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	March 08, 2010	

Best Current Practice for IP-based In-Vehicle Emergency Calls
draft-rosen-ecrit-ecall-04.txt

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   TOC

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 similar or more extended functionality can be accomplished using IP-based mechanisms.
This document is organized as follows: Section 2 (Terminology) defines the terminology, Section 3 (Protocol Profile) illustrates the required protocol functionality, Section 4 (Data Profile) indicates the required data that has to be transmitted within a PIDF-LO and Section 5 (Example) shows an example message exchange. This document concludes

with the security considerations in [Section 6 (Security Considerations)](#) and IANA considerations in [Section 7 (IANA Considerations)](#).

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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 [\[1\] (Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels," March 1997.)](#). This document re-uses a lot of the terminology defined in Section 3 of [\[9\] (Schulzrinne, H. and R. Marshall, "Requirements for Emergency Context Resolution with Internet Technologies," January 2008.)](#).

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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 [\[2\] (Rosen, B. and J. Polk, "Best Current Practice for Communications Services in support of Emergency Calling," January 2010.)](#) 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 [\[2\] (Rosen, B. and J. Polk, "Best Current Practice for Communications Services in support of Emergency Calling," January 2010.)](#) 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 [\[3\] (Peterson, J., "A Presence-based GEOPRIV Location Object Format," December 2005.)](#) is described in [Section 4 (Data Profile)](#). 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] (Rosen, B. and J. Polk, "Best Current Practice for Communications Services in support of Emergency Calling," January 2010.); 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] (Rosen, B. and J. Polk, "Best Current Practice for Communications Services in support of Emergency Calling," January 2010.) are not applicable to this document. For location conveyance in SIP [4] (Polk, J. and B. Rosen, "Location Conveyance for the Session Initiation Protocol," February 2010.) MUST be used. Further aspects that are not relevant for this document are multiple locations (Section 6.9 of [2] (Rosen, B. and J. Polk, "Best Current Practice for Communications Services in support of Emergency Calling," January 2010.)), location validation (Section 6.10 of [2] (Rosen, B. and J. Polk, "Best Current Practice for Communications Services in support of Emergency Calling," January 2010.)), default location (Section 6.11 of [2] (Rosen, B. and J. Polk, "Best Current Practice for Communications Services in support of Emergency Calling," January 2010.))

LoST: Emergency call routing support, for example utilizing LoST, is provided by VSP. As such, the description in Section 8 of [2] (Rosen, B. and J. Polk, "Best Current Practice for Communications Services in support of Emergency Calling," January 2010.) is applicable to this document, except for requirement SP-25 and SP-26 regarding legacy devices.

Signaling of emergency calls: Section 9 of [2] (Rosen, B. and J. Polk, "Best Current Practice for Communications Services in support of Emergency Calling," January 2010.) 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] (Rosen, B. and J. Polk, "Best Current Practice for Communications Services in support of Emergency Calling," January 2010.) 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] (Polk, J. and B. Rosen, "Location Conveyance for the Session Initiation Protocol," February 2010.).

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] (Rosenberg, J., Schulzrinne, H., and P. Kyzivat, "Caller Preferences for the Session Initiation Protocol (SIP)," August 2004.) 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] (Rosen, B. and J. Polk, "Best Current Practice for Communications Services in support of Emergency Calling," January 2010.) is relevant for this document.

Mid-call behavior: The description in Section 11 of [2] (Rosen, B. and J. Polk, "Best Current Practice for Communications Services

in support of Emergency Calling," January 2010.) is fully
applicable to this document.

Call termination: The description in Section 12 of [2] (Rosen, B.
and J. Polk, "Best Current Practice for Communications Services
in support of Emergency Calling," January 2010.) is fully
applicable to this document.

Disabling of features: The description in Section 13 of [2] (Rosen,
B. and J. Polk, "Best Current Practice for Communications
Services in support of Emergency Calling," January 2010.) is
fully applicable to this document.

Media: If hardware and software for real-time text, voice, and
video is available in the end device then the requirements
regarding multi-media support described in [2] (Rosen, B. and J.
Polk, "Best Current Practice for Communications Services in
support of Emergency Calling," January 2010.) are applicable.

Testing: The description in Section 15 of [2] (Rosen, B. and J.
Polk, "Best Current Practice for Communications Services in
support of Emergency Calling," January 2010.) is fully applicable
to this document.

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4. Data Profile   TOC

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] (Winterbottom, J., Thomson, M., and H.
Tschofenig, "GEOPRIV Presence Information Data Format Location Object
(PIDF-LO) Usage Clarification, Considerations, and Recommendations,"
March 2009.) MUST be implemented: 2d and 3d Point (see Section 5.2.1 of
[6] (Winterbottom, J., Thomson, M., and H. Tschofenig, "GEOPRIV
Presence Information Data Format Location Object (PIDF-LO) Usage
Clarification, Considerations, and Recommendations," March 2009.)),
Circle (see Section 5.2.3 of [6] (Winterbottom, J., Thomson, M., and H.
Tschofenig, "GEOPRIV Presence Information Data Format Location Object
(PIDF-LO) Usage Clarification, Considerations, and Recommendations,"
March 2009.)), and Ellipsoid (see Section 5.2.7 of [6] (Winterbottom,
J., Thomson, M., and H. Tschofenig, "GEOPRIV Presence Information Data
Format Location Object (PIDF-LO) Usage Clarification, Considerations,
and Recommendations," March 2009.)). The coordinate reference systems
(CRS) specified in [6] (Winterbottom, J., Thomson, M., and H.
Tschofenig, "GEOPRIV Presence Information Data Format Location Object
(PIDF-LO) Usage Clarification, Considerations, and Recommendations,"

March 2009.) 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] (Schulzrinne, H., Singh, V., Tschofenig, H., and M. Thomson, "Dynamic Extensions to the Presence Information Data Format Location Object (PIDF-LO)," March 2010.) MUST be supported.

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5. Example

Figure 1 (Example of In-Vehicular Emergency Call Message Flow) 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.

```
                    +--------+
                    | LoST   |
                    | Servers|
                    +--------+
                        ^                      +-------+
                        |                      | PSAP2 |
                        |                      +-------+
                        v
                    +-------+     +------+     +-------+
        Vehicle ------>| Proxy |---->| ESRP |---->| PSAP1 |-----> Call-Taker
                    +-------+     +------+     +-------+

                                              +-------+
                                              | PSAP3 |
                                              +-------+
```
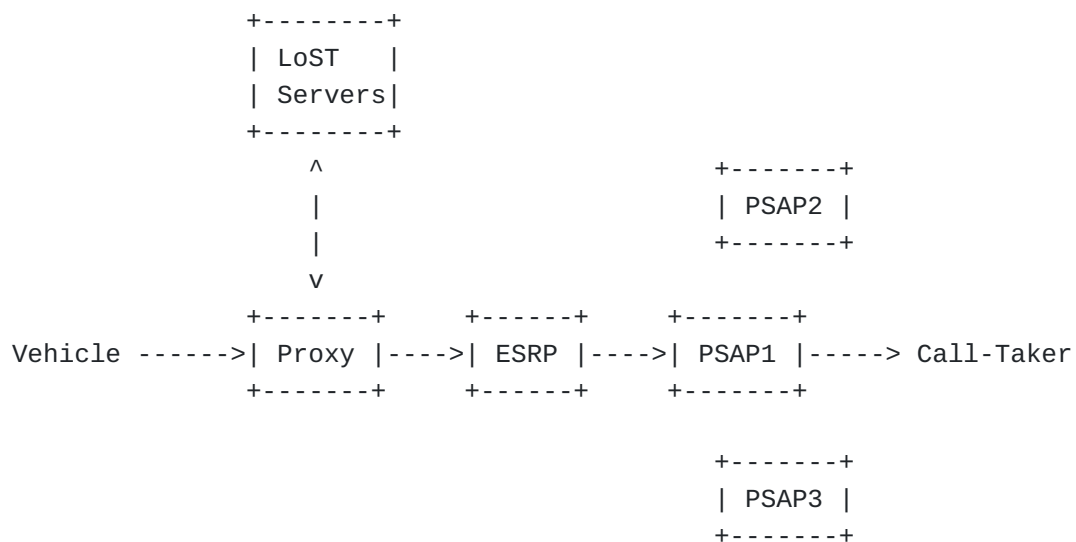
Figure 1: Example of In-Vehicular Emergency Call Message Flow

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The following example, in Figure 2 (Example of In-Vehicular Emergency Call Message Flow), 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   TOC

This document does not raise security considerations beyond those
described in [10] (Taylor, T., Tschofenig, H., Schulzrinne, H., and M.
Shanmugam, "Security Threats and Requirements for Emergency Call
Marking and Mapping," January 2008.). 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]
(Tschofenig, H., Schulzrinne, H., and B. Aboba, "Trustworthy Location

Information," March 2010.) for a discussion of some of these
vulnerabilities.

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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] (Schulzrinne,
H., "A Uniform Resource Name (URN) for Emergency and Other Well-Known
Services," January 2008.).

> **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.

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8. Acknowledgements

We would like to thank Michael Montag, Arnoud van Wijk, and Gunnar
Hellström for their feedback.

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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.

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10. References   [TOC]

10.1. Normative References
[TOC]

[1]	Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels," BCP 14, RFC 2119, March 1997 (TXT, HTML, XML).
[2]	Rosen, B. and J. Polk, "Best Current Practice for Communications Services in support of Emergency Calling," draft-ietf-ecrit-phonebcp-14 (work in progress), January 2010 (TXT).
[3]	Peterson, J., "A Presence-based GEOPRIV Location Object Format," RFC 4119, December 2005 (TXT).
[4]	Polk, J. and B. Rosen, "Location Conveyance for the Session Initiation Protocol," draft-ietf-sipcore-location-conveyance-02 (work in progress), February 2010 (TXT).
[5]	Rosenberg, J., Schulzrinne, H., and P. Kyzivat, "Caller Preferences for the Session Initiation Protocol (SIP)," RFC 3841, August 2004 (TXT).
[6]	Winterbottom, J., Thomson, M., and H. Tschofenig, "GEOPRIV Presence Information Data Format Location Object (PIDF-LO) Usage Clarification, Considerations, and Recommendations," RFC 5491, March 2009 (TXT).
[7]	Schulzrinne, H., Singh, V., Tschofenig, H., and M. Thomson, "Dynamic Extensions to the Presence Information Data Format Location Object (PIDF-LO)," draft-singh-geopriv-pidf-lo-dynamic-09 (work in progress), March 2010 (TXT).
[8]	Schulzrinne, H., "A Uniform Resource Name (URN) for Emergency and Other Well-Known Services," RFC 5031, January 2008 (TXT).

10.2. Informative references
[TOC]

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

| [10] | Taylor, T., Tschofenig, H., Schulzrinne, H., and M. Shanmugam, "Security Threats and Requirements for Emergency Call Marking and Mapping," RFC 5069, January 2008 (TXT). |
| [11] | Tschofenig, H., Schulzrinne, H., and B. Aboba, "Trustworthy Location Information," draft-tschofenig-ecrit-trustworthy-location-03 (work in progress), March 2010 (TXT). |

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