EENA NG112 Technical Committee Document

Handset Derived Location for Emergency Calls

Title:	Handset Derived Location for Emergency Calls
Version:	1.0
Code:	Handset_Derived_Location
Revision Date:	15-04-2015
Status of the document:	Draft For comments **Approved**

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1 Executive Summary

The scope of this document is:

a. Evaluation of the capability of GNSS, WiFi and other handset location technologies for emergency communications. Short term and long term solutions are evaluated and recommended (Refer to EENA Case Study on AML).

b. Specify if new legislation is needed. Considers Privacy / Data protection and security issues.

c. Recommend architecture (short/long term) for transporting the handset derived location to the PSAP.

2 Introduction

Emergency caller location is vital to PSAPs and first responders.

In recent years, emergency caller location information in Europe for mobile phones has been typically cell-id. Often, cell-id is inadequate because the cell radius is too large.

Developments in location technologies and the proliferation of smartphones are leading to improved location information being available in the handset. Making such handset derived location information available to PSAPs during emergency communications in a secure and reliable manner is highly desirable [5].

3 List of abbreviation

GNSS	Global Navigation Satellite System
AML	Advanced Mobile Location
PSAP	Public Safety Answering Point
A-GNSS	Assisted GNSS
OTDOA	Observed Time Difference Of Arrival
GPS	Global Positioning System
FCC	US Federal Communications Commission
3GPP	Third Generation Partnership Project
ATIS	Alliance for Telecommunications Industry Solutions
SDO	Standardisation Organisation

4 Evaluation of handset based location technologies

A wider description of GNSS, A-GNSS, OTDOA, WiFi and indoor location technologies is contained in Annex B.

GNSS is the collective term for satellite based positioning systems including GPS, GLONASS (Russia) and Galileo (EU). The number of GNSS enabled smartphones connected in Europe in 2014 is estimated to be 426 million [4] (the European population is about 507.4 million persons [9]). The European Galileo system is expected to be partially operational with 4 satellites in 2015 and fully operational with 24 satellites in 2020.

GPS is deployed on most smartphones, which are becoming ubiquitous. GPS typically provides a location accuracy which is sufficient for emergency responders to find the emergency caller in outdoor environments.

The European Geostationary Navigation Overlay Service (EGNOS) is an operational satellite based augmentation system. It can sometimes improve accuracy by sending correction information to users via satellite or terrestrial links.

Assisted GNSS (A-GNSS) improves accuracy, time to first fix, and indoor performance with respect to stand-alone GNSS, making A-GNSS more suitable for emergency caller location than GNSS. A-GNSS is often implemented in handsets but not enabled by default. Further, A-GNSS may not be supported in the mobile network. Support of A-GNSS in mobile networks is recommended by CEPT ECC Report 225 [1].

Indoor location techniques are emerging and likely to be implemented in smartphones in the future. Indoor location may be achieved by augmentation of GNSS and A-GNSS with WiFi and/or other terrestrial based technologies such as Observed Time Difference Of Arrival (OTDOA). In the USA, the FCC has mandated support for more accurate indoor location for 911 calls including requiring improvements in horizontal and, at a later date, vertical location accuracy and use of dispatchable (civic) location. It is likely that this will lead to standardisation work in 3GPP – e.g. a work item to add new requirements has been agreed by 3GPP SA1 and ATIS is looking into necessary standards changes in both 3GPP and other SDOs. Furthermore, 3GPP RAN is currently engaged in a study item to evaluate the performance of existing and new positioning technologies that may support accurate indoor location and it is expected that either existing 3GPP standards will be shown to be adequate or enhancements to the existing standards will occur to support improvements.

It is also likely that there will be a trend towards accurate indoor location in smartphones for support of commercial applications. This will occur with or without new EU legislation for emergency caller location.

The European Commission is considering a requirement for mobile phones, and perhaps other portable devices such as tablets, to be equipped with Galileo receivers that would automatically send location data as part of any emergency call to 112. [2]. This would have the effect of ensuring the minimum accuracy and performance which can be achieved by GALILEO and EGNOS. Some accuracy and performance regulatory requirements, which would unfortunately probably be at national and not European level, may be useful to set a benchmark for implementations and may be enforceable by type approval. EENA would prefer to see pan-EU accuracy targets enforced by the Member States.

It should be pointed out that high accuracy in an outdoor environment can typically be achieved using any fully deployed GNSS system and can be improved by combining two or more GNSS systems (e.g. GPS + Galileo) as has been shown in a study by 3GPP [TS36.171]. Therefore, any performance requirements may best be used agnostically to verify performance using all available GNSS systems, including but not limited to GALILEO and EGNOS. In fact, performance requirements linked to a single GNSS system may understate what is possible using multiple systems leading possibly to poorer PSAP and user experience if too rigidly deployed.

5 Legislation / regulatory domain

5.1 General

There are currently no EU regulatory requirements for emergency caller location accuracy. Since the CGALIES report in 2002, emergency caller location in Europe has effectively been on a best effort basis and is typically cell-id. In some other regions, there are legal accuracy requirements (e.g. USA).

The revised Universal Services Directive 2009/136/EC states that competent regulatory authorities [in Member States] shall lay down criteria for the accuracy and reliability of the caller location information. The aforementioned is still awaited.

National legislation on emergency caller location accuracy may result from the Universal Service Directive, 2009/EC/136. If introduced at national level, it should not vary from country to country.

There are currently no regulatory requirements for specific location technologies (i.e. GALILEO) in handsets although it is likely to be forthcoming.

5.2 Applicable legislation

EU legislation pertaining to emergency communications is listed in Annex A.

5.3 Privacy and security

By means of appropriate legislation, emergency caller location shall not be permitted to be linked to any tracking application and, therefore, privacy risk will be low.

Storage of caller location at the time of the emergency call in the PSAP would continue to be in accordance with the PSAPs operating policy.

Permanent storage of caller location at the time of the emergency call in the handset is not required. If stored permanently there may be a privacy issue because the handset's precise location at a given time could be retrieved, although this could be protected by a PIN.

If there is no location information at the time of the 112 call, e.g. because the caller is in a basement or tunnel, then it would be useful to send the last known location along with an uncertainty marker. This would require ongoing temporary storage of location, but it could be ring-fenced for 112 use only.

There are cases when it would be useful for a PSAP to be able to "pull" additional location information. For example, this may arise if the PSAP or emergency responders need to know where the caller is at some time after the 112 call or if no location information was initially available (e.g. user in a tunnel or basement) but the user later moves (e.g. if able and if requested by the PSAP).

Suppression or degradation of the location information by the caller during the 112 call should be preventable. Additionally handset battery problems should be also taken into consideration.

Another security risk is spoofing of handset derived emergency call location. However the risk can be mitigated by checking handset derived location against cell-id at the PSAP.

6 Transport of location data

Transport of emergency caller location data is being studied in ETSI EMTEL. IMS emergency call and IMS Multimedia Emergency Service, with handset derived location sent as data has been identified as a good long term off-the-shelf solution.

The EENA recommended long term (5+ years) transport solution is to use additional data on IMS emergency call according to 3GPP specifications and IETF additional data recommendations [3]. Such a long term solution may also be employed for other types of emergency call when supported using Next Generation technology (e.g. eCall, M2M emergency calls, mHealth emergency calls) which could enable common support by both PSAPs and user devices for most or all types of emergency calls.

Short term methods, which may vary between countries, are:

- Advanced Mobile Location (AML) as deployed in the UK [6].
- Pushing data, during the emergency call, using SMS or over-the-top to a national database which can then be interrogated by the PSAP (as recommended in the EENA 112 Apps document).
- Use eCall infrastructure, i.e. "personal eCall", whereby location is sent in-band using the existing eCall in-band modem.

AML is easy to deploy in countries where there is already a text to 112 service. Text to 112 has been deployed in approximately 16 countries as a service for hearing-impaired people. A disadvantage of AML is that it does not readily support roaming emergency callers because SMS is routed back to the home country and not the local PSAP.

Personal eCall may be suitable in countries where all PSAPs are eCall capable. Further standardisation work would be required for personal eCall but there is an identified migration path for eCall to NG eCall, which is in effect the same as NG112.

If a short term method listed above is deployed then there should be a compatibility plan to IMS emergency call.

7 EENA recommendations

Stakeholders	Actions
All	EENA strongly recommendations that handset derived location is used and that mechanisms to validate the authenticity of the data are put in place.
European Authorities	Mandate of GALILEO and EGNOS on mobile devices is already expected. Promote IMS emergency call long term. Pan EU accuracy and reliability targets (preferably GNSS agnostic)
National Government	Accuracy and reliability legal requirements, if any, should be consistent and enforced.
National / Regional Authorities	If a text to 112 service exists, then deploy Advanced Mobile Location (AML) immediately as in the UK. Otherwise deploy as soon as possible. Alternative short term solutions are national server method or use eCall infrastructure.
Emergency services	At the PSAP verify handset derived location against cell-id.
National telecommunication regulator Network operators	Deploy A-GNSS in mobile networks. Deploy IMS emergency call within 5 years.
Handset manufacturers	Engage with the PSAP community, operators and National Regulators.

8 EENA Requirements

Requirements	
Short term (up to 1 year)	Deployment of an immediate solution such as AML in the UK.
Medium term (2 to 4 years)	Set pan EU targets and ensure all smartphones have the capability to provide handset derived location information in Europe.
Long term (5+ years)	Move to IMS in line with standardisation efforts and guidelines.

9 References

[1] CEPT ECC Report 225, “Establishing Criteria for the Accuracy and Reliability of the Caller Location Information in support of Emergency Services”, 21 October 2014.
http://www.erodocdb.dk/Docs/doc98/official/pdf/ECCREP225.PDF

[2] http://gpsworld.com/europe-weighs-mandate-of-galileo-chips-in-mobile-phones/
[3] Internet Engineering Task Force (IEFT), Additional Data Related to an Emergency Call, 15 December 2014.
https://datatracker.ietf.org/doc/draft-ietf-ecrit-additional-data

[4] Galileo value proposition for emergency caller location (E112), 10 September 2014.
http://ec.europa.eu/DocsRoom/documents/5374/attachments/1/translations/en/renditions/native

[5] 2014 EENA document on Caller Location information
http://www.eena.org/uploads/gallery/files/pdf/2014_11_21_EENA_2_2_2_v2%200_FINAL.pdf

[6] EENA case study on AML.
http://www.eena.org/uploads/gallery/files/operations_documents/2015_02_18_AML_FINAL.pdf

[7] EENA apps document
http://www.eena.org/uploads/gallery/files/operations_documents/2014_02_25_112smartphoneapps.pdf

[8] ETSI TR 103 140, eCall for VoIP

[9] Eurostat:
http://ec.europa.eu/eurostat/tgm/table.do?tab=table&language=en&pcode=tps00001&tableSelection=1&footnotes=yes&labeling=labels&plugin=1

Annex A: EU Legislation and policy documents

Directive 2009/136/EC of the European Parliament and the Council of 25 November 2009 amending Directive 2002/22/EC on universal service and users' rights relating to electronic communications networks and services.

Directive 2002/58/EC concerning the processing of personal data and the protection of privacy in the electronic communications sector and Regulation (EC) No 2006/2004 on cooperation between national authorities responsible for the enforcement of consumer protection laws.

Directive 2009/140/EC of the European Parliament and the Council of 25 November 2009 amending Directives 2002/21/EC on a common regulatory framework for electronic communications networks and services, 2002/19/EC on access to, and interconnection of, electronic communications networks and associated facilities, and 2002/20/EC on the authorisation of electronic communications networks and services.

Directive 2002/21/EC of the European Parliament and the Council of 7 March 2002 on a common regulatory framework for electronic communications networks and services (Framework Directive).

Directive 2002/58/EC of the European Parliament and of the Council of 12 July 2002 concerning the processing of personal data and the protection of privacy in the electronic communications sector (Directive on privacy and electronic communications).

Directive 2002/22/EC of the European Parliament and the Council of 7 March 2002 on universal service and user's rights relating to electronic communications networks and services (Universal Service Directive).

Recommendation 2003/558/EC of the Commission of the European Communities of 25 July 2003 on the processing of caller location information in electronic communication networks for the purpose of location-enhanced emergency call services.

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Annex B: Handset based location technologies

B.1 Global Navigation Satellite System (GNSS)

A Global Navigation Satellite System (GNSS) consists of three functional elements: Space Segment (satellites), User Segment (receivers), and Control Segment (maintenance etc.). The GNSS receiver calculates its own position based on measured pseudo-range times for typically at least four satellites and satellite orbital data which is broadcast by every satellite. Systems in this category, that are currently or soon to be operational include GPS, Galileo and GLONASS.

A handset may support one or several GNSSs. A handset with GNSS measurement capability may operate in an autonomous mode (GNSS) or in an assisted mode (A-GNSS). In autonomous mode the handset determines its position based solely on signals received from GNSS satellites (which convey orbital data and include means for measuring pseudo-ranges) without assistance from a network. In assisted mode, the handset receives assistance data from the network which can include both GNSS orbital data and other data to assist measurements and location computation. Some chipmakers can provide alternative solutions to A-GNSS in providing GNSS orbital and other data (e.g. the Qualcomm XTRA system) which can serve a similar purpose to network provided assistance data without requiring a handset or network to support A-GNSS. In such cases, the performance of autonomous GNSS can be similar to that for A-GNSS.

B.2 A-GNSS

Network-assisted GNSS (A-GNSS) methods provide additional assistance data to GNSS-enabled handsets to assist with speeding up the fixing of satellites and the positioning calculations. The assistance data can avoid the need for a handset to demodulate and decode satellite signals in order to obtain the same data from a satellite which can enable location with weaker signal levels and in a shorter time. The assistance data can also improve the accuracy of location (e.g. by enabling compensation for varying ionospheric delays and other sources of timing errors). The end result can be an improvement in the availability of the location service, the accuracy of the position, sensitivity (e.g. to fading), integrity and reliability, the in-building functioning and the time to first fix.

Network-assisted GNSS methods rely on a network location server to provide the assistance data and a near continuously operating GNSS reference receiver network, which has clear sky visibility of the same satellites as the assisted terminal. Two assisted modes are supported:

- **terminal-Assisted**: The mobile terminal performs GNSS measurements (pseudo ranges, pseudo Doppler, etc.) and sends these measurements to the network location server where the position calculation takes place, possibly using additional measurements from other (non GNSS) sources;
- **terminal-Based**: The mobile terminal performs GNSS measurements **and** calculates its own location, possibly using additional measurements from other (non GNSS) sources.

The assistance data provided to the mobile terminal can be classified into:

- data assisting the measurements: e.g. reference time, visible satellite list (e.g. satellite almanac), expected satellite signal Doppler, expected code phase, Doppler and code phase search windows, data bit assistance and information provided by satellite based augmentation systems such as EGNOS;

- data providing means for position calculation: e.g. reference time, reference position, satellite ephemeris, clock corrections.

- Information that may be used to improve position calculation accuracy and reliability and enable use of multiple GNSS systems such as: Ionospheric Models, Earth Orientation Parameters, GNSS-GNSS Time Offsets, Differential GNSS Corrections, Ephemeris and Clock Models, Real-Time Integrity, UTC Models.

In order to transfer the assistance data and measurements or calculated location estimate between a mobile terminal and a location server, there are two possible architectures:

- Control Plane Architecture

- User Plane Architecture

B.2.1 Control plane architecture

With a Control Plane based A-GNSS method, the server and handset communicate over existing communication signal interfaces and through existing network elements (e.g. via a serving eNodeB base station and serving Mobility Management Entity (MME) in the case of LTE access). For this, the necessary interfaces and most of the protocols are already available in the network due to support of normal network operation. Control Plane architecture implementation typically requires some alteration of the network infrastructure based on 3GPP Location Services Standards in order to add a location server and support certain additional location specific communication protocols. It is important to mention that, in the context of emergency calls, control plane A-GNSS implementations allow operators to provide the location information of the mobile terminal, to the PSAPs, regardless of the existence of a valid voice and data subscription. This means that a mobile terminal without a data or voice subscription can still be located as the data and voice service is not used in the positioning process.

B.2.2 User plane architecture

In a User Plane A-GNSS method implementation, communications between the Location Server and the mobile terminal take place over a standard data connection based on TCP/IP. This avoids any impact to existing network interfaces and avoids adding new location specific protocols except between the location server and mobile terminal. The existing protocols and interfaces of the mobile radio and switching networks are used only to support data communication between the mobile terminal and location server. A location server still needs to be provided by a network but can mostly or entirely be treated as a source and recipient of data by other network elements.

The Open Mobile Alliance (OMA), an association of Mobile Network service providers and manufacturers, has produced a Standard for user plane location technology (OMA-SUPL). This means that a mobile terminal uses the data service to be located. In addition, a terminal without a valid subscription can also be located for an emergency call as with a control plane location solution. The main restriction of a user plane location solution like OMA SUPL is that it cannot easily be used to locate a mobile terminal with an emergency call over circuit switched resources such as normally used for 2G and 3G systems. However, it is applicable to 4G systems and to 3G systems where packet access is available.

B.3 Observed Time Difference of Arrival (OTDOA)

The OTDOA method is based on measuring the difference in time of arrival of downlink signals received at the handset from different pairs of base stations. These measurements, together with information concerning the surveyed geographic location of the base stations and the relative time difference of the actual transmissions of the downlink signals enables an estimate of the position of the handset to be calculated using a multi-lateration technique. The OTDOA method may be operated in two modes similarly to A-GNSS: terminal-assisted and terminal-based. The two modes differ in where the actual position calculation is carried out. In the terminal-assisted mode, the handset measures the difference in time of arrival of pairs of cells and signals the measurement results to the network, where a location server or a location server function carries out the position calculation. In the terminal-based mode, the handset makes the measurements and also carries out the position calculation, and thus requires additional information (such as the position of the measured base stations) that may be provided as assistance data by the location server or location server function.

Enhanced observed time differences (E-OTD) was an early technology applied to handset-based positioning in GSM networks. The observed time difference measurements from downlink signals from several base stations are routed from the mobile station to a mobile location centre (MLC) that performs the calculation for estimating the mobile station position.

3GPP has standardized OTDOA for a control plane location solution for both UMTS (3G) and LTE (4G). In the case of UMTS, the location server is known as a Standalone Serving Mobile Location Centre (SAS) and the location server function (used when there is no physical SAS) is provided by the serving Radio Network Controller (SRNC). In the case of LTE, the location server is known as an enhanced Serving Mobile Location Centre (E-SMLC) and there no separate location server function. The 3GPP solution supports both terminal assisted and terminal based modes for UMTS but only terminal assisted mode for LTE. However, OMA has added support for terminal based mode for LTE and enabled OTDOA support for the SUPL user plane location solution for both UMTS and LTE.

Based on existing and ongoing deployments, OTDOA for UMTS may not ever be deployed but OTDOA for LTE appears is already being deployed (e.g. in the USA to support FCC location mandates).

B.4 WiFi Location

Wi-Fi-based positioning is useful where other positioning methods described above are challenged such as in indoor environments where GNSS signals may be significantly attenuated and where there may not always be enough LTE eNodeBs to enable accurate OTDOA location.

The localization technique used for positioning with wireless access points is based on identifying nearby WiFi access points at a mobile terminal and optionally measuring the received signal strength and/or round trip signal propagation delay. Typical parameters useful to identify the Wi-Fi hotspot or wireless access point include the SSID and the MAC address of the access point. The MAC address may subsequently be found in a database (e.g. available at a location server or at an external entity) which may result in discovering the location of the access point. This location may have been determined originally from a site survey or a drive by or walk by survey or by crowdsourcing of WiFi measurement data by many terminals whose locations could be established independently such as using GNSS, A-GNSS or OTDOA. The location(s) of the identified access point(s) may then be used to approximate the location of the mobile terminal which would be nearby the identified access point(s) – e.g. through averaging when more than one access point is identified. Any measurements obtained by a terminal of signal strength or round trip delay may also be used to improve the location estimate.

B.5 Indoor location

GNSS and A-GNSS typically do not always work reliably inside buildings though can be used in some cases to obtain a location or help obtain a location.

3GPP is currently evaluating the capability of existing and new location methods including OTDOA to support indoor location. It is expected that more than one method will ultimately be used for indoor location purposes. While it is too early to say which methods will predominate, there seems a good likelihood that methods based on WiFi (and Bluetooth®) access points will at least be included.

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Annex C: Transport of emergency caller location to PSAP.

C.1 Advanced Mobile Location (AML)

The UK Advanced Mobile Location (AML) service uses the emergency text system to deliver handset derived location during an emergency call. It is described in [5].

C.2 Personal eCall

Current EU legislation only covers eCall for vehicles. Personal eCall has been discussed in CEN TC 278 and in ETSI TC MSG but no standardisation has yet been done.

Personal eCall is essentially eCall initiated by a user from a mobile phone rather than (e.g. automatically) from a vehicle.

Personal eCall involves sending a modified MSD from a mobile phone to the PSAP using the same transfer mechanism as for vehicle eCall. For Personal eCall, the MSD can contain the current location of the mobile phone (and possibly information about the user of the mobile phone such as a name and address) instead of information about a vehicle as is used for current vehicular eCall. In the near term, MSD transfer can be via an in-band modem using the circuit switched 112 service; in the longer term a packet based solution can be used based on IMS Emergency Call or IMS Multimedia Emergency Service. Personal eCall could be deployed as a "smartphone app" on the mobile phone or as integrated functionality.

For near term Personal eCall, transient loss of voice connectivity (due to muting whilst the MSD is sent using the in-band modem) is a disadvantage. The loss of voice connectivity for typically 4 seconds (but potentially 20 seconds) may be problematic for emergency callers and may require the PSAP to change its operating policy. A method to mitigate the loss of voice connectivity could be to not to send the MSD at the beginning of the call, but instead let the PSAP request an MSD if needed. Existing eCall protocols allow this to be done. The PSAP operator could tell the caller that there will be a few seconds of silence whilst the data is collected.

A major advantage of personal eCall is that the data is inherently routed to the same PSAP as the emergency call and intrinsically attributed to that emergency call. Furthermore, there need not be any network impact and Personal eCall could be deployed quickly in cases where PSAPs are already eCall equipped. There would be no need for central server standardization, deployment, cost, or delay. The extent to which PSAPs will be eCall equipped will vary between countries. In the best case, when all PSAPs in a country are eCall capable, then Personal eCall would be a good solution. At the other extreme, where there is only one dedicated PSAP to receive eCalls and existing PSAPs that receive 112 calls are not eCall equipped, Personal eCall would not be so easily deployable.

A method to distinguish Personal eCalls from vehicle eCalls (manual and automatic) and from normal 112 calls is needed. Re-use of the existing vehicular eCall flags for Personal eCall can not be recommended because each category of call may potentially need to be handled differently. Ideally, a new flag for Personal eCalls would be standardised in 3GPP. There is only one spare bit in the emergency service category information element (ETSI TS 124 008) so it would be better to use this as an extension bit and use a bit in a new octet for Personal eCall. As an alternative, a new subscription option might be created that informed a network operator (e.g. an MSC) that any emergency call for a particular subscriber would support personal eCall. Both alternatives require some impact (probably small) to networks.

If there is no new flag and no new subscription option, then Personal eCalls would be routed to the same PSAP as other 112 calls. In this case, the PSAP may or may not be eCall capable. If the PSAP was eCall capable and knew that the UE was capable of Personal eCall, then the PSAP could "pull" the MSD. A UE may be able to indicate its capability to the PSAP by in-band signalling (e.g. DTMF tones) or some new control plane signalling. The latter would need 3GPP standardisation. If neither of these are deployed, and the PSAP is eCall capable but does not know the UE capabilities, the PSAP could still try to pull the MSD anyway; for instance during silent calls or as a last resort. As one alternative, users with phones capable of personal eCall could be registered (e.g. via their MSISDN) in some national database which a PSAP could access to determine the capability. The database (which would need to be secure) might be populated by network operators and/or by users. This is not an elegant solution but appears low cost and avoids any new impacts to networks and any new inband or new control signaling.

A further consideration for Personal eCall deployed on CS emergency call is that the in-band modem was optimised for existing codecs and its performance with future codecs is not known.

Personal eCall deployed on the IMS Emergency Call or IMS Multimedia Emergency Service instead of Circuit Switched emergency call with in-band modem, would overcome all of the disadvantages mentioned above. Notably there would be no muting. Additionally, the call can be easily identifiable as Personal eCall by signalling elements allowing for the call to be routed, handled, and processed as desired by the emergency authorities. Furthermore, a migration path from circuit switched to IMS eCall has been defined in ETSI TR 103 140 [8]. Next Generation eCall is essentially the same as NG112 – the MSD is sent as additional data (see clause C.4). Being able to migrate from a CS version of personal eCall to an NG version should reduce changes at the PSAP side and, in particular, avoids the possibility of a legacy CS based solution continuing and causing problems in the NG era. It also avoids the expense of deploying an interim solution that is not identical to the long-term migration path.

C.3 National server method

Please refer to EENA 112 apps document.

C.4 IMS emergency call with additional data

When an IMS emergency call is sent to a PSAP, the device that sends it, as well as any application service provider in the path of the call, or access network provider through which the call originated may have information about the call, the caller or the location which the PSAP may be able to use. The IETF document "Additional Data Related to an Emergency Call" [3] describes data structures and a mechanism to convey such data to the PSAP. The mechanism uses a Uniform Resource Identifier (URI), which may point to either an external resource or an object in the body of the SIP message. The mechanism thus allows the data to be passed by reference (when the URI points to an external resource) or by value (when it points into the body of the message). This follows the tradition of prior emergency services standardization work where data can be conveyed by value within the call signalling (i.e., in body of the SIP message) and also by reference. It should be noted that this solution can be seen as a variant of Personal eCall (Annex C.2) using an IMS (NG) solution in which the MSD is sent as additional call data.