displayed on the eCall operator's console and is answered by assigned operator:
   A. The eCall modem receives and transmits the MSD message to the MSD decoding module; During MSD transmission the eCall operator hears a voice message that informs data transmission;
   B. The MSD decoding module decodes the message, extracts the VIN and transmits it to the VIN processing;
   C. The MSD decoding module decodes the MSD message and transmits the decoded data to the MSD processing module;
   D. The MSD data is processed and inserted into the 112 applications;

9. The 112 operator processes the received information and ask for VIN information:
   I. The operator requests VIN data from the MSD processing module;
   II. The MSD processing module requests VIN data from the MSD decoding module.

- **Was there already cross-border activities? Or in the next phase?**

For all the tests in the first phase, IVSs from two different providers were used.

First interoperability tests were started in Q4 2012. These tests were documented, but the results will only be included in the reports for the second phase. The interoperability tests were performed with 3 other IVSs from the HeERO consortium: one from Croatia, one from
Italy and one from Sweden. Additional tests were done with a Taiwanese manufactures that is not part of the HeERO consortium.

For the second phase, 3 different IVS units provided by national manufacturers were used for the majority of the tests. In addition to the countries in the first phase, more interoperability tests were done with a forth Romanian IVS, 2 different units from Bulgaria, one from Poland and one from Fujitsu TEN.

5.17.2 IVS

- **technical performance – problems and solutions**

The IVSs used for field tests were not capable of receiving a call back from the PSAP after a call was ended. This will be fixed until the second testing phase will start.

- **any issues related to standards**

The eCall in-band modem works well when radio signal is good. Where radio signal is low the IVS is making a lot of retries before having a succeeded eCall. We encountered situation when the voice call was possible from a regular phone, but the IVS didn’t succeed to generate the call. We consider that an update of the standards is needed to force IVS to switch to another mobile network after a number of repeated unsuccessful tries.

During the laboratory tests only Topex IVSs (T-IVS) were used. Radio interface used: 2G, 3G GSM module made by Cinterion – AH3-W with QualComm in-band eCall modem.

**T-IVS:**

- Manufacturer: Topex
- Version of standard for eCall Modem: 10.0.0
- Version of standard for MSD: June 2011

During the drive tests only Civitronic and R&D Software Solutions IVSs were used. Radio interface used: 3G GSM module made by Cinterion with QualComm in-band eCall modem. Used only with 112 number to call.

**C-IVS:**

- Manufacturer: Civitronic
- Version of standard for eCall Modem: 10.0.0
- Version of standard for MSD: June 2011
5.17.3 MNO – Communications

- technical performance – problems and solutions

Call back isn’t supported when an IVS calls from a network other than the native one of the SIM. The normal call goes through and is being handled correctly by the PSAP, but call back isn’t possible because the telephone number isn’t available in the PSAP. This will be resolved by implementing national roaming.

- any issues related to stakeholders and operational issues

Not all PLMNs in Romania yet support the 112 eCall flag handling. If an eCall isn’t routed based on eCall flag and reaches an unprepared PSAP, in most of the cases ended as “silent calls”. This situation must be further analysed to determine very clearly if it is a scenario that can happen in real life operation, after the eCall solution is finalized or not (eCall flag implemented in all MNOs).

- other

In Romania there are currently 4 MNOs: RDS-RCS, Orange, Vodafone and Cosmote. RDS-RCS is the only MNO that has implemented eCall flag in the live network. The eCall flag was activated on request in the counties were the field tests were done. With Orange and Vodafone tests were performed in test cell were eCall was implemented. In addition, Orange has implemented the eCall flag in the Bucharest area.

5.17.4 PSAPs

- technical performance – problems and solutions

The following mean values were achieved during the tests:

- 3.5 seconds from the moment we generate the call until is presented to the operator;
- 15 seconds from the moment an operator answer the call until MSD information is displayed in 112 applications;

- any issues related to stakeholders and operational issues

While all the 112 PSAP operators were trained for handling eCall, the emergency agency operators haven’t been trained. This is mainly due to the large number of people that need to
be trained (over 2000 at national level). This training will be done by STS after the end of the HeERO project, before the deadline of October 2015.

5.17.5 Other issues

An interface with the Traffic Management Centre was developed during the project.

The interface is implemented using the standard Web Services architecture, the connection with the web service is made over an encrypted SSL channel.

Information received automatically from the eCall IVS and information completed by 112 human operators during phone conversation with the caller is being sent to the TMC through this interface.

The following data fields will be published by the 112 PSAP and retrieved by the Traffic Management Centre: date/time, geographical coordinates county, city, address and 2 indexes used for incident classification.

5.17.6 Conclusions and recommendations

- The eCall in-band modem works well when radio signal is good. Where radio signal is low the IVS is making a lot of retries before having a successful eCall. We encountered a situation when the voice call was possible from a regular phone, but the IVS didn’t succeed to generate the call. We consider that an update of the standards is needed to force IVS to switch to another mobile network after a number of repeated unsuccessful tries.

- The in-band modem seems to have a slightly lower robustness than the voice call itself.

- In all eCall tests, during an eCall session the MSD has the same data (If a resend MSD command is sent by the operator, a new MSD is presented to the operator but it contains the same information as the initial one). We consider that when a resend MSD requests made by the eCall operator, the IVS equipment should send actualized data.

- If an eCall session is terminated (with clear down command), there is no possibility to call-back the IVS.

- Further activities such as test of foreign IVSs roaming to and within Romania should be done (also foreign SIM cards).
• Analyses upon the time in which an IVS is generating eCall (registered / unregistered in a MNO) must be done.

• More drive tests in various rural or highway areas with low radio signal coverage should be done to clearly identify potential problems. In areas with varying results, tests should be repeated to find out that the results vary substantially.

Not all PLMNs in Romania yet support the 112 eCall flag handling. If an eCall isn’t routed based on eCall flag and reaches an unprepared PSAP, in most of the cases ended as “silent calls”. This situation must be further analysed to determine very clearly if it is a scenario that can happen in real life operation, after the eCall solution is finalized or not (eCall flag implemented in all MNOs).

5.18 Piloting in Sweden

5.18.1 Current E112 handling – the foundation for eCall in Sweden

The piloting in Sweden has been done by implementing additions to the systems that are in use for E112 services today. The pilot has used test software in non-production systems (with exception of the mobile networks where the production systems have been used). A brief overview of the current E112 organisation and services is first described below, in order to better understand the Swedish HeERO pilot and its results.

Sweden has had a nationwide emergency number since 1956, and the EU-common emergency number 112 was implemented in 1996. 112 is the one emergency number where you can reach police, fire rescue services, ambulance, sea and air rescue, as well as social services. The company SOS Alarm AB is the first receiver of all 112 calls. In addition, SOS Alarm handles certain interviews and dispatches ambulance and fire units on commission from most of the county councils and communities.

SOS Alarm is mutually owned by the Swedish state (50%) and the Swedish communities and county councils (50%) together. SOS Alarms commitment is regulated by the Swedish state in an agreement.

The organisation of SOS Alarm and the 112 service is currently under investigation and a report has been delivered April 30, 2013.
Figure 14: Overview of Emergency Response operations

Currently there are 16 alarm centres, so called SOS-centrals, spread across Sweden. They are organised in a redundant and resource efficient way, which means that each of the centres could handle calls from anywhere in the country. This structure allows both for load sharing and redundancy on all levels. The alarm centres handle all incoming 112 calls, that is, SOS Alarm is today the only first level PSAP organisation in Sweden.

In addition, SOS Alarm handles most 112-calls concerning Fire & Rescue Service and Ambulance Service within its organisation. For these two functions, Fire & Rescue Service and Ambulance Service, SOS Alarm is also the second level PSAP. Agreements with the concerned municipalities and county councils regulate how this service is provided. Different county councils, who are responsible for the healthcare service including ambulance, may have different agreements. For example several, but not all, county councils require that all calls concerning healthcare and possible need of ambulance are to be handled by a nurse.

The responsibility for healthcare and ambulance service part of the 112-service is regularly procured by the county councils. Up to 2010 SOS Alarm had all agreements, but then the company Medhelp secured an agreement with 4 county councils (Uppsala, Västmanland, Södermanland and Gotland).

This means that another actor is responsible for the evaluation of the 112-callers need for ambulance and dispatching ambulances as of November 1\textsuperscript{st}, 2011. This in turn means that SOS Alarm will transfer 112-calls concerning healthcare in the 4 concerned counties directly to Medhelp for further handling.
The handling of calls will be more complex concerning incidents or events where more than one of the helpers on 112 is needed, for example a traffic incident that involves ambulance, police, and fire brigade. During 2012 there have been discussions between SOS Alarm and OEM manufactures and OEM branch organisations regarding handling of TPS-eCall. The current approach has been that if a TPS call centre receives an eCall they should at least be allowed to call the SOS centres and verbally transfer the eCall and MSD information to the SOS Operator.

Figure 15: The way from 112-caller, via SOS Alarm, to the responsible helper/type of help needed

SOS Alarm delivers event information to, amongst others, The Swedish Transport Authority and the national Swedish radio, Sveriges Radio (SR) who is a public service company owned by the Swedish state. This event information is automatically generated in SOS Alarms operational technical system, CoordCom G5, when certain types of fire and rescue events occur. This allows the Transport Authorities Traffic Management centrals (TMC) to monitor the incident and even send resources, Road Assistance, in Stockholm and Gothenburg areas. Sweden. SR may in their broadcasts immediately alert the public that a traffic incident has occurred which give the drivers a possibility to choose an alternative road.

This event information is accessible also to the media by individual agreements with SOS Alarm.
TMC and SOS Alarm communicate and cooperate in several ways, for example in exchanging information in case of a road incident. This exchange is taking place both verbally (by phone) and automatically (event information).

Much of this information exchange takes place in the Joint Cooperation Web (Samverkanswebben). This is a web site available only (by agreement) to fire & rescue services, SOS-centrals, County Administration Boards, the police, and others who has a part in the 112- and/or crisis management in Sweden.

When eCall is deployed it is expected that any car crash information is more accurate and received in a timely manner, especially in rural or less populated areas. The flow of information is not expected to be dramatically affected.

5.18.2 HeERO pilot set-up

Based on the current structure of emergency handling the Swedish HeERO pilot has seen eCall as “just another type of E112 calls”. As the partners in the Swedish pilot covers the systems where eCall is specified, it has been possible to get a very “near-real” test environment, from use of a real car to use of two production mobile networks, to use of a modified version of the system used by SOS Alarm for first and second line PSAP.
PSAP (Public Service Answering Point):

Handling of Pan-European eCall with the In-Band Modem technology was added to the CoordCom system, which is the PSAP system used by the SOS Centres. During the pilot however three physical instances of the PSAP were used, two CoordCom PSAPs and one lap-top PC PSAP. The majority of the tests were conducted using the PSAP installed at the CoordCom vendor Ericsson’s premises (CC-PSAP). A test-PSAP installed at SOS Alarm´s premises in Stockholm was also used (SOS-Alarm´s_test-PSAP). Finally, the eCall PSAP functionality was also implemented and installed in a lap-top PC (AC-PC).

PLMNs (Public Land Mobile Networks):

The eCall flag handling was implemented for test purposes throughout Sweden in the existing mobile networks of TeliaSonera and Telenor. The routing tables in the switches in the mobile networks, the MSCs, were modified to fit the test scenarios, whereas the eCall in most test scenarios are routed to the CC-PSAP. For most of the tests the eCall flag was used. However, the long numbers to address the PSAP (in addition to using 112) was also used, especially for the interoperability and cross-border tests.

IVS (In-vehicle system) and cars:

One Volvo V60 with the proprietary Volvo “On Call”-system with an In Vehicle System, IVS, from Actia has been used. The Pan-European eCall In-Band Modem was implemented in the software of this unit. Laptop/mobile-phone-based IVS and PSAP with good logging and debugging tools have been used in functional verification, drive tests and interoperability testing with other HeERO pilots.

The car has been driven in Sweden, while Test Sessions which incorporated a computer-generated Test Sequence was run continuously. This test session encompassed; setting up an eCall, transmitting two MSDs, hanging up, initiating a call-back with Pull-request from the PSAP, transmitting a third MSD and hanging up; then repeating all over.

All planned KPIs are captured, all planned functionality and interoperability tests were done, also the PSAP operator evaluation and laboratory tests. The drive tests are done with the following results. The drive covered a total of 2700 km – rural, urban, highway, 1050 eCall attempts, 3000 MSD attempts. Overall success rate ranges in these Test Sessions from 100% down to 75%, depending on mobile coverage. Time from eCall-triggering to MSD presentation at the PSAP were 8- 24 sec (with registered IVS)
The tests were divided into different types of tests, listed below:

a. **Drive tests:** The drive test were divided into two different type of tests; Computer-Initiated Tests, and Voice testing:

   - **Computer-Initiated tests** – These tests can be initiated from and to a driving vehicle by computer units in IVS and PSAP. The Test Procedure is designed to capture the KPIs in a reliable and resource efficient way.

   - **Voice testing** - voice channel disturbance tests – These voice tested eCall are manually triggered and evaluated by a professional PSAP call taker and expert listeners in the testing car.

b. **Laboratory tests** – These tests are used for test of the eCall performance in weak or interfering (mobile network) radio signal conditions, cross border tests and the other tests. The PLMN-laboratory environment is used to emulate and simulate various critical situations in a controlled manner, to be able to evaluate specific KPIs for an in-depth analysis.

c. **Interoperability tests** – These tests are aimed to assess the performance of the eCall service in situations when at least residents or organisations of two different EU
countries are involved in the eCall service provision. The interoperability tests have been conducted in both laboratory and live-network conditions.

d. **Functional tests** – we have also performed other types of tests, for example, verification that transmission chain works according to expectations. The issues found during these tests have been brought forward to HeERO standardisation task force. (Those tests are not further described in this document).

![Figure 18: Functional test setup to SOS-PSAP (SE)](image)

Successful functional tests with the Swedish PSAP SOS-Alarm have been performed. SOS-Alarm is equipped with the CoordCom system from Ericsson, the same equipment as used in the Swedish drive tests and lab tests.

### 5.18.3 Main issues

- Start of next eCall deployment step need involvement from SOS Alarm and MSB (Swedish Civil Contingencies Agency).

- Some identified issues for eCall deployment were:
  
  o PSAP/SOS Alarm: Operational questions to be handled: silent calls, noise, time delay between call in queue and voice call up and running, answering eCall where the MSD transmission delays or fails. How can a good enough quality for the eCall functionality in all of the IVSs be guaranteed?
  
  o MNO consequences – only eCall flag? Will there be problems for some of the PLMNs to handle long numbers for the SIM-cards for the IVSs?

- Conformance test specification – issues raised by industry partners. How will such testing be conducted?
• TPS: consequences for OEM services?

• The performance and reliability of eCall is lower in rural areas than in urban areas. The In-Band Modem seems to perform less robust than the 112 voice call itself.

• The pilot also recognises that the time expected for the eCall set-up time while the dormant mode is used as another important issue. How will the resulting longer set-up time affect the number of “silent” eCall to SOS Alarm, the Swedish PSAP operator? A long call set-up time may give many “silent” calls, as passengers that are able to, often try to leave a crashed car quickly after an airbag deployment.

• There are concerns regarding possible privacy violations and the risk for tracking and supervision of individual vehicles. This issue will need to be handled both in Sweden as well as on an EU-wide basis.

5.18.4 Conclusions

The intent of the Swedish HeERO pilot has been to evaluate if the requested performance of the eCall service can be met with a deployment of the approved eCall standards in the existing public mobile networks and within the existing 112 system. This means that the testing has had a strong focus on the eCall standards and capturing the key performance indicators, the KPIs. Other issues, such as the response time of the rescue services and ambulances, use of EUCARIS and use of VIN in the operational rescue chain, as well as non-operational issues, like legal liability, periodic time inspections, change of a car ownership, etc. have not been considered by the Swedish pilot.

The outcomes of the tests performed by Swedish HeERO Pilot Site and reported in this document confirm that the pan-European eCall is working according to expectations when used in communication environments with good quality (high strength) of public mobile network radio signals. The results show that the performance and reliability of eCall is lower in rural areas than in urban areas, as expected as the coverage generally is better in urban areas. The In-Band Modem seems to perform less robust than the 112 voice call itself.

Lessons learned and remarks

This section is a collection of things we have learned during our testing, mistakes we have done that we would like to help other pilots to avoid. There is not any importance semantics in the order of these lessons learned.

1. Lesson: The effort for preparation and testing was far higher than estimated beforehand and the allocated budget was not adequate.
2. Lesson: Several uncertainties in the standards caused more effort than anticipated.

3. Lesson: Calibrate the equipment in lab environment before or after drive testing, if an exact comparison is wanted; be aware that individual equipment varies in radio performance, which has an influence on eCall KPIs.

4. Lesson: In areas with varying results repeat tests more often; to find out whether or not the results vary substantially the same route must be used at least twice.

5. Lesson: In order to evaluate the timing-KPIs precisely to 1-second-granularity, the clocks in the PSAP and IVS need to be synchronised beforehand to a granularity of at least 0.5 second, better to 0.1 seconds, to get precise time stamps.

6. The definition of KPIs in D4.2 is maybe not fully sufficient. It is e.g. of interest to differentiate Voice-call-success and MSD-success also in call-backs. Also the simple average of the timing KPIs is maybe misleading and Min-, Average- and Max-values are at least required. Swedish HeERO Pilot Site extended therefore the KPI definition.

7. Lesson: Not all PLMNs in Sweden (and other countries) support the 112-eCall Flag handling (so far). Just calling 112 “blindly” in any PLMN may cause a roaming IVS in “cross-border-testing” to end up in a real, life PSAP, diverting the attention of the PSAP operator from real emergencies. A roaming IVS shall therefore either use a white list” of allowed PLMNs (TeliaSonera and Telenor, so far) or use “long-number” calling to the CC-PSAP directly (number will be given on request).

8. Lesson: No significant difference in KPIs was observed between 112-eCalls with eCall Flag and normal “long-number” voice calls. This holds for the tested networks under the given (non-congested) network conditions.

5.18.5 Beyond Swedish HeERO Pilot Site test result

The Swedish HeERO Pilot Site tests focused on the reliability and coverage of the basic eCall service as specified so far. No in-depth considerations have been given to future aspects, like adding features or more incident-related information, e.g. providing better severity estimation from vehicle to PSAP for better judgement, resource allocation and treatment preparation.

Also other aspects, which may play important roles in other regions, such as data encryption, or text chat for hearing or speaking disabled people, are so far not considered in the Swedish
HeERO Pilot Site. It is, however, to some extent obvious that the specified In-Band Modem has only very limited capability for such additional aspects. It is not likely that the In-Band Modem standard will be able to be extended to have such capabilities.

Further: have the privacy issues had an impact in the standards? The functionality verification for privacy protection would need to be specified, which has not been done so far.

There have also been concerns raised by the Swedish HeERO Pilot Site partners regarding the possibility for Third Party Services, such as Volvo-On-Call, to co-exist with eCall. Is there a risk that the mandatory eCall service will negatively affect commercial services?

### 5.18.6 Recommendations for further activities

There are some additional these activities that should be dealt with before deployment of the eCall service nationwide. Future eCall pre-deployment activities in Sweden should handle these, as they have not been possible to handle within the Swedish pilot due to either not ready common specifications, or because the needed organisations have not been available.

- Test of eCall behaviour for Dormant IVSs.
- Test of eCall in all relevant PLMNs in Sweden. It should be verified that the echo cancellation problem occurring in for example Germany is not a problem in the two non-HeERO-PLMNs. Any echo cancelling equipment may delay the deployment of and operational eCall service.
- The procedures for handling SIM-cards for the cars will need to be known and accepted. Can a vehicle change between eCall only and eCall+TPS-services? The procedure will place requirements on the SIM-card handling and number series, as well as must be reviewed from an integrity-perspective.
- Interoperability testing in Finland and over the border into Russia. This to confirm interoperability with ERA GLONASS (support from this Russian project is required). (Outside the scope of HeERO).
- Evaluate effect on MSD success rate with back-up solutions, for example back-up SMS.
5.19 Other challenges identified during the study

It was considered necessary to document both challenges reported by the pilot sites and challenges available from other sources such as the results of other work packages of the HeERO project. The challenges known via other sources than the interviews of the pilot sites are documented in this chapter.

Policy layer

eCall standards provide only few guidelines for developing the human machine interface of the IVS

At present, standards of eCall provide only a limited amount of guidance for development of the human machine interface (HMI) of the eCall IVS. For example, there is no commonly agreed way how the status of the IVS should be presented to the user and no detailed guidelines for designing the manual activation feature of the IVS.

On the one hand, this has been an intentional decision to allow the IVS providers to innovate. On the other hand, the absence of clear guidelines for the human machine interface may lead to solutions which are not optimal for an emergency call service or solutions which are not easily recognisable as eCall. This may lead to unintentional false alarms when the user confuses eCall with something else like a breakdown call or a situation in which the user does not know without difficulties how to activate or use the eCall IVS available in the vehicle.

Business layer

Lack of a solution for testing the functionality of the IVS

The eCall IVS is most of the time in an inactive state and its ability to function normally cannot usually be directly observed. Therefore, it should be possible to test the functionality of the IVS during the normal lifecycle of the vehicle. At present, there is no commonly accepted solution which would allow verifying the functionality of the IVS. There is also a risk that false automatic or manual eCall may be generated with the purpose of testing the functionality of the IVS.

PSAPs in member states need updates which may be difficult to complete until 1st October 2015
Updating the PSAPs to be able to receive and process eCall may be difficult to complete until 1st October 2015 in all member states of the EU. The challenges to meet the deadline may come from technical or administrative issues. Information systems of PSAPs typically have high requirements for information security and system reliability and may be complex systems consisting of both hardware and software. This may increase the time required for the update needed to have eCall functional.

**Limitations of interoperability tests performed in HeERO**

Many of the interoperability tests carried out in HeERO were remote tests in which the IVS was physically located in a country different from the PSAP. These remote tests are different from a realistic use case in a few important aspects. First, the IVS is not attached to any of the mobile networks in use in the country of the PSAP. Second, the call path between the IVS and PSAP includes also international telecommunication links which may have characteristics different from domestic ones. For these reasons, the results obtained in remote tests are not necessarily the same as the results of locally made tests which would also be closer to a realistic use case.

**It is not fully clear who will purchase and install the SIM card to the IVS**

The standards of eCall provide no direct answer to the question who will purchase and install the SIM card into the eCall IVS. So far, the availability of dormant ‘eCall only’ SIM cards has been limited: only one of the pilot sites which were represented in the HeERO final event (Denmark) reported tests made with a dormant SIM.

**Operational layer**

No specific challenges.

**Technical layer**

Realised voice channel blocking time is longer than the target value in requirements specified for eCall.

The objective that the MSD should be transmitted in four seconds has been expressed in ETSI TS 122 101:

“The MSD should typically be made available to the PSAP within 4 seconds measured from the time when end to end connection with the PSAP is established”
This target was later adopted by the 3GPP SA4 eCall Sub Working Group (3GPP 2008):

“11. The MSD should typically be made available to the PSAP within 4 seconds, measured from the time when end to end connection with the PSAP is established.

This service requirement is considered in the selection as follows: ‘In optimal conditions (error-free radio channel, GSM FR codec and FR AMR 12.2 kbit/s mode) the eCall candidate procedure shall be able to transmit the whole 140 bytes of the MSD reliably within 4 seconds, measured from the time when the transmission from the IVS to the PSAP begins (after a trigger from the PSAP has been detected).’

Note: See Performance Requirement 14.

Note: ‘Reliability’ is defined in the new Performance Requirement 15.

Note: The Performance Objectives give additional guidelines for the performance under non-ideal channel conditions.”

The times measured in laboratory environment in conditions of good mobile network carrier to interference ratio typically resulted in MSD transmission times of five seconds or less (ETSI 2010). Even shorter times have been documented with tests in laboratory environment carried out by (Werner et al. 2009).

The time defined in ETSI TS 122 101 can be understood as the time between completion of call setup at PSAP side and the reception of MSD with a correct CRC checksum by the PSAP. The definition leaves somewhat open whether the time required to finalise the in-band data transmission by sending acknowledgements from PSAP to IVS would be included in the time mentioned by ETSI TS 122 101.

The voice channel blocking time measured in HeERO as KPI_007A includes both the time used for transmission of MSD (from start of MSD transmission to reception of MSD with a correct CRC checksum) and the time required for transmission of acknowledgements from the PSAP to the IVS (LL-ACK and HL-ACK). The mean voice channel blocking times (KPI_007A) reported by pilot sites are summarised in Table 1.
Means of voice channel blocking time (MSD transmission time) reported by HeERO pilot sites. Variations within pilot sites are caused for example by differences between test cases such as differences between IVSs and MNOs.

<table>
<thead>
<tr>
<th>Pilot site</th>
<th>Low / s</th>
<th>High / s</th>
<th>All / s</th>
</tr>
</thead>
<tbody>
<tr>
<td>Croatia</td>
<td>5.23</td>
<td>9.48</td>
<td></td>
</tr>
<tr>
<td>Czech Republic</td>
<td>6.59</td>
<td>6.67</td>
<td>-</td>
</tr>
<tr>
<td>Finland</td>
<td>8.57</td>
<td>9.18</td>
<td>-</td>
</tr>
<tr>
<td>Germany</td>
<td>8.8</td>
<td>10</td>
<td>-</td>
</tr>
<tr>
<td>Greece</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Italy</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>The Netherlands</td>
<td>4.64</td>
<td>8.30</td>
<td>-</td>
</tr>
<tr>
<td>Romania</td>
<td>12.33</td>
<td>12.77</td>
<td>-</td>
</tr>
<tr>
<td>Sweden</td>
<td>-</td>
<td>-</td>
<td>7.75</td>
</tr>
</tbody>
</table>

Table 1 Means of voice channel blocking time (KPI_007A) measured by HeERO pilot sites (Hentschinski 2013).

In practice, the time required for transmission of LL-ACKs and HL-ACKs is typically around 2.0-2.1 seconds, if only one LL-ACK is sent. However, it may be as long as about 3.9 s, if several LL-ACKs and HL-ACKs are sent as in one of the examples of the Finnish eCall test-bed logs presented below.

In this example, the PSAP has transmitted only one LL-ACK and five HL-ACKs (time used to send LL-ACKs and HL-ACKs: 2.089 s):

```
“1369138190736: [PSAP] sending NACK
13691381911127: [PSAP] MSD successfully received; redundancy versions: 1
13691381911127: [CTRL] MSD received from PSAP
13691381911127: MSD
0100078067D31570855C228A28A2B8A45A8CDB1F2C674938842ACDAD0460
13691381911127: [PSAP] HLACK data received from control
13691381911127: [----]
13691381911127: SENDINGHLACK
13691381911127: MSDRECEIVED
13691381911136: [PSAP] sending ACK  (HLACK pending)
1369138191215: [PSAP] sending HLACK; data: 0x00
1369138191616: [PSAP] sending HLACK; data: 0x00
1369138192015: [PSAP] sending HLACK; data: 0x00
1369138192416: [PSAP] sending HLACK; data: 0x00
1369138192815: [PSAP] sending HLACK; data: 0x00
1369138193216: IDLEPOSTHLACK”.
```

The Finnish eCall test-bed was configured to send four LL-ACKs until transmitting the HL-ACKs to ensure that at least one LL-ACK would be received by the IVS. An example in which four LL-ACKs have been sent is shown below (time used to send LL-ACKs and HL-ACKs: 3.903 s):

```
“1369741683785: [PSAP] sending NACK
```
The number of LL-ACKs to be transmitted is not specified in the standards of the eCall in-band modem or the standard concerning the application layer protocol. Therefore, the PSAPs implemented by the pilot sites have possibly been using different settings for the number of LL-ACKs and HL-ACKs to be transmitted in case of a successful MSD transmission. This has to be taken into account when interpreting the results provided by HeERO WP4.

Even though the time required to complete the data transmission by sending acknowledgements (both LL-ACK and HL-ACK) is not considered to be included in the four seconds specified in TS 122 101, it can be concluded that the typical MSD transmission times have been longer than 4 s at least at some pilot sites.

For example, the Finnish eCall test-bed was configured to send four LL-ACKs and five HL-ACKs, and this configuration corresponds to the time of about 3.9 s required for sending acknowledgements after receiving the MSD. The mean of KPI_007A for the test case with best results in terms of voice channel blocking time was 8.57 s. It can be concluded that the mean of the MSD transmission time even in the best of the test cases measured in Finland was 4.67 s which is longer than 4 s.

Similar comparison can be made for the German test site. The German PSAP used in HeERO interoperability tests with a Finnish IVS was configured to transmit four LL-ACKs and four HL-ACKs. The configuration of the PSAP can be assumed to be the same both in the...
interoperability tests and in the tests carried out within the German HeERO pilot site. An example of the PSAP log file of the Finnish-German interoperability tests carried out in HeERO is shown below:

```
2013-06-15 19:52:42 (DEBUG): [PSAP] HLACK data received from control
2013-06-15 19:52:43 (DEBUG): sent 1. hlack (value: 0x00) to ivs
2013-06-15 19:52:43 (DEBUG): sent 2. hlack (value: 0x00) to ivs
2013-06-15 19:52:43 (DEBUG): sent 3. hlack (value: 0x00) to ivs
2013-06-15 19:52:44 (DEBUG): sent 4. hlack (value: 0x00) to ivs
2013-06-15 19:52:44 (INFO): calling psap operator at sip:inactive@127.0.0.1
2013-06-15 19:52:44 (DEBUG): local_port is 25390
2013-06-15 19:52:44 (DEBUG): I have received an event nua_i_state status 0 INVITE sent
2013-06-15 19:52:44 (DEBUG): I have received an event nua_r_invite status 200 OK
2013-06-15 19:52:44 (DEBUG): remote_port is 16742
```

The time between establishment of voice connection and the reception of MSD is around 3 s (44 – 41 = 3). This is consistent with the fact that the German PSAP sent one HL-ACK less than the Finnish PSAP and transmission of a LL-ACK or a HL-ACK takes about 400 ms. In conclusion, the time needed for transmission of acknowledgements has most likely been between 3 and 4 s as in case of the Finnish PSAP.

The average voice channel blocking time measured at the German pilot site was 8.8 s in the best of the test cases. When the time used for transmission of LL-ACKs and HL-ACKs has been excluded, the average MSD transmission time is around 4.8-5.8 s in that the test case.
This is in line with the conclusion of the German pilot site that the voice channel blocking time (KPI_007A) was longer than originally expected (Chapter 5.13). Performing a similar analysis for all of the pilot sites would require additional data collection.

The average MSD transmission times have been longer than the 4 s defined in ETSI TS 122 101 at least at the Finnish and German pilot sites. It is also likely that there are one or more other pilot sites with typical MSD transmission times in excess of 4 s. This is the case for example for Romania. It is extremely unlikely that over 50% of the voice channel blocking time and over 6 s would have been used just for the transmission of LL-ACKs and HL-ACKs.

The number of the two types of acknowledgements (LL-ACK and HL-ACK) sent by the PSAPs implemented by the pilot sites have not determined by any standard or theoretical analysis of the communication protocols used for transmission of MSD. They have been parameters with values specific to pilot site.

It is likely that the voice channel blocking time (KPI_007A) could be reduced by optimising the acknowledgement mechanism for example by making LL-ACK optional and giving a recommendation on the number of HL-ACKs to be sent after a successful MSD transmission. In-depth analysis is recommended to determine the optimum number and type of acknowledgements in terms of the reliability of the acknowledgement mechanism, impact on the voice channel blocking time, user aspects and service quality of eCall in general. Reducing the time required for acknowledgements has the same effect as reducing MSD transmission time: both of them reduce the voice channel blocking time (time between call setup and opening of the voice connection).

When interpreting the results on the MSD transmission time, it should be noted that most of the pilot sites have not been using the European emergency number 112. It is possible that the routing of the call as well as the signal processing along the call path would be different for a 112 emergency call. Extensive analysis of MSD transmission times with real 112 calls was not possible due to the limitations of the HeERO pilots. The IVSs used by the pilot sites during the HeERO tests were prototypes. In fact, several weaknesses in IVS implementations were identified and corrected during the project. This suggests that improved IVS (and PSAP) implementations may reduce MSD transmission times.

MSD transmission times longer than the value specified in the requirements for eCall (ETSI 2008) may have unintended impacts on the operation of the service. For example, the user in the incident vehicle may be confused because of the long time required for MSD data transmission after opening the call. For example, when call progress indications such as the
ones defined in 3GPP TS 22.001 (3GPP 2012) are used, the user may expect the voice connection be available almost instantly after the call setup has been completed unless he or she is informed about the progress of the MSD transmission.

There are no guidelines or target values for MSD success rate acceptable for eCall.

The performance requirements for the eCall in-band modem in terms of the reliability of the MSD transmission are discussed in ETSI TS 126 267 (ETSI 2012). Annex A (informative) of TS 126 267 mentions reliable MSD transmission as one of the performance requirements:

“15. The MSD shall be transmitted reliably to the PSAP. An MSD transmission is considered reliably terminated, if a cyclic redundancy check (CRC) of at least 28 bits, applied to the entire MSD, detects no errors.”

The source of this requirement mentioned in ETSI TS 126 267 is not fully clear. TS 126 267 states that the performance requirements for eCall have been taken directly from the 3GPP TS 22.101. However, the requirement quoted above cannot be found in the corresponding (release 11) of 3GPP TS 22.101 (3GPP 2013) where the requirements for MSD transmission are discussed in chapter A.27 of Annex A (normative).

A similar requirement has also been expressed by 3GPP SA4 eCall Sub Working Group (3GPP 2008):

“15. The MSD shall be transmitted reliably to the PSAP. An MSD transmission is considered reliably terminated, if a cyclic redundancy check (CRC) of at least 28 bits, applied to the entire MSD, detects no errors.

Note: If the CRC detects an error in the MSD, then an automatic retransmission shall be triggered, unless the PSAP decides to stop the transmission.”

The documents mentioned above mention no numerical target values for the reliability of eCall MSD transmission. However, they set a clear objective that MSD transmission should be reliable. This is in line with the role of eCall as an emergency service and its safety-critical nature.

MSD transmission is not always successful

The successfulness of MSD transmission has been included as a separate indicator (KPI_003) in the set of key performance indicators used in HeERO and also been measured.
by several HeERO pilot sites. A summary of the results measured by pilot sites in 2013 with real-life mobile networks has been provided in Table 2.

<table>
<thead>
<tr>
<th>Pilot site</th>
<th>Low / %</th>
<th>High / %</th>
<th>All / %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Croatia</td>
<td>92.82</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>Czech Republic</td>
<td>96.93</td>
<td>99.23</td>
<td></td>
</tr>
<tr>
<td>Finland</td>
<td>10.28</td>
<td>91.31</td>
<td>-</td>
</tr>
<tr>
<td>Germany</td>
<td>77</td>
<td>94</td>
<td></td>
</tr>
<tr>
<td>Greece</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Italy</td>
<td>-</td>
<td>-</td>
<td>90.4</td>
</tr>
<tr>
<td>The Netherlands</td>
<td>88</td>
<td>95</td>
<td>92</td>
</tr>
<tr>
<td>Romania</td>
<td>60</td>
<td>100</td>
<td>-</td>
</tr>
<tr>
<td>Sweden</td>
<td>-</td>
<td>-</td>
<td>83.3</td>
</tr>
</tbody>
</table>

Table 2 MSD success rates (KPI_003) measured by HeERO pilot sites (Hentschinski 2013).

For Sweden, the relatively low success rate can be explained by the fact that some of the calls were initiated in locations with bad coverage (underground parking house). For the Finnish pilot site, low success rates in some test cases can be at least partly explained by non-standard behaviour of the IVS. There are indications that weaknesses in IVS implementation may have contributed to weaker results achieved in one of the test cases of the German pilot site. In case of the Romanian pilot, many of the test cases included only a limited number of calls. (Hentschinski 2013)

The results in table 2 have to be interpreted carefully because no detailed analysis on the causes of unsuccessful MSD transmissions at each pilot site has been carried out in the HeERO project, most of the measurements documented in the table have been carried out with a normal phone number instead of the European emergency number 112 and there may have been differences in the ways the KPIs have been interpreted or the way the measurements have been carried out. For example, the strict interpretation of KPI_003 has likely reduced the reported share of successful MSD transmissions in case of the Finnish pilot site. In addition to successful CRC check, also successful reception of HL-ACK by IVS was required to classify MSD transmission as successful.

The results indicate that three of the eight pilot sites (Croatia, Czech Republic and Romania) have achieved MSD success rates of close to 100% at least in some of the test cases. However, no confidence intervals for the MSD success rate has been estimated by pilot sites in D4.4 of HeERO except in case of the Finnish pilot site. Therefore, a conclusion that close to 100% reliability of MSD transmission has been achieved cannot be made on the basis of
the results achieved by any of the pilot sites. Correspondingly, it is not possible to conclude that that high level of reliability close to 100% has not been achieved by any of the pilot sites because all pilot sites have not calculated confidence intervals for the MSD success rate for example with techniques described in (Öörni and Korhonen 2013).

The measurements carried out at the pilot sites give a somewhat uneven picture of the MSD success rate. The results seem to be different between pilot sites, MNOs and IVS prototypes. In case of the Finnish HeERO pilot, statistically significant differences were observed in two MNOs at the same physical location and also between different IVS prototypes (Hentschinski 2013).

At least the following factors have been found to contribute to the MSD success rate in empirical trials carried out so far in real-life mobile and fixed line networks:

- low-quality fixed line links (Weber 2013)
- weaknesses in IVS prototype or modem implementation (Hentschinski 2013).

The laboratory tests have been carried out by ETSI to analyse the impact of various factors present in mobile and fixed line networks on the MSD transmission time (ETSI 2010). Examples of these include:

- buffers used in switches and routers
- echo cancellers
- jitter
- transcoding
- mobile network speech channel codec types
- conditions of the voice channel (such as automatic level control settings)
- handovers
- sample slips or small delay variations because of a handover.

Due to the design of the in-band modem and the eCall application layer, an unsuccessful MSD transmission commonly ends when the maximum MSD transmission time of 20 s is exceeded (in other words, when timers T7 and T8 expire, see Annex A of EN16062). Therefore, factors that affect the MSD transmission time can also be expected to have an impact on the share of MSDs successfully transmitted until the 20 s timeout.
The results summarised in Table 2 suggest that the MSD success rate should be close to 100% (<95%) at most at two or three of the eight pilot sites with measurements although no confidence intervals have been calculated. It also seems very possible or even likely that at least one of the pilot sites has had MSD success rate less than 90%. This conclusion is possible without any sophisticated statistical methods.

Even though there are no numerical target values or service quality requirements available for the MSD success rate, it is doubtful whether MSD success rates of less than 90% would be acceptable. In this case, the MSD transmission would fail in 10 or more of 100 eCall. It could be argued that even more stringent requirements would be appropriate for a service with the characteristics like eCall.

In case the MSD transmission in the beginning of the connection fails, the PSAP may either decide to use the voice connection to obtain information from the vehicle occupants or decide to request a MSD retransmission as defined in EN16062. The correlation of the outcomes between successive MSD transmissions during the same call has not been analysed in HeERO in detail. The correlation between the outcomes of successive MSD transmissions and the reliability of MSD transmission mechanism including the use of retransmission should be analysed using statistical techniques.

**User layer**

No specific challenges were identified in addition to the ones pointed out by the pilot sites.
6 Identified enablers, opportunities and challenges

A summary of the challenges reported by pilot sites and identified in the literature study is presented in Table 3.
### Policy layer

<table>
<thead>
<tr>
<th>Challenge</th>
<th>Pilot site(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Challenges in gathering full support from all stakeholders (PSAP, MNO, etc.) due to lack of legislative framework or legally binding decision to implement eCall at member state level</td>
<td>CR, DE</td>
</tr>
<tr>
<td>Stakeholders may understand standards in a different way (for example, ETSI/3GPP standards could have more clearly marked references to timers mentioned in Annex A of EN16062)</td>
<td>FI, NL</td>
</tr>
<tr>
<td>Difficulties in assigning responsibility for eCall in a complex administrative situation</td>
<td>DE</td>
</tr>
<tr>
<td>Retrofit IVS will require a legal framework</td>
<td>DE</td>
</tr>
<tr>
<td>eCall standards provide only few guidelines for developing the human machine interface of the IVS</td>
<td>-</td>
</tr>
</tbody>
</table>

### Business layer

<table>
<thead>
<tr>
<th>Challenge</th>
<th>Pilot site(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limitations in the scope of eCall tests (no eCall flag or real PSAP)</td>
<td>FI, DE, NL</td>
</tr>
<tr>
<td>Lack of commitment of iVMS developers due to perceived lack of business case (waiting for a clear decision or government subsidies)</td>
<td>FI</td>
</tr>
<tr>
<td>Current standards of eCall do not mandate the IVS to support third generation mobile networks</td>
<td>FI</td>
</tr>
<tr>
<td>Implementation of eCall affecting several players is a difficult organisational issue</td>
<td>DE</td>
</tr>
<tr>
<td>Different competences of different players</td>
<td>DE</td>
</tr>
<tr>
<td>Insufficient awareness of stakeholders (decision-makers) on eCall</td>
<td>DE</td>
</tr>
<tr>
<td>PSAPs in a member state have very different technical infrastructure</td>
<td>DE</td>
</tr>
<tr>
<td>HeERO pilot sites and HeERO partners dependent on resources or technical support from outside the consortium</td>
<td>IT</td>
</tr>
<tr>
<td>Consequences of eCall for commercial third party services are unknown</td>
<td>SE</td>
</tr>
<tr>
<td>Availability of a conformance test specification as technical specification but not as European standard</td>
<td>SE</td>
</tr>
<tr>
<td>Performance and reliability of eCall are lower in rural areas than in urban areas</td>
<td>SE</td>
</tr>
<tr>
<td>There is currently no way to check the functionality of the IVS except making a false eCall. The final version of the proposal for PTI of the IVS is not yet available.</td>
<td>-</td>
</tr>
<tr>
<td>PSAPs in member states need updates which may be difficult to complete until 1st October 2015</td>
<td>-</td>
</tr>
<tr>
<td>Limitations of interoperability tests (remote tests are not equivalent to local tests)</td>
<td>-</td>
</tr>
<tr>
<td>It is not fully clear who will purchase and install the SIM card to the IVS</td>
<td>-</td>
</tr>
</tbody>
</table>

### Operational layer

<table>
<thead>
<tr>
<th>Challenge</th>
<th>Pilot site(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Organisational or technical changes in PSAP simultaneously with eCall deployment</td>
<td>Fi</td>
</tr>
<tr>
<td>PSAPs do not have personnel resources to manage eCalls in other languages</td>
<td>DE</td>
</tr>
<tr>
<td>Possible false alarms from eCall enabled vehicles</td>
<td>DE, GR</td>
</tr>
<tr>
<td>Call routing plan is required to route manual and automatic eCalls to correct places</td>
<td>IT</td>
</tr>
<tr>
<td>Planned software update in the mobile network interfered with HeERO tests</td>
<td>IT</td>
</tr>
<tr>
<td>All the staff in PSAPs has not been trained to handle eCalls</td>
<td>RO</td>
</tr>
<tr>
<td>Silent calls</td>
<td>NL, SE</td>
</tr>
<tr>
<td>Operational questions in call handling (noise, silent calls, queuing of calls, answering eCall with failed MSD transmission etc.)</td>
<td>SE</td>
</tr>
</tbody>
</table>

### Technical layer

<table>
<thead>
<tr>
<th>Challenge</th>
<th>Pilot site(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unavailability of IVS prototypes in the beginning of the HeERO pilot</td>
<td>CR, GR</td>
</tr>
<tr>
<td>Weaknesses in IVS implementation</td>
<td>CR, CZ, FI, RO</td>
</tr>
<tr>
<td>Problems with mobile network coverage or signal strength</td>
<td>CR, GR, RO</td>
</tr>
<tr>
<td>Time synchronisation between IVS and PSAP is required to calculate several of the HeERO KPIs</td>
<td>CR, GR</td>
</tr>
<tr>
<td>Increased duration of IVS transmission and call setup duration when testing with a moving vehicle</td>
<td>CR</td>
</tr>
<tr>
<td>Repeated MSD update request by PSAP not possible</td>
<td>CZ</td>
</tr>
<tr>
<td>Mobile network echo cancellers have been suspected to have an adverse effect on MSD transmission</td>
<td>-</td>
</tr>
<tr>
<td>False eCalls generated by mobile phones which erroneously activate eCall flag</td>
<td>CZ, FI, GR</td>
</tr>
<tr>
<td>Voice channel blocking time longer than expected</td>
<td>DE</td>
</tr>
<tr>
<td>MSD transmission times have been longer than the target value for eCall at least at some pilot sites</td>
<td>DE</td>
</tr>
<tr>
<td>Differences between performance of IVS even if the IVS conform to standards</td>
<td>FI</td>
</tr>
<tr>
<td>eCall may end up as a &quot;silent call&quot; with no voice connection, if eCall flag not implemented</td>
<td>NL</td>
</tr>
<tr>
<td>Lower than expected robustness of in-band modem</td>
<td>RO, SE</td>
</tr>
<tr>
<td>Some PLMNs may have problems in handling long numbers of the SIM cards of the IVSs.</td>
<td>SE</td>
</tr>
<tr>
<td>Long time needed for network registration and call setup when IVS activated in dormant mode; possibly has an impact on the number of silent calls received by PSAP</td>
<td>SE</td>
</tr>
<tr>
<td>Satellite based positioning techniques do not function properly in tunnels</td>
<td>SE</td>
</tr>
<tr>
<td>There are no guidelines or target values for MSD success rate acceptable for eCall</td>
<td>-</td>
</tr>
<tr>
<td>MSD transmission is not always successful</td>
<td>-</td>
</tr>
</tbody>
</table>

### User layer

<table>
<thead>
<tr>
<th>Challenge</th>
<th>Pilot site(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumers or the media confuse eCall with other in-vehicle emergency call services</td>
<td>FI</td>
</tr>
<tr>
<td>Misuse of eCall</td>
<td>NL</td>
</tr>
<tr>
<td>Users’ concerns of privacy violations and risk of supervision and tracking of individual vehicles</td>
<td>SE</td>
</tr>
</tbody>
</table>

Table 3. Challenges identified by the pilot sites and in the literature study
The enablers can most easily be understood as actions or factors which remove the barriers for eCall deployment or reduce the impacts of the identified challenges. Therefore, they are discussed together with the challenges for deployment of eCall in the following chapters.

6.1 Policy Layer

The main challenge for the deployment of eCall at the policy layer seems to be gathering full support of all stakeholders required to deploy eCall at the member state level (challenge 1.1, Table 3). This applies to both private sector and public authorities. Public sector organisations may require that the legislative framework for eCall has to be in place before they can use any significant resources. On the other hand, the management of some private companies has its main focus on maximising shareholder value and this is not always seen as compatible with using company resources to implement a service providing no revenue unless there is a clear legal obligation. The completion of European level regulation on eCall (Chapters 5.1 and 5.2) is expected to remove this challenge and therefore be an important enabler for deployment of eCall in PSAPs and mobile networks.

Another identified policy level challenge present in some member states is the difficulty to assign responsibility for a complex service in a complex administrative environment (challenge 1.3, Table 3). For example, some members states have public administration at three or more levels (central government, state or region and municipality), and deployment of eCall may require simultaneous and concerted actions from all of them. A combination of measures on both member state and European level (such as regulation, Chapters 5.1 and 5.2) will likely be required although defining a solution to this challenge is out of the scope of this study.

The lack of legal framework for retrofit IVS (challenge 1.4, Table 3) is also one of the perceived challenges at the policy layer. At present, the retrofit IVS installed after the car has been delivered is not covered by the vehicle type approval procedure. There are plans to establish a voluntary certification scheme covering also the aftermarket IVS, but this arrangement is unlikely to be in place when the large-scale deployment of eCall is expected to start in 2015. This challenge increases the risks related to deployment – for example, having non-standard IVS products on the market – but will not be a barrier for deployment of eCall. The work towards an effective and widely accepted certification scheme for the IVS continues in the HeERO2 project (for a short description of HeERO2, see Chapter 5.2) and in the context of the EeIP (see EeIP task force RETRO, Chapter 5.2). The status of retrofit IVS
products should be monitored to determine if any further regulation, standardisation or other actions are necessary or any significant risks or challenges are encountered. One possible solution to the challenge is to provide guidelines for development of retrofit IVS. This could be a task of EeIP task force “RETRO”.

There are also some points in the standards of eCall which may be understood in different ways by different stakeholders (challenge 1.2, Table 3). For example, the ETSI/3GPP standard which specifies the operation of the eCall in-band modem could make more clear references to the values of timers expressed in Annex A of EN16062. This is likely to be minor challenge since most of the IVS providers and component suppliers have interpreted the standards correctly. However, increasing the clarity of standards in this point will reduce the potential for misunderstandings and non-functional components ending up in the market. The current status of eCall standards has been summarised in Chapter 5.3.

eCall standards provide only few guidelines for developing the human machine interface of the IVS (challenge 1.5, Table 3). This is unlikely to be a barrier for deployment of eCall. However, the lack of detailed design guidelines for the manual activation feature of eCall or the way the status of the IVS should be presented may lead to IVS implementations which are very different from each other and may therefore confuse the user. The recommendations given by the EeIP (for descriptions of EeIP task forces, see Chapter 5.2) and HeERO2 (for a short description of HeERO2, see Chapter 5.2) projects are expected to provide guidance for developing the HMI of the eCall IVS – for example by recommending the ways the status of the IVS should be presented to the user or the ways the manual activation of eCall should be implemented. The status of retrofit IVS products should also be monitored and regulatory actions considered, if significant challenges or risks are encountered.

6.2 Business Layer

The eCall tests carried out in the HeERO project have had certain limitations (challenge 2.1, Table 3). For example, the eCall discriminator (‘eCall flag’) and a real PSAP used to handle emergency calls were not available at many of the pilot sites. This fact has an impact on the way how the results of the tests carried out in HeERO should be interpreted and on the conclusions on the further tests required after HeERO has ended. eCall is an emergency call service which is expected to be reliable. Verifying the reliable operation of the service will require adequate testing before the actual deployment of the service. Therefore, the tests
carried out in HeERO should be continued at member state level to ensure the reliable operation of eCall since the start of its availability. This has been recommended for example in the conclusions related to the Finnish pilot site (Chapter 5.12.4).

**Current standards of eCall do not mandate the IVS to support third generation mobile networks** (3G, also called UMTS) (challenge 2.3, Table 3). This will have an impact on the lifecycles of the IVS and the mobile network technologies. The IVS with support only for GSM (2G) have to be replaced and scrapped if the GSM networks are closed down. It would also be possible to make support for 3G networks mandatory for the eCall IVS, but at least so far there has been no decision to do so.

There has been some discussion on re-using the 2G (GSM) frequency bands for 4G (LTE networks). For the 900 MHz GSM band, the GSMA mAutomotive technology roadmap states (GSMA 2013):

“Re-farming of 2G spectrum (particularly in the 900MHz band) has been discussed, but hasn’t gained significant momentum.”

On the other hand, the roadmap comments also the future of the 1800 MHz GSM frequency band:

“There is also considerable interest in the re-farming of existing 2G spectrum in the 1800MHz band to use for 4G LTE services. According to Wireless Intelligence, re-farmed spectrum in the 1800MHz band currently accounts for almost 40% of the global LTE market and will continue to do so over the next four years.”

GSM represents 70% of global mobile connections (status in Q3/2013, GSMA 2013). Therefore, it is unlikely that GSM will completely disappear within a short time. However, it is possible that some of the GSM frequency bands may be allocated to LTE over time and that GSM may be replaced by some other technology in the long term in future. For example, Deutsche Telekom is already using the 1800 MHz band for LTE in urban environments (Stevens and Grethe 2011).

In a worst-case scenario, the shutdown of all GSM networks within a country or any other geographical region could leave many users without a functional IVS in a situation in which the user is not necessarily aware of the obsolescence of the IVS and the unavailability of eCall.

To summarise, this challenge has no immediate effects on the deployment or operation of eCall. Instead, it is related to the long-term evolution for eCall and other in-vehicle
emergency call services. Further research and related road-mapping work on the long-term evolution of eCall, cooperation between stakeholders in the context of the EeIP (Chapter 5.2) and standardisation will likely have important roles achieving an optimal solution. For example, the realisation of eCall functionalities in 4G LTE networks is currently being studied by the ETSI Specialist Task Force ETSI STF 456 (ETSI 2013) and IETF (Internet Engineering Task Force) (Gellens and Tschofenig 2014). The first results of the work carried out by ETSI STF 456 have been presented in July 2013 (Al-Bakri 2013).

The experience from the HeERO pilots has shown that the PSAPs in member states need updates which may be difficult to complete at least in all EU member states until 1st October 2015 (challenge 2.13, Table 3). This can expected to delay the implementation of eCall in some member states but not to prevent it. It is also expected that the continuity of service in Europe will be realised gradually rather than at once.

The reasons for longer than expected time needed for the update are numerous: complex administrative structures of PSAPs, differences in ICT infrastructures of PSAPs between member states, high requirements for information systems in terms of reliability and information security etc. The solutions to this challenge will be analysed further in the later deliverables of WP6 of HeERO. It is likely that monitoring of the deployment of eCall in member states will be required after 1st October 2015 and that this monitoring will be based on the European ITS directive (EU Commission 2010).

The finalisation of the European level regulation for eCall (Chapters 5.1 and 5.2) will most likely contribute to achieving the deployment of eCall in PSAPs and mobile networks in a shortest possible time. The results of HeERO and HeERO2 projects provide also support for deploying eCall in member states within and outside HeERO projects (Chapter 5.9). Increasing awareness of stakeholders on member state level on the options available for implementation of eCall and the related benefits and costs will contribute to solving this challenge.

Temporary arrangements for receiving and processing eCall may be required in member states in which all PSAPs have not been updated yet. In practise, this may require routing all eCall to one PSAP equipped with eCall. The schedule of deployment and the actions required should be defined in a national eCall roadmap or an implementation plan.
The experience with the implementation of the common European emergency number E112 shows that the implementation of a new emergency communication service in Europe will be a gradual process which will take place at different time in different member states.

The interoperability tests carried out in HeERO also had certain limitations (challenge 2.14, Table 3). Most of the interoperability tests carried out was remote tests in which the IVS was physically located in a different country than the PSAP. This testing arrangement is different from the real use cases in terms of the mobile network used in the test, call routing and use of eCall discriminator and the call path in fixed line networks. Therefore, the results of these tests provided useful information on interoperability between IVSs and PSAPs but they do not represent accurately the practical use cases in which the interoperability is realised.

eCall interoperability events (Chapter 5.5, also known as eCall testfests) can provide opportunities for interoperability testing between IVSs and PSAPs from different member states. eCall interoperability events should be continued to provide a platform for interoperability testing. Interoperability between systems from different member states may also be a part of the eCall pre-deployment testing initiatives at member state level. Effective sharing and publication of the results of the interoperability tests to be carried out after HeERO and HeERO2 projects is also recommended – for example in the context of the EeIP or international eCall conferences to be organised.

One of the challenges encountered in HeERO was the necessity to rely on technical support and resources outside the national HeERO consortiums (challenge 2.8, Table 3). For example, all technology and component suppliers to the national eCall pilots were not involved in the national HeERO consortiums. This increased the time to solve technical problems encountered and in some cases even made it impossible within the timeframe of HeERO. In case of full deployment, this will be a less significant challenge because of direct involvement of PSAPs and MNOs. This was a challenge specific to the HeERO project and overlapping with the other challenges identified. Therefore, it will be covered by the summaries of other challenges such as the weaknesses of the IVS prototypes and the related enablers.

One of the pilot sites reported the lack of commitment by the IVS supplier due to lack of business case (challenge 2.2, Table 3) as a challenge for testing and implementation of eCall. In this case, the IVS supplier was waiting for a clear decision on mandatory deployment or on government subsidies. This challenge will most likely be solved by the
There is currently no way to check the functionality of the eCall only IVS except making a false eCall to 112 (challenge 2.12, Table 3). The Periodic technical inspection (PTI) task force of the EeIP has investigated the matter, but there have been no final results yet from the task force. The lack of means to test the functionality of the IVS can prevent the user from detecting the faulty state of the IVS and may increase the number of false manual eCall. Continuing the work carried out by the PTI task force of EeIP (for descriptions of EeIP task forces, see Chapter 5.2) and possibly also changes to standards of eCall will be required to introduce a solution to this challenge.

The self-test feature of the IVS should be implemented according to standards. The availability of a self-test feature in the IVS is mandated in Chapter 7.1.5 of EN16062: “On power up, the IVS shall normally perform a self-test without attempting to connect to the network…”

It is somewhat unclear; who will purchase and install the SIM card to the IVS and how a SIM card can be obtained (challenge 2.15, Table 3). The standards of eCall specify that the IVS must have a SIM card but they do not state whether obtaining a SIM card is the responsibility of the IVS provider or the user. The ACEA position paper on eCall (ACEA 2012) sees the SIM card as an element outside the control of the vehicle manufacturer and therefore recommends excluding it from the vehicle type-approval procedure: “ACEA does not believe that those elements outside of the OEM control should be included in type approval (e.g. SIM card, communication device, etc.).”. However, performing the tests described in the eCall conformance test specification CEN TS 16454 is not possible without a SIM card (for summary of eCall standards, see Chapter 5.3). The definition of a certification procedure for eCall IVS and finalising the vehicle type approval requirements will likely provide clarity on the responsibility to obtain a SIM card and install it to IVS (for current status and plans for type-approval requirements, see Chapters 5.1 and 5.2).

This challenge is also related to the fact that the availability of dormant SIM cards specified in the standards of eCall is very limited. At present, they are available from very few MNOs or not available at all. The lack of suitable SIM cards may restrict the availability of IVS at least in the beginning. This applies to the eCall only IVS. At present, the mobile network operators have no legal obligation to provide dormant SIMs to IVS manufacturers. It is somewhat uncertain how and when this will be solved on the basis of market principles between mobile
network operators and IVS providers. The need for regulation should be studied in case no dormant SIMs with reasonable prices appears on the market.

One of the HeERO pilot sites has expressed a concern that the **consequences of eCall for commercial third party services are unknown** (challenge 2.9, Table 3). According to an estimate made in 2009, commercial third-party services covered in 2009 0.4% of the European passenger car fleet (EU Commission 2009) even though these services have been available many years. Even though this estimate is now five years old, it is still likely of the correct magnitude because the share of vehicles equipped with private services is still relatively limited. For example, the private services are rarely available for small or mid-size cars. An overview on the current status of the services is available in (Öörni et al. 2013) and the EuroNCAP web site.

A public consultation on the deployment of eCall was launched in 2011 to study the opinions of various stakeholders on eCall (EU Commission 2011b). The four car manufacturers which responded to the questionnaire had somewhat mixed opinions whether the deployment of eCall should be left to the market forces but three out of four opposed mandatory deployment. The only reason for opposing mandatory deployment mentioned for the in the report was the risk that introduction of eCall may increase the prices of new cars and therefore reduce sales.

Private in-vehicle emergency call services are typically provided as a part of a larger service package. This is the case for example with GM OnStar, Volvo OnCall, BMW Assist and Ford SYNC. Therefore, they are not direct substitutes for pan-European eCall due to differences in functionality.

On the other hand, some car manufacturers see eCall as an enabler for other services. This is the case for example with Fiat (EU Commission 2011b).

The currently limited fleet penetration of private in-vehicle emergency call services (EU commission 2009) and the differences in functionality between commercially available service packages and pan-European eCall suggest that the impact of pan-European eCall on the existing private services will likely be limited on the European level.

When assessing the impact of pan-European eCall on third party services, it should be noted that a member state may decide to support TPS-eCall in their PSAPs using the interfaces defined in EN16102 although there is no legal obligation to do so.
The implementation of eCall affecting several players may be a difficult organisational issue (challenges 2.4 and 2.5, Table 3). Involvement of several organisations with their own agendas, planning processes, budgets and competences has potential to make eCall implementation more difficult. At least the time needed for planning and coordinating deployment and achieving support of all relevant stakeholders will increase. In case of any of the critical stakeholders has no motivation to implement eCall, the deployment process may become impossible or very difficult.

Although there is no single solution which would guarantee successful deployment process with a large number of stakeholders, a few relevant enablers can be identified. First, there has to be a stakeholder on the member state level which monitors and possibly also coordinates the overall process towards deployment of eCall and formally or informally takes responsibility that the upcoming problems are solved and that the process moves forward. Increasing awareness of decision-makers on the impacts of eCall and on the related regulation may be required to obtain a decision to implement eCall. Before starting the actual implementation, a national eCall implementation roadmap may be required for use as a tool for identifying the relevant stakeholders and their roles, the actions to be carried out and to set a schedule for eCall deployment (for conclusions of the pilot sites after the HeERO pilots, see Chapters 5.10-5.18).

The deployment of eCall may be slowed down by the fact that different stakeholders required for deployment of eCall typically have very different areas of competence (challenge 2.5, Table 3). This may increase need for coordination and time required for implementation but will not be a significant barrier for deployment. One of the enablers identified by the pilot sites is mutual cooperation and technical support between stakeholders in the member state (Chapter 5.10.1).

There are indications in the results of one pilot site that the performance and reliability of eCall may be lower in rural areas than in urban areas (challenge 2.11, Table 3). However, it is not fully clear from the results whether this has been caused by the mobile network signal strength or by some other factor and whether the situation has been the same at other pilot sites. The factors affecting the reliability of eCall should be further investigated. This challenge is also overlapping with other challenges such as the overall reliability of MSD transmission. This means that the enablers are partly the same.

First, eCall end-to-end tests should be performed on member state level to ensure correct functioning and reliable operation of eCall. Second, the impact of the network echo canceller disabling tone on the reliability of MSD transmission should be investigated and the NEC
disabling tone implemented in PSAPs, if clear improvement can be observed. Third, the reliability of eCall should be analysed on member state level – including a brief analysis of the factors contributing to it. After the analysis one should identify and implement the measures necessary in the communication networks or in the PSAP (for example, changes to codecs used or transcoding between codecs along the call path from IVS to PSAP).

The service quality of E112 emergency calls should be monitored. The status of national regulations concerning the coverage of the mobile networks and handling of 112 calls should also be analysed and changes implemented if necessary.

**The PSAPs currently in operation in a member state may have very different technical infrastructures** (challenge 2.7, Table 3). In practise, this means that the technical solutions used for receiving and processing eCall have to be very different between individual PSAPs, and developing a single technical solution suitable for all of them is impossible or very difficult. Large variation in information systems of PSAPs may increase the time needed for planning the technical implementation and implementing the solution.

The need to upgrade all PSAPs with equipment suitable for handling eCall can be avoided by architectural choices and operational models in which the reception and handling of eCall is centralised to a few key PSAPs. This was the solution used in the Romanian eCall pilot (Chapter 5.17.1). There are also other architectural solutions for PSAPs which allow more or less centralised of processing of eCall. For example, Germany is developing its own solution suitable for its own needs (Chapter 5.13).

The architectural solutions and operational processes should be documented in a national eCall implementation roadmap or a national eCall implementation plan.

**The awareness of stakeholders such as decision-makers on eCall may be insufficient** (challenge 2.6, Table 3). Awareness on the impacts of and general facts related to eCall is an important enabler for making informed decisions. Stakeholders with no sufficient information on the operation of eCall, its impacts as well as costs and benefits are unlikely to make a strong commitment to implementation.

The awareness of stakeholders can be increased with actions on European and member state level. The dissemination activities of HeERO projects, EeIP (Chapter 5.4) and iMobility Challenge will contribute to increasing awareness on the impacts of eCall and the implementation options available. Dissemination information within member states can be achieved for example by cooperation and communication between stakeholders relevant for deployment of eCall by organising round table discussions and working groups (Chapter
5.15.8), creating and publishing a national eCall implementation roadmap (5.15.8) (such as in Öörni et al. 2013) or implementation plan and maintaining a database on the studies of the impacts of eCall as a part of the iMobility effects database (http://www.imobility-effects-database.org)

The conformance test specifications are available as CEN technical report CEN TS 16454 but not yet as European standard (challenge 2.10, Table 3). There is plan to develop TS 16454 to EN, but the final version is not yet available and this may cause some uncertainty among developers of IVS and PSAPs. However, this is unlikely to be a significant barrier for deployment of eCall.

## 6.3 Operational Layer

Challenges related to deployment of eCall may also be related to the operation of eCall or PSAP services in general. First, there are several **operational issues in call handling such as silent calls, calls with noise, queuing of calls and answering of eCall with a failed MSD transmission** (challenge 3.8, Table 3). First, countries intending to implement eCall in their PSAPs have to develop guidelines for handling of eCall in their PSAPs. Second, recommendations can be provided on European level for typical issues related to call handling.

For example, this work has been carried out by the EeIP task force SILENT (Chapter 5.4) for **silent calls** (challenge 3.7, Table 3). Silent calls are likely to be one of the operational level challenges for successful and efficient operation of eCall. Silent calls may be false eCall or real emergency calls in which the vehicle occupant is not able to talk or has left the vehicle. The validation of silent eCall has been discussed in one of the presentations given in the 2nd International HeERO conference (Verlinden 2013). In case of a silent call, background noise which can be heard via the voice connection can support the risk assessment made by the PSAP. Information in the MSD is also important in cases where it is not possible to obtain additional information using the voice connection. Network-based positioning, which is available for all E112 emergency calls, can also be used to validate the coordinates included in the MSD. In any case, handling of silent calls should be taken into account when developing call handling procedures at member state level.

Silent eCall may also be **false calls** (challenge 3.3, Table 3) or vice versa. False calls may be either deliberate or unintentional, and they may be generated either by a human user or by the IVS. It is possible to reduce the number of false eCall by designing appropriate user interface for the manual activation function and designing correctly the automatic activation
feature. This can be facilitated by providing development guidelines for the IVS – especially for the automatic and manual triggering features. Development of a certification scheme for the IVS will also contribute to solving this challenge. Educating car users on the operation and correct use of eCall (Chapters 5.16.10 and 5.14.6) will have an important role as a tool for reducing the number of false manual calls. Some HeERO countries are also planning to implement plans to validate the incoming calls before they are connected to the PSAP operators for handling (Chapter 5.14.6).

Operational layer of eCall includes also the verbal communication between the PSAP and the vehicle occupants. Communication between the vehicle occupants and the PSAP may be difficult in cases in which the **PSAP has no personnel capable of managing eCall except on their own language** (challenge 3.2, Table 3) and the occupants of the incident vehicle have no knowledge of the language of the member state they are travelling in. The capabilities of the PSAPs to handle calls in different languages have been summarised in (European Commission 2013). Issues with language are common to all 112 emergency calls and therefore not specific to eCall.

However, eCall has certain advantages over an emergency call with voice connection only. First, the PSAP operator can use the information in the MSD even in cases where it is not possible to obtain information using the voice connection. Therefore, eCall would be an improvement to the current situation even in cases where the vehicle occupants and the PSAP have no common language. In conclusion, this is an operational issue related to eCall but not a barrier for deployment.

Appropriate call handling procedures – including also calls in foreign languages – should be defined at member state level. These procedures may include, for example, opening a conference call between the IVS, PSAP and staff speaking the language of the vehicle occupants and utilization of the information included in MSD.

It is also possible that **all the staff working in the PSAP have not been trained how to handle eCall** (challenge 3.6, Table 3) when operation of the eCall is supposed to begin or has already started. The lack of proper training may be a barrier for use of the eCall features in most effective way by the PSAP and therefore reduce the impact to be achieved with eCall. The requirement to provide adequate training for PSAP staff may also delay the introduction of eCall in PSAPs. It is important that training of PSAP staff is included in the national eCall deployment plan or national eCall implementation roadmap (Öörni et al 2013). Temporary arrangements for receiving and processing for eCall may also be used in the beginning when all PSAPs do not have the means required to support eCall such as trained
staff and suitable equipment. For example, this may include routing all eCall to one PSAP having the staff with appropriate training for processing eCall.

The deployment of eCall in the PSAP may also be affected by other organisational or technical changes being made in PSAP simultaneously with eCall deployment (challenge 3.1, Table 3). For example in the Finnish case, the whole information system of the PSAPs is being replaced, and eCall is only a small part of a larger ICT project being carried out. This means that it will be more difficult to control the schedule in which the deployment of eCall will take place in PSAPs. Other changes made to the ICT system and organisation of the PSAP simultaneously with eCall deployment may result in unanticipated delays. However, they are not expected to be a long-term barrier for eCall deployment.

Temporary arrangements for receiving and processing eCall may be required in member states which are making major organisational or technical changes to PSAPs simultaneously with deployment of eCall. For example, routing all eCall to one PSAP equipped with eCall may be required. For member states having this challenge, it is even more important to have a well-documented and communicated national eCall implementation plan or a national eCall implementation roadmap because of increased need for planning of deployment and management of changes in the ICT infrastructure used by PSAPs.

The implementation of eCall in PSAPs and mobile networks will require a call routing plan which will be used to route manual and automatic eCall (challenge 3.4, Table 3) to correct places. Planning the routing of calls is related to the operation model of the PSAPs being applied and the characteristics of mobile and fixed line networks. It is also an integral part of planning the deployment of eCall and related to the overall approach chosen for routing 112 emergency calls. Therefore, it is not expected to be a major barrier for deployment of eCall.

One of the challenges encountered during HeERO tests were planned software updates in mobile network which interfered HeERO tests (challenge 3.5, Table 3). This problem was related with HeERO tests, and it is not expected to affect the normal operation of eCall.

### 6.4 User Layer

Three challenges on the user layer were identified for the deployment of eCall: possibility that consumers or the media confuse eCall with other in-vehicle emergency call services (challenge 5.1, Table 3), misuse of eCall (challenge 5.2, Table 3) and users’ concerns of
privacy violations and risk of supervision and tracking of individual vehicles (challenge 5.3, Table 3).

Educating the car users on the functionality and correct use of eCall has an important role in solving these challenges. Public awareness campaigns to communicate eCall to car users have been discussed by the EeIP task force CAMP (for descriptions of EeIP task forces, see Chapter 5.4). The public awareness campaigns (Chapter 5.14.6) will likely be organised by member states with the support of the EeIP and EC.

### 6.5 Technical/Technological Layer

Several of the HeERO pilot sites reported weaknesses in IVS implementation (challenge 4.2, Table 3). They are a group of limitations of IVS used by the pilot sites and deficiencies in their implementation which have been identified and reported by the pilot sites. They have been summarised in detail in Table 4.

<table>
<thead>
<tr>
<th>Weaknesses in IVS implementation</th>
<th>Pilot site(s)</th>
<th>Solved?</th>
</tr>
</thead>
<tbody>
<tr>
<td>IVS sent only predefined MSD content</td>
<td>CR, IT</td>
<td>yes</td>
</tr>
<tr>
<td>Unnamed issues with IVS</td>
<td>CR</td>
<td>yes</td>
</tr>
<tr>
<td>IVS stability (IVS freezes unexpectedly)</td>
<td>CZ</td>
<td>yes</td>
</tr>
<tr>
<td>Audio quality</td>
<td>CZ</td>
<td>?</td>
</tr>
<tr>
<td>MSD content not updated between MSD messages</td>
<td>CZ</td>
<td>yes</td>
</tr>
<tr>
<td>Problems with eCall status visualisation</td>
<td>CZ</td>
<td>yes</td>
</tr>
<tr>
<td>GPS receiver stability (GPS freezes)</td>
<td>CZ</td>
<td>yes</td>
</tr>
<tr>
<td>Incorrect values in the field of N-1 and N-2 position</td>
<td>CZ</td>
<td>yes</td>
</tr>
<tr>
<td>Problems with increment of message identifier field in MSD and position update in case of MSD retransmission</td>
<td>CZ, RO</td>
<td>CZ: still in discussion</td>
</tr>
<tr>
<td>Wrong value of timer T6 (2 s instead of 5 s mentioned in EN16062)</td>
<td>FI</td>
<td>yes</td>
</tr>
<tr>
<td>IVS erroneously quits MSD transmission without any of the timers expiring when synchronisation with PSAP is lost</td>
<td>FI</td>
<td>no modem firmware update yet</td>
</tr>
<tr>
<td>All IVS functionalities not supported from the beginning</td>
<td>CR, IT</td>
<td>related to piloting</td>
</tr>
<tr>
<td>Inconsistencies in encoding of the MSD</td>
<td>FI</td>
<td>yes</td>
</tr>
<tr>
<td>Problems with VIN number</td>
<td>IT</td>
<td>yes</td>
</tr>
<tr>
<td>No eCall flag implemented by the IVS</td>
<td>IT</td>
<td>yes</td>
</tr>
<tr>
<td>Callback from PSAP to IVS not supported when IVS calls from a network not the native home of the SIM</td>
<td>RO</td>
<td>to be solved with national roaming</td>
</tr>
<tr>
<td>IVS has difficulties with call setup in areas with low mobile network signal strength</td>
<td>RO</td>
<td>update of standards necessary?</td>
</tr>
<tr>
<td>No call-back from PSAP to IVS possible, if original call terminated with cleardown</td>
<td>RO</td>
<td>?</td>
</tr>
</tbody>
</table>

**Table 4. Weaknesses in IVS implementations reported by pilot sites**

It can be seen from Table 4 that many of the weaknesses in IVS implementation have already been solved. However, some of them are still being discussed or have been identified but not corrected within the timeframe of HeERO.

Development of certification schemes for the IVS and the components providing the in-band modem functionality will likely be at least a partial solution to the weaknesses of IVS implementation summarized in Table 4. For example, an IVS or a chipset not providing the...
features of eCall or having a clearly incorrect implementation will not pass the certification procedure (Chapter 5.14.6).

In addition to certification, there are other activities which will increase the probability that weaknesses of an IVS will be identified and solved until the IVS appears on consumer market. First, eCall interoperability events offer a platform for testing the interoperability of the IVS prototypes and PSAP, if the events are continued after 2012 and 2013. Second, tests to be carried at member state level to ensure correct functioning and reliable operation of eCall service chain may reveal weaknesses in the available IVS models even though the focus of these tests is not necessarily verifying the functionality of the IVS.

The causes of some of the identified weaknesses should be analysed further – for example the problems with call-back encountered in Romania may be related to the IVS or the national implementation of eCall in mobile networks and PSAPs (Chapter 5.17).

**Problems with mobile network coverage or signal strength** (challenge 4.3, Table 3) were reported by three pilot sites (Table 3) as a challenge for eCall deployment. The coverage of mobile networks and the quality of signal is a factor which will affect the ordinary 112 emergency calls in addition to eCall. The coverage the mobile network operators are expected to maintain is subject to national regulations and telecom policy.

Member states should monitor the service quality of E112 emergency calls; analyse the status of national regulations concerning the coverage of the mobile networks and handling of 112 calls, and implement changes to national regulations if necessary.

Three of the pilot sites (CZ, FI and GR) reported **false eCall generated by mobile phones which erroneously activate the eCall flag** (challenge 4.8, Table 3). However, these false calls are not expected to significantly increase the workload of PSAPs. Documenting the erroneous operation of the mobile phones and contacting the manufacturers will likely contribute to solving this problem.

**The voice channel blocking time has been longer than expected until the HeERO project and MSD transmission times longer than the target value for eCall at some pilot sites** (challenges 4.9 and 4.10, Table 3). However, no detailed analysis has been carried out for the difference. The reason for the difference should be further investigated to identify solutions which would shorten the voice channel blocking time. First, the use of network echo canceller disabling tone may contribute positively to solving this challenge. Second, the possibilities to optimise the acknowledgement mechanism used with the MSD transmission should be analysed further (Chapter 5.19).
The results achieved by the pilot sites have showed that the MSD transmission is not always successful (challenge 4.19, Table 3). This challenge has also been raised by some of the pilot sites although with different wording. The results suggest that differences in IVS and PSAP implementations and fixed-line and mobile networks have contributed to the differences between pilot sites and measurement sets within the same pilot site. It is also a fact that the IVSs and PSAPs used in HeERO were prototypes.

In case of a failed MSD transmission, the PSAP can either use the voice connection to communicate with vehicle occupants or initiate a MSD retransmission. The correlation of the outcomes of individual MSD transmissions within the same call should be analysed further (Chapter 5.19). This would support the use of the MSD retransmission feature in case the first MSD transmission in the beginning of the call fails.

The possibility that a certain percentage of MSD transmissions fails has to be taken into account in operation of eCall and related guidelines such as instructions for call handling at PSAPs. For example, the PSAP may be instructed to use the voice connection to obtain information from the vehicle or to initiate a MSD retransmission (Chapter 5.19).

The HeERO project included no detailed analysis of the causes which contributed to failed MSD transmissions. However, there are reasons which are considered likely. First, the weaknesses of IVS implementations can be addressed by developing a certification scheme for the IVS and the in-band modem components. Second, problems related to mobile and fixed line communication networks and PSAPs can be identified by performing eCall end-to-end tests on member state level to ensure correct functioning and reliable operation of eCall.

The factors contributing to the MSD success rate should be further investigated to provide recommendations how to increase the reliability of eCall MSD transmission. Frequently reported cases with MSD transmission or MSD transmissions may reduce users’ trust on the service. Failed MSD transmission also prevents the PSAP from obtaining the information included in the MSD or forces it to initiate a MSD retransmission.

The fact that the MSD transmission is not always successful is related to the observation that there are differences between the performances of IVS even if the IVS conform to standards (challenge 4.12, Table 3). This was an observation of the Dutch pilot site. Most IVSs used in HeERO were prototypes. Therefore, it is likely that the weaknesses of IVS prototypes have contributed to this outcome, and the enablers are also the same as in case of weaknesses of IVS implementation or the MSD transmission not being always successful.
The network based echo cancellers based in mobile networks have been suspected to have an adverse effect on MSD transmission (challenge 4.7, Table 3). One of the pilot sites has also reported that some IVS devices do not synchronize in PUSH mode during the initiation phase, probably due to the echo cancellers (Chapter 5.14.5). Their contribution of network based echo cancellers based in mobile networks to MSD transmission failures should be investigated further (Chapters 5.11 and 5.18.6) and the impact of the network echo canceller tone measured.

Although MSD transmission of eCall is expected to be reliable, there are no guidelines or target values for MSD success rate acceptable for eCall (challenge 4.18, Table 3). This means that there are no unambiguous criteria for the MSD success rate which should be considered acceptable or unacceptable. Setting a target value to be used as a guideline for eCall implementation in member states should be considered (Chapter 5.19). In general, development of guidelines on the service quality acceptable for eCall service should be considered.

The unavailability of IVS prototypes in the beginning of the HeERO project (challenge 4.1, Table 3) and even later in the project (Miettinen-Bellevergue 2013) was a challenge experienced by some of the pilot sites such as Croatia and Finland. However, the lack of IVS prototypes suitable for testing can be expected to be a less significant problem in future because the number of IVS suppliers has increased since the first eCall test-fest. This challenge is not expected to be a barrier for deployment of eCall.

One of the HeERO pilot sites has reported increased duration of MSD transmission and call setup when testing with a moving vehicle (challenge 4.5, Table 3) instead of a vehicle standing still. It is possible that MSD transmission times are generally longer for a moving vehicle than a stationary one although the evidence on the subject is not fully conclusive (Öörni and Korhonen 2013). In cases where eCall is activated in the incident vehicle this challenge is less relevant because the incident vehicle is likely not moving when the MSD is being transmitted. The enablers or solutions related to shortening MSD transmission time in general are relevant also for solving this challenge.

The MSD standard EN15722 has been reported to have minor inaccuracies (challenge 4.11, Table 3). An annex of the standard provides an example of MSD decoding according to the standard. This example has some decoded MSD fields which do not match the values in the encoded MSD and are not possible according to the ASN.1 specification of the MSD. The incorrect example in the annex of the standard may confuse developers working with IVS or PSAP and may prevent them from using effectively the example. The inaccuracies have
been discussed in the HeERO standardization task force and brought to the attention of CEN. In case the standard cannot be immediately updated, adding errata to the document or otherwise informing the users of the standard should be considered.

One of the technical level challenges raised is the **long time needed for network registration and call setup when IVS is activated in dormant mode which possibly may have an impact on the number of silent calls received by the PSAP** (challenge 4.16, Table 3). The time for call establishment (KPI_008) has been measured by several pilot sites during the second round of HeERO tests. For example, the median for KPI_008 was around 6 seconds or less in several test sets measured in Croatia (Hentschinski 2013). On the other hand, considerably longer times have been reported in Italy (14.9 s) and Romania (9–10 s) (Hentschinski 2013). It should be noted that call setup times measured for 112 emergency calls by member states are typically between 0.6–7 s (European Commission). However, these times have been measured using criteria different from HeERO.

EN16062 states that the IVS “shall periodically scan and maintain a list of available PLMNs” when in an inactive state to reduce the network registration and call setup time (EN16062, Chapter 7.1.6). This functionality has to be implemented correctly to ensure that the network registration and call setup time is as short as possible. Finally, the car users should be educated on the functionality and correct use of eCall – including the possibility that establishing a connection to PSAP takes typically a few seconds and sometimes a longer time.

One of the pilot sites has reported that making a **repeated MSD update request during the call has not been possible** (challenge 4.6, Table 3). This challenge is most likely related to an individual PSAP or IVS implementation. Certification of the IVS and the components used to implement the in-band modem will likely contribute to solving the weaknesses in IVS implementations.

The report of the Romanian pilot site has also highlighted that **an eCall may end up as a “silent call” with no voice connection if the eCall flag has not been implemented** (challenge 4.13, Table 3). It is somewhat unclear whether this is an issue related to the PSAP implementation or some national arrangements in call routing in Romania or whether similar problems are possible also in other member states implementing eCall. The causes of the problem should be investigated to find out whether the problem is specific to a single PSAP implementation (Chapter 5.17).
One of the pilot sites (Sweden) has reported on some public land mobile networks (PLMNs) possibly having problems with handling the long numbers of the SIM cards used by the IVS (challenge 4.15, Table 3). This issue has been raised by the Swedish pilot site but the problem has not been documented in detail or demonstrated with empirical tests.

Both the old GSM core specification GSM 03.03 and the current corresponding specification ETSI TS 123 003 state that the MSISDN (mobile phone number of the mobile subscriber) will be allocated on the basis of ITU recommendation ITU E.164 and that the length if IMSI (international mobile subscriber identity) is 15 digits.

According to the information provided by the Swedish pilot site, this is not a problem specific to eCall, but a problem with implementation of the standards for mobile networks. In Sweden, this problem was fixed with a software update of the elements of mobile network. At present, it is difficult to estimate the consequences of the problem or the number of networks affected in the absence of more detailed information. However, it is likely that a software update of mobile networks will solve the problem also outside Sweden.

**Time synchronisation between IVS and PSAP was required to calculate several of the HeERO key performance indicators (KPIs)** (challenge 4.4, Table 3). This was one of the challenges encountered in piloting and measuring the KPIs, but it is not expected to have any impact on the deployment of eCall because the operation of the eCall is not dependent on the precise synchronisation of clocks between the PSAP and the IVS.

**Satellite based positioning techniques do not function properly in tunnels** (challenge 4.17, Table 3). This problem applies to tunnels but also other built-in spaces in which there is no line of sight to satellites – for example, underground parking garages. To some extent, the lack of positioning data provided by the IVS can be mitigated by use of network based positioning which is an essential part of the E112. There are also other solutions like pseudolites which provide signal similar to the GNSS satellites (Cobb 1997) and combining position obtained from GNSS with dead-reckoning (Favey et al. 2011).

### 6.6 Overview of enablers and challenges

The following table (Table 5) provides an overview of the enablers and challenges previously reported.
<table>
<thead>
<tr>
<th>Identified Challenge</th>
<th>Identified Enablers and solutions</th>
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<tbody>
<tr>
<td>1.1: Challenges in gathering full support from all stakeholders (PSAP, MNO, etc.) due to lack of legislative framework or legally binding decision to implement eCall at member state level</td>
<td>- Completion of European level regulation which mandates implementation of eCall in PSAPs, communication networks and new type-approved vehicles</td>
</tr>
<tr>
<td>1.2: Stakeholders may understand standards in a different way (for example, ETSI/3GPP standards could have more clearly marked references to timers mentioned in Annex A of EN16062)</td>
<td>- Include references to CEN standards in the ETSI/3GPP standards, when necessary</td>
</tr>
</tbody>
</table>
| 1.3: Difficulties in assigning responsibility for eCall in a complex administrative situation | - Increasing awareness of stakeholders on member state level on the options available for implementation of eCall and the related benefits and costs  
- Completion of European level regulation which mandates implementation of eCall in PSAPs, communication networks and new type-approved vehicles  
Note: solutions will likely be specific to individual member states due to differences in legal framework and roles of stakeholders. |
| 1.4: Retrofit IVS will require a legal framework | - Provide development guidelines for retrofit IVS products; this could be a task of the EeIP task force "RETRO"  
- Monitor the status of retrofit IVS products and consider actions, if significant challenges or risks are encountered  
- Continue development of IVS certification scheme in HeERO2 |
| 1.5: eCall standards provide only few guidelines for developing the human machine interface of the IVS. | - Provide development guidelines for retrofit IVS products; this could be a task of the EeIP task force "RETRO"  
- Monitor the status of retrofit IVS products and consider regulatory actions, if significant challenges or risks are encountered |
| 2.1: Limitations in scope of eCall tests (no eCall flag or real PSAP) | - Perform eCall end-to-end tests on member state level to ensure correct functioning and reliable operation of eCall  
- Take limitations into account when interpreting the results of the pilot sites |
| 2.2: Lack of commitment of IVS developers due to perceived lack of business case (waiting for a clear decision or government subsidies) | - Completion of European level regulation which mandates implementation of eCall in PSAPs, communication networks and new type-approved vehicles |
| 2.3: Current standards do not mandate the IVS to support 3G networks | - Further research and related road-mapping work on the long-term evolution of eCall including analysis of options available to manage the lifecycles of vehicles and wireless communication networks  
- Cooperation of stakeholders in the context of EeIP  
- Standardisation taking into account the work carried out by ETSI STF 456 and IETF working group ECRIT |
|---|---|
| 2.4: Implementation of eCall affecting several players is a difficult organisational issue | - Identification of a key stakeholder which monitors and possibly also coordinates the overall process towards eCall deployment and formally or informally takes responsibility for solving problems and keeping the process moving  
- The roles of different stakeholders should be clearly defined; this can be achieved with a national eCall roadmap or an implementation plan  
- Increasing awareness of stakeholders on member state level on the options available for implementation of eCall and the related benefits and costs |
| 2.5: Different competences of different players | - Mutual cooperation and technical support between stakeholders within a member state  
- The roles of different stakeholders should be clearly defined; this can be achieved with a national eCall roadmap or an implementation plan |
| 2.6: Insufficient awareness of stakeholders (decision-makers) on eCall | - Dissemination activities of HeERO projects, EeIP and iMobility Challenge  
- Organisation of round table discussions and working groups on member state level  
- Creating and publishing a national eCall implementation roadmap or implementation plan  
- Dissemination of information on the impacts of eCall (http://www.imobility-effects-database.org) |
| 2.7: PSAPs in a member state have very different technical infrastructure | - Analysis of the architectural and deployment options available building on the experiences from HeERO and HeERO2 projects  
- Centralisation of reception and handling of eCall to a few key PSAPs – at least as an interim solution  
- Development of a national eCall roadmap or a national eCall implementation plan |
### 2.8: HeERO pilot sites and HeERO partners dependent on resources or technical support from outside the consortium

Note: this challenge is mostly related to piloting and is expected to be less important when the actual deployment of eCall is taking place because of the direct involvement of PSAPs and MNOs. This challenge was specific to HeERO project and overlapping with other challenges identified. Therefore, it is covered by summaries of other challenges and related enablers.

### 2.9: Consequences of eCall for third party services are unknown

- Member states may decide to support TPS-eCall in their PSAPs using the interfaces defined in EN16102.

Note: Third party services are typically offered as a part of a larger service package. Pan-European eCall is not a direct substitute for the third party services already on the market, and the fleet penetration of third party services in new vehicles is relatively small. This suggests that the impact of pan-European eCall on the existing private services would be limited on the European level.

### 2.10: Availability of conformance test specification

- Development of CEN TS 16454 into an European Standard

### 2.11: Performance and reliability of eCall are lower in rural areas than in urban areas

- Perform eCall end-to-end tests on member state level to ensure correct functioning and reliable operation of eCall
- Analyse the impact of the network echo canceller disabling tone on the reliability of MSD transmission and implement NEC disabling tone in PSAPs, if clear improvement can be observed
- Analyse the reliability of eCall on member state level and the factors contributing to it. Implement necessary changes to the communication networks or to the PSAP (for example, changes to codecs used or transcoding between codecs along the call path from IVS to PSAP)
- Monitor the service quality of E112 emergency calls; analyse the status of national regulations concerning the coverage of the mobile networks and handling of 112 calls, and implement changes if necessary

### 2.12: There is currently no way to check the functionality of the IVS except making a false eCall. The final version of the proposal for PTI of the IVS is not yet available

- Continue the work of the PTI task force of the EeIP
- Implementation of the self-test feature of the IVS; this is mandated in Chapter 7.1.5 of EN16062: “On power up, the IVS shall normally perform a self-test without attempting to connect to the network…”
- Implement changes to standards of eCall, if required
<table>
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<tr>
<th>Section</th>
<th>Description</th>
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<tr>
<td>2.13:</td>
<td>PSAPs in member states need updates which may be difficult to complete until 1st October 2015</td>
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</table>
| - Temporary arrangements may be used to have eCall available in a situation in which all PSAPs have not been updated yet (for example, routing all eCall to one PSAP equipped with eCall)  
- The schedule of deployment and the actions required should be defined in a national eCall roadmap or an implementation plan  
- Increasing awareness of stakeholders on member state level on the options available for implementation of eCall and the related benefits and costs  
- Results for HeERO and HeERO2 projects will support deployment of eCall in shortest possible time  
- Monitoring of eCall deployment based on the European ITS directive |
| 2.14: Limitations of interoperability tests (remote tests are not equivalent to local tests) | - Interoperability tests can be integrated with eCall end-to-end tests to be performed by member state level  
- Effective sharing and publication of the results of the interoperability tests to be carried out after HeERO and HeERO2 projects – for example in the context of the EeIP or international eCall conferences to be organised  
- Continue eCall testfest activities to provide platform for interoperability testing |
| 2.15: | It is not fully clear who will purchase and install the SIM card to the IVS |
| - Definition of a certification procedure of eCall IVS and finalising vehicle type-approval requirements  
- Analyse the availability of dormant SIM cards and then decide on the actions necessary |
| 3.1: | Organisational or technical changes in PSAP simultaneously with eCall deployment |
| - Temporary arrangements may be used to have eCall available in a situation in which all PSAPs have not been updated yet (for example, routing all eCall to one PSAP equipped with eCall)  
- The schedule of deployment and the actions required should be defined in a national eCall roadmap or an implementation plan |
| 3.2: | PSAPs do not have personnel resources to manage eCall in other languages |
| - Appropriate call handling procedures should be defined at member state level (for example, opening a conference call between the IVS, PSAP and staff speaking the language of the vehicle occupants and use of information in the MSD)  
- Information included in the MSD is available even in cases in which it is not possible to obtain additional information from the vehicle occupants |
| 3.3: Possible false alarms from eCall enabled vehicles | - Development of certification scheme for eCall IVS  
- Provision of development guidelines for IVS – especially for the automatic and manual triggering features  
- Education of car users on the operation and correct use of eCall  
- Validation of incoming calls before connecting them to a PSAP operator |
| 3.4: Call routing plan is required to route manual and automatic eCall to correct places | - Define call routing in a national eCall implementation roadmap or eCall implementation plan |
| 3.5: Planned software update in the mobile network interfered with HeERO tests | Note: this challenge is related to HeERO tests but is not expected to affect the actual operation of eCall |
| 3.6: All the staff in PSAPs have not been trained to handle eCall | - Training of PSAP staff  
- Temporary arrangements may be used to have eCall available in a situation in which all PSAPs have not been updated yet (for example, routing all eCall to one PSAP with trained staff) |
| 3.7: Silent calls | - Appropriate call handling procedures to be defined at member state level  
- Use of information available via voice connection (background noise etc.)  
- Utilisation of information available in MSD  
- Use of network based positioning to validate location of the caller (available for all E112 calls) |
| 3.8: Operational questions in call handling (noise, silent calls, queuing of calls, answering and eCall with failed MSD transmission etc.) | - Appropriate call handling procedures to be defined at member state level (use the guidelines from EeIP and results of the HeERO and HeERO2 projects) |
| 4.1: Unavailability of IVS prototypes in the beginning of the HeERO pilot | Note: this challenge is not expected to be relevant in current situation with many IVS prototypes available. |
| 4.2: Weaknesses in IVS implementation | - Development of certification scheme for eCall IVS  
- Development of certification scheme for the components implementing the eCall in-band modem  
- Continuation of the eCall test-fest events  
- Further analysis of the weaknesses identified but not analysed in detail in HeERO project  
- Perform eCall end-to-end tests on member state level to ensure correct functioning and reliable operation of eCall |
<p>| 4.3: Problems with mobile network coverage or signal strength | - Monitor the service quality of E112 emergency calls; analyse the status of national regulations concerning the coverage of the mobile networks and handling of 112 calls, and implement changes if necessary |</p>
<table>
<thead>
<tr>
<th>Challenge</th>
<th>Description</th>
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| 4.4: Time synchronisation between IVS and PSAP is required to calculate several HeERO KPIs | - Synchronisation of PSAP clock using NTP (network time protocol), GPS or some other means to an accurate time reference  
Note: this challenge is related to calculation of HeERO KPIs but not to the operation of eCall |
| 4.5: Increased duration of MSD transmission and call setup when testing with a moving vehicle | - See challenge 4.10 |
| 4.6: Repeated MSD update request by PSAP not possible | - Further analysis of the scope of the problem and corrective actions if necessary  
- Development of a certification scheme for eCall IVS and the in-band modem components  
Note: this challenge is likely related to an individual IVS or PSAP implementation |
| 4.7: Mobile network echo cancellers have an adverse effect on MSD transmission | - Analyse the impact of the network echo canceller disabling tone on the reliability of MSD transmission and implement NEC disabling tone in PSAPs, if clear improvement can be observed |
| 4.8: False eCall generated by mobile phones which erroneously activate eCall flag | - Documentation of the erroneous operation of the mobile phones affected by the problem and contacting the equipment manufacturers |
| 4.9: Voice channel blocking time longer than expected | see challenge 4.10 |
| 4.10: MSD transmission times have been longer than the target value for eCall at least at some pilot sites | - Study the possibilities to reduce voice channel blocking time by optimising the acknowledgement mechanism of eCall MSD transmission  
- Analyse the reason for the difference in the results measured in laboratory environment and results measured in real-life networks  
- Analyse the impact of the network echo canceller disabling tone on the reliability of MSD transmission and implement NEC disabling tone in PSAPs, if clear improvement can be observed |
| 4.11: Inaccuracies in the MSD standard (EN15722) | - Update the annex A of EN15722 or add an errata to the standard |
| 4.12: Differences between performance of IVS even if IVS conform to standards | see challenge 4.19 |
| 4.13: eCall may end up as a “silent call” with no voice connection, if eCall flag not implemented | - Further analysis of the scope of the problem and corrective actions if necessary |
| 4.14: Lower than expected robustness of in-band modem | see challenge 4.19 |
| 4.15: Some PLMNs may have problems in handling long numbers of the SIM cards of the IVS | - Software update of mobile network elements will likely solve the problem  
Note: this is a problem with implementation of the standards of mobile networks and not specific to eCall |
|---|---|
| 4.16: Long time needed for network registration and call setup when IVS activated in dormant mode; possibly has an impact on the number of silent calls | - When in inactive state, the IVS "shall periodically scan and maintain a list of available PLMNs" to reduce the network registration and call setup time (EN16062, Chapter 7.1.6)  
- Educate car users on the functionality and correct use of eCall |
| 4.17: Satellite based positioning techniques do not function properly in tunnels | - Use of pseudolites in tunnels and in other underground spaces  
- Dead-reckoning combined with GNSS  
- Use of network based positioning of E112 emergency calls |
| 4.18: There are no guidelines or target values for MSD success rate acceptable for eCall | - Development of guidelines on the service quality acceptable for eCall service |
| 4.19: MSD transmission is not always successful | - PSAP initiates a retransmission of the MSD in case the first transmission is not successful  
- PSAP uses the voice connection to communicate with vehicle occupants  
- Possibility that the MSD transmission fails should be taken into account in operation of eCall and related guidelines  
- Further analysis on correlation of the outcomes of individual MSD transmissions during the same call should be carried out  
- Development of certification scheme for eCall IVS  
- Development of certification scheme for the components implementing the eCall in-band modem  
- Perform eCall end-to-end tests on member state level to ensure correct functioning and reliable operation of eCall  
- Further analysis of the factors which contributed to MSD success rate in the HeERO pilots should be carried out to increase the reliability of MSD transmission |
| 5.1: Consumers or the media confuse eCall with other in-vehicle emergency call services | - Educate car users on the functionality and correct use of eCall; public awareness campaigns organised by member states with support of EC and EeIP |
| 5.2: Misuse of eCall | - Educate car users on the functionality and correct use of eCall; public awareness campaigns organised by member states with support of EC and EeIP |
| 5.3: Users’ concerns of privacy violations and risk of supervision and tracking of individual vehicles | - Educate car users on the functionality and correct use of eCall; public awareness campaigns organised by member states with support of EC and EeIP |

**Table 5: Overview of enablers, opportunities and challenges**
7 Discussion of results

The approach used in the study is based on systematic identification of challenges identified by the HeERO pilot sites and documented in deliverables of HeERO project and other material. Information on the challenges was collected directly from pilot sites and with a literature study focusing on earlier deliverables of HeERO and other material related to eCall. Therefore, it is likely that the most important challenges related to the implementation and operation of eCall have been identified and documented. However, the challenges identified in the report have not been analysed in terms of their likely consequences, impacts on eCall deployment and expected level of criticality. This has to be taken into account when preparing the recommendations for eCall deployment.

The approach used included also identification of the enablers or solutions to the challenges, and mapping of the enablers against the challenges identified. Some of the enablers identified may look like recommendations even though they are not necessarily intended to be interpreted as recommendations at this stage – further analysis and information will be required to produce a set of recommendations for implementation and operation of eCall in Europe. First, the consistency or coherency of the enablers and solutions has to be ensured, and the implementation roadmaps developed by HeERO countries should also be taken into account. Recommendations for implementation and operation of eCall in Europe will be discussed in detail in D6.5 of HeERO.

The approach chosen in the study performed well as a tool to provide a synthesis of the results achieved during the HeERO project. On the other hand, the approach used in this study also had certain limitations. First, it was not practically possible to carry out new measurements at this stage of the HeERO project. Second, detailed theoretical analysis of the test results was not within the scope of WP4 or WP6 of HeERO. For example, in-depth analysis of the factors which contributed to successes or failures of MSD transmission at pilot sites, theoretical analysis of the in-band-modem solution, its potential improvements and the eCall application layer were not possible within the timeframe and resources of HeERO WP6.

It is likely, that more enablers and solutions could have been identified with a combination of in-depth theoretical analysis of the results of HeERO pilots and a carefully selected set of new measurements. Therefore, the list of the potential enablers for eCall deployment and solutions to challenges has to be understood as non-exhaustive.
The deliverable includes research questions which were not anticipated when starting the HeERO project. For example, the MSD transmission times achieved in real-life conditions have been longer than the transmission times expected when planning the HeERO project.

The in-vehicle systems used by the HeERO pilots were mostly prototypes. The results indicate that the prototypes were improved and many of the weaknesses identified were in fact corrected during the project. However, the fact that the IVSs were mostly prototypes has to be taken into account when interpreting the results of the project. It should also be noted that most of the pilot sites have not been using the European emergency number 112. It is possible that the routing of the call as well as the signal processing along the call path would be different for a 112 emergency call and the MSD success rates and MSD transmission times would therefore different.

The MSD transmission times measured in HeERO were longer than the 4 s set as the target value for eCall ETSI TS 122 101 at least at some pilot sites. However, detailed analysis of the causes of transmission times longer than the times measured in laboratory environment was not possible within the information and time available. The relation between the MSD transmission times and user behaviour was not analysed in the study. However, it is likely that it takes more than a few seconds for two average human users to communicate the exact location of the incident using the voice connection in an emergency situation.

8 Conclusions

The deliverable has documented the challenges related to deployment of eCall and provided a non-exhaustive list of enablers and solutions related to the challenges. The challenges and enablers identified in the deliverable can be used as inputs for drafting of guidelines for eCall deployment and preparation of recommendations.

The time and resources available in HeERO WP6 did not allow detailed analysis of all potential enablers to the challenges identified. This is in line with the HeERO work plan and consistent with the fact that HeERO has originally been intended to be a pre-deployment project instead of a research project.

The results indicate that the stakeholders working with the HeERO pilots have been able to solve many of the challenges identified during the project. The tests carried out in HeERO provided important information, prepared ground for deployment of eCall but also had certain
limitations in most HeERO countries. For example, all pilots did not have the opportunity to use the common European emergency number E112, eCall flag, and a real PSAP for testing. In other words, the tests carried out did not include all the components of the real eCall service chain. This means that there is a need to continue the tests on member state level after the closure of the HeERO project to ensure the correct functioning and reliable operation of the whole service chain.

It seems likely that the progress of the European level regulation will have an important role in ensuring the timely deployment of eCall in PSAPs and mobile networks. For example, some public authorities and mobile network operators on member state level may be reluctant to act or commit any resources unless there is a legal obligation to do so.

The study found no evidence of technical challenges which would prevent the eCall from functioning in the EU member states where the national HeERO pilots were implemented. However, close attention should be paid to technical challenges related to the level of service quality and the reliability eCall is expected to provide. eCall is a safety-relevant and safety-critical service, and the expectations for its reliability may be high even though there are no formally set target values or standards for acceptable level of reliability.

Current standards of eCall do not mandate the eCall IVS to support UMTS (3G) or any other mobile network technology introduced after GSM. However, complete shutdown of GSM in Europe or fast reduction in its geographical coverage does not seem likely. In other words, this has no immediate effects on the deployment or operation of eCall. Instead, it is related to the long-term evolution for eCall and other in-vehicle emergency call services.

Further research and related road-mapping work on the long-term evolution of eCall, cooperation between stakeholders in the context of the EeIP and standardisation will likely have important roles achieving an optimal solution. Close attention should be paid to the results of the ETSI specialist task force studying possibilities for implementation of eCall in LTE (4G) networks and the work of IETF working group ECRIT.

The target value for typical MSD transmission time in case of eCall has been set in ETSI TS 122 101. The means of MSD transmission times measured in HeERO were longer than that at least at some pilot sites. It is likely that the voice channel blocking time could be reduced by optimising the acknowledgement mechanism of MSD transmission. Reducing the time required for acknowledgements has the same effect as reducing MSD transmission time: both of them reduce the voice channel blocking time (time between call setup and opening of the voice connection). In-depth analysis is recommended to determine the optimum number
and type of acknowledgements in terms of the reliability of the acknowledgement mechanism, impact on the voice channel blocking time, user aspects and service quality of eCall in general.

The results indicate that the eCall MSD transmission is not always successful. In case the MSD transmission in the beginning of the connection fails, the PSAP may either decide to use the voice connection to obtain information from the vehicle occupants or decide to request a MSD retransmission as defined in EN16062. The correlation of the outcomes between successive MSD transmissions during the same call has not been analysed in HeERO. The correlation between the outcomes of successive MSD transmissions and the reliability of MSD transmission mechanism including the use of retransmission should be analysed using statistical techniques.
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