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Best Current Practice for IP-based In-Vehicle Emergency Calls
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Abstract

This document describes how to use a subset of the IETF-based emergency call framework for accomplishing emergency calling support in vehicles. Simplifications are possible due to the nature of the functionality that is going to be provided in vehicles with the usage of GPS. Additionally, further profiling needs to be done regarding the encoding of location information.

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1. Introduction

Emergency calls made from vehicles can assist with the objective of significantly reducing road deaths and injuries. Unfortunately, drivers often have a poor location-awareness, especially on urban roads (also during night) and abroad. In the most crucial cases, the victim(s) may not be able to call because they have been injured or trapped.

In Europe the European Commission has launched the eCall initiative that may best be described as a user initiated or automatically triggered system to provide notifications to Public Safety Answering Point's (PSAP), by means of cellular communications, that a vehicle has crashed, and to provide geodetic location information and where possible a voice channel to the PSAP. The current specifications being developed to offer the eCall solution are defined to work with circuit switched telephony. This document details how the same functionality can be accomplished using IP-based mechanisms. Since cellular systems are being enhanced with IP-based infrastructure this document complements the ambiguous goal to provide widespread availability of in-vehicular emergency services solutions.

This document is organized as follows: Section 2 defines the terminology, Section 3 illustrates the required protocol functionality, Section 4 indicates the required data that has to be transmitted within a PIDF-LO and Section 5 shows an example message exchange. This document concludes with the security considerations in Section 6 and IANA considerations in Section 7.

2. 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 [1].

This document re-uses a lot of the terminology defined in Section 3 of [9].

3. Protocol Profile

The usage of in-vehicular emergency calls does not require the usage of a Location Configuration Protocol since GPS is used. Furthermore, since the GPS receiver is permanently turned on it can even provide useful information in cases where the car entered a tunnel. Consequently, there is no need to discover any LIS.

Since the emergency call within the car is either triggered by a button or, in most cases, automatically thanks to sensors mounted in the car there is no need to learn a dial string. This document registers a separate Service URN, namely 'urn:service:ecall', used specifically for emergency calls that are triggered by vehicles.

The following list provides information about the sections and requires of [2] that are relevant to this specification:

Identifying an emergency call: Emergency calls are detected at the end point, i.e., by the vehicle, and the Service URN 'urn:service:ecall' MUST be implemented by the end point and recognized by the VSP. The requirements listed in Section 5 of [2] are therefore irrelevant to this specification, as they deal

with identifying an emergency call based on dial strings.

Location: The encoding of the PIDF-LO [3] is described in Section 4. In an emergency, the end point adds the available location information to the initial SIP INVITE emergency call message. In special cases a location update may be provided, using the procedure described in requirement ED-38 of Section 6.8 of [2]; all other aspects of Section 6.8 from that document are not applicable to this specification. Section 6.2.1, 6.2.2, 6.2.4, 6.4, 6.5 and 6.6 of [2] are not applicable to this document. For location conveyance in SIP [4] MUST be used. Further aspects that are not relevant for this document are multiple locations (Section 6.9 of [2]), location validation (Section 6.10 of [2]), default location (Section 6.11 of [2])

LoST: Emergency call routing support, for example utilizing LoST, is provided by VSP. As such, the description in Section 8 of [2] is applicable to this document, except for requirement SP-25 and SP-26 regarding legacy devices.

Signaling of emergency calls: Section 9 of [2] is applicable to this document with the following exception: ED-60/AN-25 is not applicable as HELD is not used. Video and real-time text may be supported by end device in the future, although currently not envisioned. The corresponding text paragraphs are relevant from Section 9 of [2] when support is being provided. Additionally,

ED-62 dealing with "SIP signaling requirements for User Agents" is simplified as follows. The initial SIP signaling method is an INVITE request with the following setting:

1. The Request URI MUST be the service URN 'urn:service:ecall'.

2. The To header MUST be a service URN 'urn:service:ecall'.

3. The From header MUST be present and SHOULD be the AoR of the caller.

4. A Via header MUST be present.

5. A Contact header MUST be present which MUST be globally routable to permit an immediate call-back to the specific

device which placed the emergency call.

6. Other headers MAY be included as per normal SIP behavior.

7. A Supported header MUST be included with the 'geolocation' option tag [4].

8. The device MUST include location by-value into the call.

9. A normal SDP offer SHOULD be included in the INVITE. If voice is supported the offer SHOULD include the G.711 codec, if a voice channel can be established based on the equipment in the car.

10. If the device includes location-by-value, the UA MUST support multipart message bodies, since SDP will likely be also in the INVITE.

11. The UAC MUST include a "inserted-by=endpoint" header parameter on all Geolocation headers. This informs downstream elements which device entered the location at this URI (either cid-URL or location-by-reference URI).

12. SIP Caller Preferences [5] MAY be used to signal how the PSAP should handle the call. For example, a language preference expressed in an Accept-Language header may be used as a hint to cause the PSAP to route the call to a call taker who speaks the requested language. SIP Caller Preferences may also be used to indicate a need to invoke a relay service for communication with people with disabilities in the call.

Call backs: The description in Section 10 of [2] is relevant for this document.

Mid-call behavior: The description in Section 11 of [2] is fully applicable to this document.

Call termination: The description in Section 12 of [2] is fully applicable to this document.

Disabling of features: The description in Section 13 of [2] is fully applicable to this document.

Media: Real-time text and video may be supported in devices some time in the future. If voice calls are supported then the description in Section 14 is applicable to this document.

Testing: The description in Section 15 of [2] is fully applicable to this document.

4. Data Profile

Due to the requirement for a built-in GPS receiver only geodetic location information will be sent within an emergency call. Furthermore, the number of location shapes is is restricted. Hence, the following location shapes of [6] MUST be implemented: 2d and 3d Point (see Section 5.2.1 of [6]), Circle (see Section 5.2.3 of [6]), and Ellipsoid (see Section 5.2.7 of [6]). The coordinate reference systems (CRS) specified in [6] are also mandatory for this document. Furthermore, the direction of travel of the vehicle is important for dispatch and hence it MUST be included in the PIDF-LO. The <bearing> element specified in [7] MUST be supported.

5. Example

Figure 1 shows an emergency call placed from a vehicle whereby location information information is directly attached to the SIP INVITE message itself. The call is marked as an emergency call using the 'urn:service:ecall' service URN and the PSAP of the VoIP provider determines which PSAP to contact based on the provided location information. As shown in the figure, this route determination may be based on LoST. Then, the emergency call continues towards the PSAP and in this example it hits the ESRP, as the entry point to the PSAP operators emergency services network. Finally, the emergency call will be received by a call taker and first reponders will be dispatched.

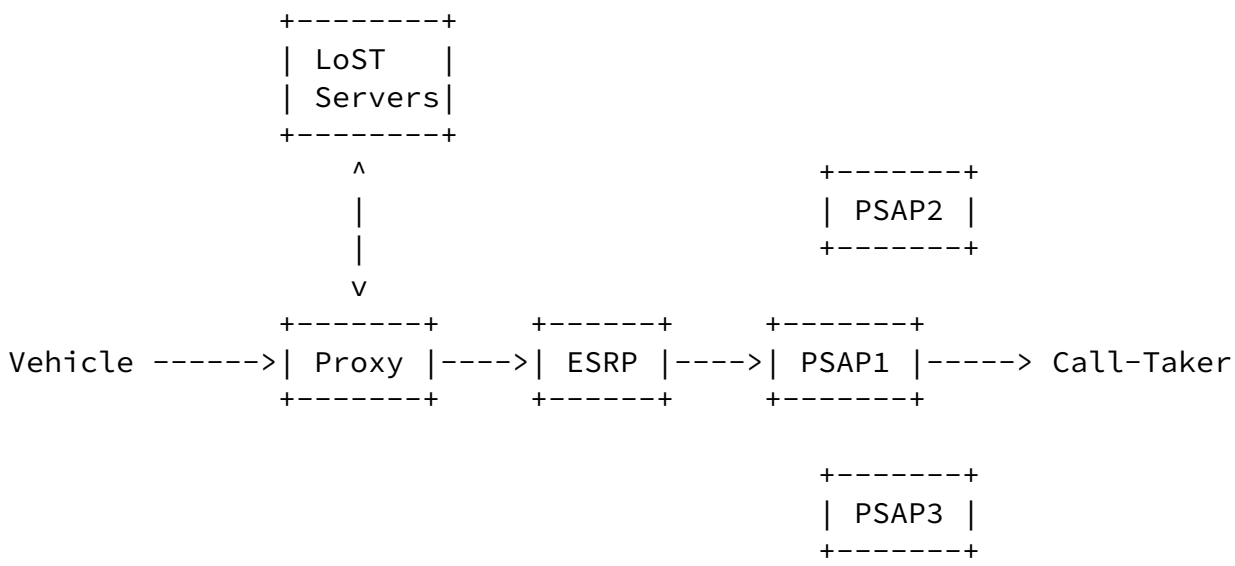

Figure 1: Example of In-Vehicular Emergency Call Message Flow

The following example, in Figure 2, shows location information encoded in a PIDF-LO that is being conveyed in such an emergency call.

```
                <?xml version="1.0" encoding="UTF-8"?>
      <presence xmlns="urn:ietf:params:xml:ns:pidf"
          xmlns:gp="urn:ietf:params:xml:ns:pidf:geopriv10"
          xmlns:gml="http://www.opengis.net/gml"
          xmlns:gs="http://www.opengis.net/pidflo/1.0"
          entity="pres:vehicle-identification@example.com">
        <device id="123">
            <gp:geopriv>
              <gp:location-info>
                <gs:Circle srsName="urn:ogc:def:crs:EPSG::4326">
                  <gml:pos>42.5463 -73.2512</gml:pos>
                  <gs:radius uom="urn:ogc:def:uom:EPSG::9001">
                    850.24
                  </gs:radius>
                </gs:Circle>
                <gml:bearing>
                 <gml:DirectionVector>
                  <gml:vector> 270.0 -60.0</gml:vector>
                 </gml:DirectionVector>
                </gml:bearing>
              </gp:location-info>
              <gp:usage-rules/>
              <method>GPS</method>
            </gp:geopriv>
        </device>
      </presence>
```

Figure 2: Example of In-Vehicular Emergency Call Message Flow

6. Security Considerations

This document does not raise security considerations beyond those described in [10]. As with emergency service systems with end host provided location information there is the possibility that that location is incorrect, either intentially (in case of an a denial of service attack against the emergency services infrastructure) or due to a malfunctioning devices. The reader is referred to [11] for a discussion of some of these vulnerabilities.

7. IANA Considerations

IANA is requested to register the URN 'urn:service:ecall' under the sub-services 'sos' registry defined in Section 4.2 of [8].

urn:service:ecall This service identifier reaches a public safety answering point (PSAP), which in turn dispatches aid appropriate to the emergency related to accidents of vehicles.

8. Acknowledgements

We would like to thank Michael Montag for his feedback.

9. Open Issues

While working on this document a few aspects where discovered that require further discussion:

- Today's work on the eCall system does not necessarily require a voice call to be established; a voice call may be established whenever possible by the functionality offered by the device. From a protocol mechanims, however, the design for establishing an emergency call including voice and without voice support are somewhat different. Further discussion on the design aspects are

needed to align this aspect.

- This document currently defines a new service URN to differentiate it from ordinary calls as in-vehicular emergency calls are, in some countries, routed to different PSAPs than regular emergency calls. More thoughts are needed to determine whether this is the best approach.

- The current version of the document assumes the usage of LoST at the VSP to perform call routing of the in-vehicular emergency call. This is useful when there are no dial strings need to be learned nor any other service URNs need to be discovered. Further discussion is needed whether additional service URNs might be made available to the vehicle, for example to request roadside assistance or similar services. In that case the option might be provided to run LoST at the end host as well as on the VSP.

10. References

10.1. Normative References

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[3] Peterson, J., "A Presence-based GEOPRIV Location Object Format", RFC 4119, December 2005.

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[5] Rosenberg, J., Schulzrinne, H., and P. Kyzivat, "Caller Preferences for the Session Initiation Protocol (SIP)", RFC 3841, August 2004.

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10.2. Informative references

[9] Schulzrinne, H. and R. Marshall, "Requirements for Emergency Context Resolution with Internet Technologies", RFC 5012, January 2008.

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[11] Tschofenig, H., Schulzrinne, H., and B. Aboba, "Trustworthy Location Information",

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