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Next-Generation Pan-European eCall
draft-ietf-ecrit-ecall-00.txt

Abstract

This document describes how to use IP-based emergency services mechanisms to support the next generation of the Pan European in-vehicle emergency call service defined under the eSafety initiative of the European Commission (generally referred to as "eCall"). eCall is a standardized and mandated system for a special form of emergency calls placed by vehicles. eCall deployment is required by 2015 in European Union member states, and eCall (and eCall-compatible systems) are also being deployed in other regions. eCall provides an integrated voice path and a standardized set of vehicle, sensor (e.g., crash related), and location data. An eCall is recognized and handled as a specialized form of emergency call and is routed to a specialized eCall-capable Public Safety Answering Point (PSAP) capable of processing the vehicle data and trained in handling emergency calls from vehicles.

Currently, eCall functions over circuit-switched cellular telephony; work on next-generation eCall (NG-eCall, sometimes called packet-switched eCall or PS-eCall) is now in process, and this document assists in that work by describing how to support eCall within the IP-based emergency services infrastructure.

This document also registers a MIME Content Type and an Emergency Call Additional Data Block for the eCall vehicle data.

time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress."

This Internet-Draft will expire on January 5, 2015.

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1. Terminology

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC2119].

This document re-uses terminology defined in Section 3 of [RFC5012].

Additionally, we use the following abbreviations:

3GPP: 3rd Generation Partnership Project
CEN: European Committee for Standardization
EENA: European Emergency Number Association
ESInet: Emergency Services IP network
IVS: In-Vehicle System
MNO: Mobile Network Operator
MSD: Minimum Set of Data
PSAP: Public Safety Answering Point

2. Document Scope

This document is limited to the signaling, data exchange, and protocol needs of next-generation eCall (NG-eCall, also referred to as packet-switched eCall (PS-eCall) and all-IP eCall). eCall itself is specified by 3GPP and CEN and these specifications include far greater scope than is covered here.

3. Introduction

Emergency calls made from vehicles (e.g., in the event of a crash) assist in significantly reducing road deaths and injuries by allowing emergency services to be aware of the incident, the state of the vehicle, the location of the vehicle, and to have a voice channel with the vehicle occupants. This enables a quick and appropriate response.

The European Commission initiative of eCall was conceived in the late 1990s, and has evolved to a European Parliament decision requiring the implementation of compliant in-vehicle systems (IVS) in new vehicles and the deployment of eCall in the European Member States in 2015. eCall (and eCall-compatible systems) are also being adopted in other regions.

The pan-European eCall system provides a standardized and mandated mechanism for emergency calls by vehicles. eCall establishes procedures for such calls to be placed by in-vehicle systems, recognized and processed by the network, and routed to a specialized PSAP where the vehicle data is available to assist the call taker in assessing and responding to the situation. eCall provides a standard set of vehicle, sensor (e.g., crash related), and location data.

An eCall may be either user-initiated or automatically triggered. Automatically triggered eCalls indicate a car crash or some other serious incident (e.g., a fire) and carry a greater presumption of risk of injury. Manually triggered eCalls may be reports of serious hazards and are likely to require a different response than an automatically triggered eCall. Manually triggered eCalls are also more likely to be false (e.g., accidental) calls and may thus be subject to different handling by the PSAP.

Currently, eCall is standardized (by 3GPP [SDO-3GPP] and CEN [CEN]) as a 3GPP circuit-switched call over GSM (2G) or UMTS (3G). An eCall flag in the call setup marks the call as an eCall, and further indicates if the call was automatically or manually triggered. The call is routed to an eCall-capable PSAP, a voice channel is established between the vehicle and the PSAP, and an eCall in-band modem is used to carry a defined set of vehicle, sensor (e.g., crash related), and location data (the Minimum Set of Data or MSD) within the voice channel. The same in-band mechanism is used for the PSAP to acknowledge successful receipt of the MSD, and optionally to request the vehicle to send a new MSD (e.g., to check if the state of or location of the vehicle or its occupants has changed). Work on next-generation eCall (NG-eCall, also referred to as packet-switched eCall or PS eCall) is now in process. As part of this work, the European Telecommunications Standards Institute (ETSI) [SDO-ETSI] has published a Technical Report titled "Mobile Standards Group (MSG); eCall for VoIP" [MSG_TR] that presents findings and recommendations regarding support for eCall in an all-IP environment. NG-eCall moves from circuit switched to all-IP, and carries the vehicle data and other eCall-specific data as additional data associated with the call. This document describes how IETF mechanisms for IP-based emergency calls, including [RFC6443] and [additional-data-draft] are used to provide the signaling and data exchange of the next generation of pan-European eCall.

A transition period will exist during which time the various entities involved in initiating and handling an eCall might support next-generation eCall, legacy eCall, or both. This transition period might last several years or longer. The issue of migration/co-existence during the transition period is very important but is outside the scope of this document. The ETSI TR "Mobile Standards

Group (MSG); eCall for VoIP" [MSG_TR] discusses these issues in Clause 7.

4. eCall Requirements

Overall eCall requirements are specified by by by CEN in [EN_16072] and by 3GPP in [TS22.101] clauses 10.7 and A.27. Requirements specific to vehicle data are contained in EN 15722 [msd]. For convenience, the requirements most applicable to the limited scope of this document are summarized very briefly below.

eCall requires:

- The call be recognized as an eCall (which is inherently an emergency call)
- The call setup indicates if the call was manually or automatically triggered
- A voice channel between the vehicle and the PSAP
- Carrying the MSD intrinsically with the call (the MSD needs to be available to the same call-taker as the voice)
- The ability for the PSAP to acknowledge receipt of the MSD
- The ability for the PSAP to request that the vehicle generate and transmit a new MSD
- The ability of the PSAP to be able to re-contact the occupants of vehicle after the initial eCall is concluded
- The ability to perform a test call (which may be routed to a PSAP but is not treated as an emergency call and not handled by a call taker)

It is recognized that NG-eCall offers many potential enhancements, although these are not required by current EU regulations. For convenience, the enhancements most applicable to the limited scope of this document are summarized very briefly below.

NG-eCall is expected to offer:

- The ability to carry more data (e.g., an enhanced MSD or an MSD plus additional sets of data)
- The ability to handle video
- The ability to handle text
- The ability for the PSAP to access vehicle components (e.g., an onboard camera (such as rear facing or blind-spot cameras) for a visual assessment of the crash site situation)
- The ability for the PSAP to request the vehicle to take actions (e.g., sound the horn, disable the ignition, lock/unlock doors)
- The ability to avoid audio muting of the voice channel (because the MSD is not transferred using an in-band modem)

5. Vehicle Data

Pan-European eCall provides a standardized and mandated set of vehicle related data, known as the Minimum Set of Data (MSD). The European Committee for Standardization (CEN) has specified this data in EN 15722 [msd], along with both ASN.1 and XML encodings for the MSD [msd]. Circuit-switched eCall uses the ASN.1 encoding (due to its more compact size). The XML encoding is better suited for use in SIP messages and is used in this document. (The ASN.1 encoding is specified in Annex A of EN 15722 [msd], while the XML encoding is specified in Annex C.)

The "Additional Data related to an Emergency Call" document [additional-data-draft] establishes a general mechanism for attaching blocks of data to a SIP emergency call. This document makes use of that mechanism to carry the eCall MSD in a SIP emergency call.

This document registers the 'application/ emergencyCallData.eCall.MSD+xml') MIME Content-Type to enable the MSD to be carried in SIP. This document also adds the 'eCall.MSD' entry to the Emergency Call Additional Data Blocks registry (established by [additional-data-draft]) to enable the MSD to be recognized as such in a SIP-based eCall emergency call.

6. Call Setup

In circuit-switched eCall, the IVS places a special form of a 112 emergency call which carries the eCall flag (indicating that the call is an eCall and also if the call was manually or automatically triggered); the mobile network operator (MNO) recognizes the eCall flag and routes the call to an eCall-capable PSAP; vehicle data is transmitted to the PSAP via the eCall in-band modem (in the voice channel).

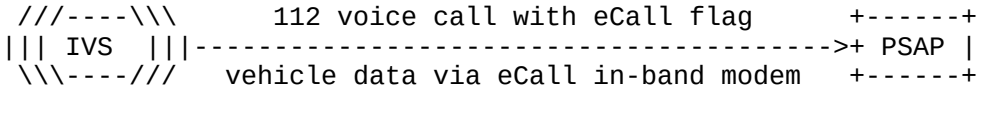

Figure 1: circuit-switched eCall

An In-Vehicle System (IVS) which supports NG-eCall transmits the MSD in accordance with [additional-data-draft] by encoding it as specified (per Appendix C of EN 15722 [msd]) and attaching it to an INVITE as a MIME body part. The body part is identified by its MIME content-type 'application/emergencyCallData.eCall.MSD+xml') in the Content-Type header field of the body part. The body part is assigned a unique identifier which is listed in a Content-ID header

field in the body part. The INVITE is marked as containing the MSD by adding (or appending to) a Call-Info header field at the top level of the INVITE. This Call-Info header field contains a CID URL referencing the body part's unique identifier, and a 'purpose' parameter identifying the data as the eCall MSD per the registry entry; the 'purpose' parameter's value is 'emergencyCallData.' and the root of the MIME type (not including the 'emergencyCallData' prefix and any suffix such as '+xml' (e.g., 'purpose=emergencyCallData.eCall.MSD').

For NG-eCall, the IVS establishes an emergency call using the 3GPP IMS solution with a Request-URI indicating an eCall type of emergency call and with vehicle data attached; the MNO or ESInet recognizes the eCall URN and routes the call to a NG-eCall capable PSAP; the PSAP interpets the vehicle data sent with the call and makes it available to the call taker.

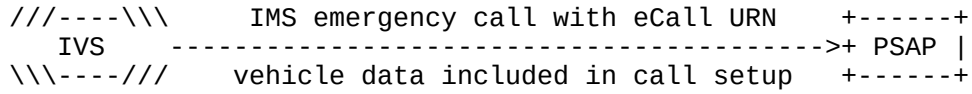

Figure 2: NG-eCall

This document registers new service URN children within the "sos" subservice. These URNs provide the mechanism by which an eCall is identified, and differentiate between manually and automatically triggered eCalls (which may be subject to different treatment, depending on policy). The two service URNs are: urn:service:sos.ecall.automatic and urn:service:sos.ecall.manual

7. Call Routing

The routing rules for eCalls are likely to differ from those of other emergency calls because eCalls are special types of emergency calls (with implications for the types of response required) and need to be handled by specially designated PSAPs. In an environment that uses ESInets, the originating network passes all types of emergency calls to an ESInet (which have a request URI containing the "SOS" service URN). The ESInet is then responsible for routing such calls to the appropriate PSAP. In an environment without an ESInet, the emergency services authorities and the originating network jointly determine how such calls are routed.

7.1. ESInets

This section provides background information on ESInets for information only.

An Emergency Services IP Network (ESInet) is a network operated by emergency services authorities. It handles emergency call routing and processing before delivery to a PSAP. In the NG1-1-2 architecture adopted by EENA, each PSAP is connected to one or more ESInets. Each originating network is also connected to one or more ESInets. The ESInets maintain policy-based routing rules which control the routing and processing of emergency calls. The centralization of such rules within ESInets provides for a cleaner separation between the responsibilities of the originating network and that of the emergency services network, and provides greater flexibility and control over processing of emergency calls by the emergency services authorities. This makes it easier to react quickly to unusual situations that require changes in how emergency calls are routed or handled (e.g., a natural disaster closes a PSAP), as well as ease in making long-term changes that affect such routing (e.g., cooperative agreements to specially handle calls requiring translation or relay services). ESInets may support the ability to interwork NG-eCall to legacy eCall to handle eCall-capable PSAPs that are not IP PSAPs (similarly to the ability to interwork IP emergency calls to legacy non-IP PSAPs). Note that in order to support legacy eCall-capable PSAPs that are not IP PSAPs and are not attached to an ESInet, an originating network may need the ability to route an eCall itself (e.g., to an interworking facility with interconnection to a suitable legacy eCall capable PSAP) based on the eCall and manual or automatic indications. The ETSI TR "Mobile Standards Group (MSG); eCall for VoIP" [MSG_TR] discusses transition issues in Clause 7.

8. Test Calls

eCall requires the ability to place test calls. These are calls that are recognized and treated as eCalls but are not given emergency call treatment and are not handled by call takers.

A service URN starting with "test." indicates a test call. For eCall, "urn:service:test.sos.ecall" indicates such a test feature. This functionality is defined in [RFC6881].

This document registers "urn:service:test.sos.ecall" for eCall test calls.

9. eCall-Specific Data from PSAP to IVS

eCall requires the ability for the PSAP to acknowledge successful receipt of the MSD, and for the PSAP to optionally request that the IVS send a new MSD (e.g., if the call taker wishes to see if the vehicle's state or location has changed). Future enhancements are desired, for example, to enable the PSAP to send other requests to the vehicle, such as starting a video stream from on-board cameras (such as rear focus or blind-spot), locking or unlocking doors, sounding the horn, flashing the lights, etc.

The same mechanism established in [additional-data-draft], used in this document to carry the MSD from the IVS to the PSAP, can be additionally used to carry a control data block from the PSAP to the IVS. This eCall control block (also referred to as eCall metadata) is an XML structure containing eCall-specific elements. When the PSAP needs to send an eCall control block that is in response to the MSD or other data sent by the IVS in a SIP request, the control block can be sent in the SIP response to the message that contained the MSD or other data (e.g., the INVITE). When the PSAP needs to send an eCall control block that is not an immediate response to an MSD or other data sent by the IVS, the control block can be transmitted from the PSAP to the IVS in a SIP INFO message within the established session. The IVS can then send any requested data (such as a new MSD) in the reply to the INFO message. This creates a framework mechanism by which the PSAP can send eCall-specific data to the IVS and the IVS can respond with data if requested. If control data sent in a response message requests the IVS to send a new MSD or other data block, the IVS can do so in an INFO message within the session (it could also use re-INVITE but that is unnecessary when no aspect of the session or media is changing).

This mechanism requires

- An XML definition of the eCall control object
- An extension mechanism by which new elements can be added to the control object definition (which may be as simple as permitting additional elements to be included by adding their namespace)
- A MIME type registration for the control object (so it can be carried in SIP messages and responses)
- An entry in the Emergency Call Additional Data Blocks sub-registry (established by [additional-data-draft]) so that the control block can be recognized as emergency call specific data within the SIP messages
- An Info-Package registration per [RFC6086] permitting the control block within Info messages

10. Example

Figure 3 shows an eCall. The call uses the request URI 'urn:service:sos.ecall.automatic' service URN and is recognized as an eCall, and further as one that was invoked automatically by the IVS due to a crash or other serious incident. In this example, the originating network routes the call to an ESInet (as for any emergency call in an environment with an ESInet). The ESInet routes the call to the appropriate NG-eCall capable PSAP. (In deployments where there is no ESInet, the originating network routes the call directly to the appropriate NG-eCall capable PSAP.) The emergency call is received by the ESInet's Emergency Services Routing Proxy (ESRP), as the entry point to the ESInet. The ESRP routes the call to a PSAP, where it is received by a call taker.

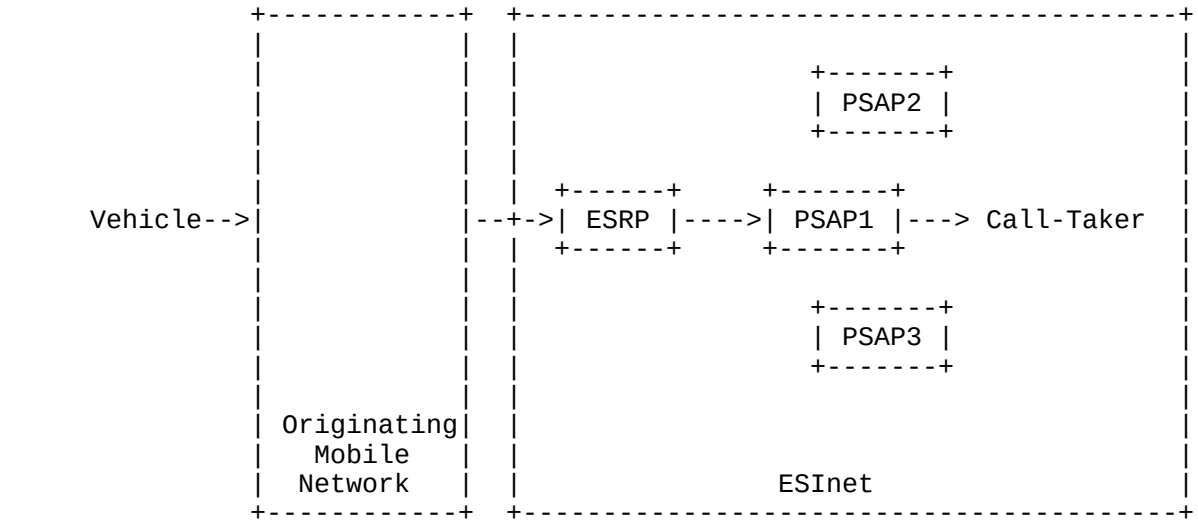

Figure 3: Example of NG-eCall Message Flow

The example, shown in Figure 4, illustrates a SIP eCall INVITE that contains an MSD.

```
INVITE urn:service:sos.ecall.automatic SIP/2.0
To: urn:service:sos.ecall.automatic
From: <sip:+13145551111@example.com>;tag=9fxced76sl
Call-ID: 3848276298220188511@atlanta.example.com
Geolocation: <cid:target123@example.com>
Geolocation-Routing: no
Call-Info: cid:1234567890@atlanta.example.com;
           purpose=emergencyCallData.eCall.MSD
Accept: application/sdp, application/pidf+xml
CSeq: 31862 INVITE
```

```
Content-Type: multipart/mixed; boundary=boundary1
Content-Length: ...

--boundary1

Content-Type: application/sdp

...Session Description Protocol (SDP) goes here

--boundary1

Content-Type: application/emergencyCallData.eCall.MSD+xml
Content-ID: 1234567890@atlanta.example.com

...eCall MSD data object goes here

 --boundary1--
```

Figure 4: SIP NG-eCall INVITE

11. Security Considerations

The security considerations described in [RFC5069] apply here.

An eCall will carry two forms of location data: the network-provided location that is inherently part of IMS emergency calls (which might be determined solely by the network, or in cooperation with or possibly entirely by the originating device), and the IVS-supplied location within the MSD. This is likely to be useful to the PSAP, especially when the two locations are independently determined. Even in situations where the network-supplied location is limited to the cell site, this can be useful as a sanity check on the device-supplied location contained in the MSD.

The document [I-D.ietf-ecrit-trustworthy-location] discusses trust issues regarding location provided by or determined in cooperation with end devices.

The mechanism by which the PSAP sends acknowledgment and optional requests to the vehicle requires authenticity considerations; when the PSAP request is received within an established session initiated by the vehicle as an eCall emergency call, there is a higher degree of trust that the source is indeed a PSAP. If the PSAP request is received in other situations, such as a call-back, the trust issues in verifying that a call-back is indeed from a PSAP are more complex (see the PSAP Callback document [I-D.ietf-ecrit-psap-callback]).

12. IANA Considerations

12.1. Service URN Registration

IANA is requested to register the URN 'urn:service:sos.ecall' under the sub-services 'sos' registry defined in Section 4.2 of [RFC5031].

This service identifies a type of emergency call (placed by a specialized in-vehicle system and carrying standardized set of data related to the vehicle and crash or incident, and is needed to direct the call to a specialized public safety answering point (PSAP) with technical and operational capabilities to handle such calls. Two sub-services are registered as well, namely

urn:service:sos.ecall.manual

This service URN indicates that an eCall had been triggered based on the manual interaction of the driver or a passenger.

urn:service:sos.ecall.automatic

This service URN indicates that an eCall had been triggered automatically, for example, due to a crash or other serious incident (e.g., fire).

IANA is also requested to register the URN 'urn:service:test.sos.ecall' under the sub-service 'test' registry defined in Setcion 17.2 of [RFC6881].

12.2. MIME Content-type Registration for 'application/ emergencyCallData.eCall.MSD+xml'

This specification requests the registration of a new MIME type according to the procedures of RFC 4288 [RFC4288] and guidelines in RFC 3023 [RFC3023].

MIME media type name: application

MIME subtype name: emergencyCallData.eCall.MSD+xml

Mandatory parameters: none

Optional parameters: charset

Indicates the character encoding of the XML content.

Encoding considerations: Uses XML, which can employ 8-bit characters, depending on the character encoding used. See Section 3.2 of RFC 3023 [RFC3023].

Security considerations: This content type is designed to carry vehicle and incident-related data during an emergency call. This data contains personal information including vehicle VIN, location, direction, etc. Appropriate precautions need to be taken to limit unauthorized access, inappropriate disclosure to third parties, and eavesdropping of this information. In general, it is permissible for the data to be unprotected while briefly in transit within the Mobile Network Operator (MNO); the MNO is trusted to not permit the data to be accessed by third parties. Sections 7 and Section 8 of [I-D.ietf-ecrit-additional-data] contain more discussion.

Interoperability considerations: None

Published specification: Annex C of EN 15722 [msd]

Applications which use this media type: Pan-European eCall compliant systems

Additional information: None

Magic Number: None

File Extension: .xml

Macintosh file type code: 'TEXT'

Person and email address for further information: Hannes Tschofenig, Hannes.Tschofenig@gmx.net

Intended usage: LIMITED USE

Author: This specification was produced by the European Committee For Standardization (CEN). For contact information, please see <http://www.cen.eu/cen/Pages/contactus.aspx>.

Change controller: The European Committee For Standardization (CEN)

12.3. Registration of the 'eCall.MSD' entry in the Emergency Call Additional Data Blocks registry

This specification requests IANA to add the 'eCall.MSD' entry to the Emergency Call Additional Data Blocks registry (established by [additional-data-draft]), with a reference to this document.

13. Contributors

Brian Rosen was a co-author of the original document upon which this document is based.

14. Acknowledgements

We would like to thank Bob Williams and Ban Al-Bakri for their feedback and suggestions. We would like to thank Michael Montag, Arnoud van Wijk, Gunnar Hellstrom, and Ulrich Dietz for their help with the original document upon which this document is based.

15. Changes from Previous Versions

15.1. Changes from draft-gellens-03 to draft-ietf-00

- Renamed from draft-gellens- to draft-ietf-.
- Added mention of and reference to ETSI TR "Mobile Standards Group (MSG); eCall for VoIP"
- Added text to Introduction regarding migration/co-existence being out of scope
- Added mention in Security Considerations that even if the network-supplied location is just the cell site, this can be useful as a sanity check on the IVS-supplied location
- Minor wording improvements and clarifications

15.2. Changes from draft-gellens-02 to -03

- Clarifications and editorial improvements.

15.3. Changes from draft-gellens-01 to -02

- Minor wording improvements
- Removed ".automatic" and ".manual" from "urn:service:test.sos.ecall" registration and discussion text.

15.4. Changes from draft-gellens-00 to -01

- Now using 'EmergencyCallData' for purpose parameter values and MIME subtypes, in accordance with changes to [additional-data-draft]
- Added reference to RFC 6443
- Fixed bug that caused Figure captions to not appear

16. References

16.1. Normative References

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16.2. Informative references

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[SDO-ETSI] , "European Telecommunications Standards Institute (ETSI)", <http://www.etsi.org>.

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