                        A Routing Request Extension for
               the HTTP-Enabled Location Delivery (HELD) Protocol

Abstract

   For cases where location servers have access to emergency routing
   information, they are able to return routing information with the
   location information if the location request includes a request for
   the desired routing information. This document specifies an
   extension to the HTTP-Enabled Location Delivery (HELD) protocol that
   updates RFC 5985 to support this function. Allowing location and
   routing information to be acquired in a single request response
   exchange updates RFC 6881, as current location acquisition and route
   determination procedures are separate operations.

Copyright Notice

Table of Contents

1. Introduction

   The general Emergency Context Resolution with Internet Technology
   (ECRIT) calling models described in [RFC6443] and [RFC6881] require a
   local Location-to-Service Translation (LoST) server or network of
   forest guides in order to determine the address of the Public Safety
   Answering Point (PSAP) in the best position to handle a call.
   Networks of forest guides have not materialized and while PSAPs are
   moving towards IP networks, LoST server deployment is not ubiquitous.
   Some regions and countries have expressed reluctance to deploy LoST
   servers making aspects of the current ECRIT architecture hard to
   realize.

   To address regulatory requirements, such as [M493], evolving
   architectures in Europe couple location and routing information in
   the access network while using a softswitch-centric approach to
   emergency call processing. This document describes an extension to
   the HELD protocol [RFC5985], so that a location information server
   can provide emergency routing information in the absence of a LoST
   server or network of forest guides.

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 [RFC2119].

   The terms "Location Information Server (LIS)", "Emergency Services
   Routing Proxy (ESRP)", "Voice Service Provider (VSP)", and "Public
   Safety Answering Point (PSAP)" are used as defined in [RFC6443].

   The term "Access Network Provider" is used as defined in [RFC5687]
   and encompasses both the Internet Access Provider (IAP) and Internet
   Service Provider (ISP).

   The term "forest guide" is used as defined in [RFC5582].

3. Motivation

   The Internet emergency calling architecture specified in [RFC6881]
   describes two main models for emergency call processing. The first
   is a device-centric model, where a device obtains location
   information using a location configuration protocol, such as HELD
   [RFC5985], and then proceeds to determine the address of the next hop
   closer to the local PSAP using LoST [RFC5222]. Figure 1 shows this
   model in a simplified form.

```
        +---Location Request---+
        |          (1)         |
  +---+----+              +---V---+
  |        |<--Location--|  LIS  |
  | Caller |    (2)       +-------+              +--------+
  |        |                                    | ESRP/  |
  |        |----Find Service-------+            |  PSAP  |
  +------^-+      (3)              |            +--------+
      |   |                +--------V----+           ^
      |   +-----Service----| LoST Server |           |
      |         (4)        +-------------+        +---+---+
      +-------------Call Initiation------------>|  VSP  |
                     (5)                          +-------+
```
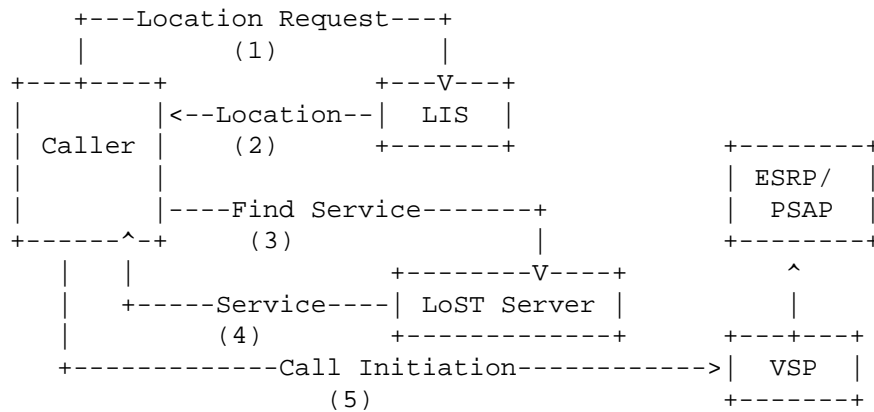
              Figure 1: Device-Centric Emergency Services Model

   The second approach is a softswitch-centric model, where a device
   initiates an emergency call, and the serving softswitch detects that
   the call is an emergency and initiates retrieving the caller's
   location from a LIS using HELD [RFC5985] with identity extensions
   [RFC6155] [RFC6915] and then determines the route to the local PSAP
   using LoST [RFC5222]. Figure 2 shows the high-level protocol
   interactions.

```
                        +---Location Request---+
                        |          (2)         |
                   +---V---+                    |
                   |  LIS  |                    |
                   +----+--+            +----+----+
                        |               |    |    |
                        +----Location--->| Soft-  |
   +--------+                 (3)        | switch |
   | Caller |------Call Initiation------------>   |    |
   +--------+          (1)               +-+-^---+-+
              +-------------+              | |   |
              | LoST Server |<-Find Service--+ |   |
              +------+------+      (4)        | |   |
                     |                        | |   |
                     +---------Service--------+   |
                             (5)                  |
              +-----------+                        |
              | ESRP/PSAP |<------Call----+
              +-----------+      (6)
```
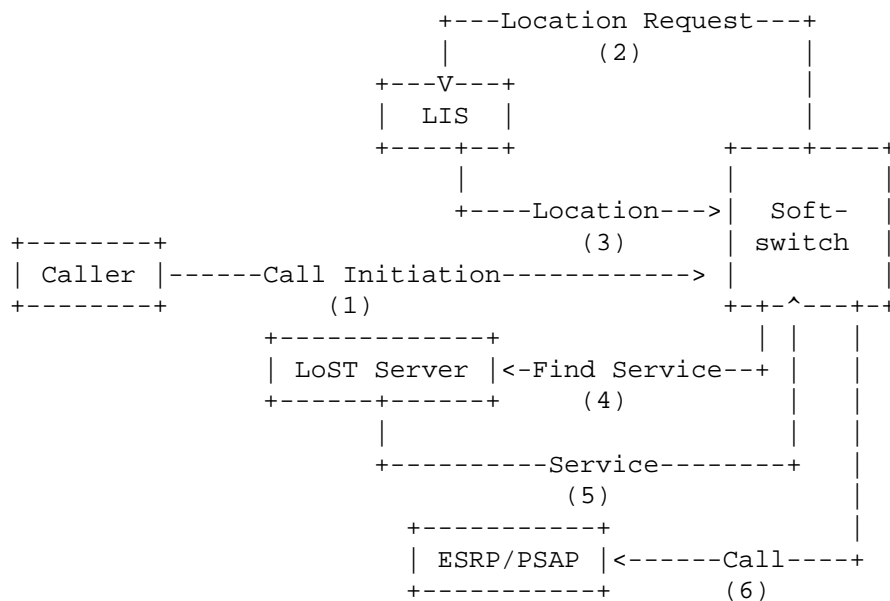
                Figure 2: Softswitch-Centric Calling Model

In the softswitch-centric model, when a VSP receives an emergency
call, it performs two tasks. The first task is to determine the
correct LIS to ask for location information; this is done using a
combination of reverse DNS lookup described in [RFC7216] to acquire
the serving domain name and then using [RFC5986] to determine the LIS
URI. Once the location is obtained from the LIS, the VSP determines
the LoST server associated with the domain serving the caller and
queries it for the correct PSAP address.

LoST server discovery is a domain-based activity, similar to the LIS
discovery technique. However, unlike the LIS that is a domain-bound
service, a LoST server is a geographically bound service. This means
that for a domain that spans multiple geographic regions, the LoST
server determined may not be able to provide a route to the necessary
PSAP. When this occurs, the contacted LoST server invokes the help
of other LoST servers, and this requires the deployment of forest
guides.

At the time of writing, several countries have expressed a reluctance
to deploy public LoST servers. In countries amenable to the use of
LoST and forest guides, no public forest guides have been deployed.
There appears to be little interest from the public sector in
establishing a global forest-guide network. These issues pose
threats to the ability of both the device-centric and the softswitch-
centric calling approaches to operate everywhere.

The device-centric and softswitch-centric calling models both involve
the notion of a LIS bound to the serving access network. In many
cases, the LIS already knows the destination PSAP URI for any given
location. In [RFC6881], for example, the LIS validates civic
locations using a location validation procedure based on the LoST
protocol [RFC5222]. The LoST validation request is similar to a LoST
routing request and provides the LIS with the same PSAP routing
information that a routing request would. In other cases, the LIS
knows the correct PSAP for a given location at provisioning time, or
the access network might always route to the same emergency provider.
Irrespective of the way in which the LIS learns the PSAP URI for a
location, the LIS will, in a great many cases, already have this
information.

This document specifies an extension to the HELD protocol, so that
emergency routing information can be requested from the LIS at the
same time that location information is requested. This document
updates [RFC6881] by requiring devices and softswitches that
understand this specification to always request routing information
to avoid the risk of query failure where no LoST server or forest-
guide network is deployed.

3.1. LoST Reuse Considerations

   The LoST protocol [RFC5222] defines a <mapping> element that
   describes a service region and associated service URLs. Reusing this
   element from LoST to provide the routing URIs was considered.
   However, this would have meant that several of the mandatory
   components in the <mapping> element would have had to contain
   ambiguous or misleading values. Specifically, the "source" attribute
   is required to contain a LoST application-unique string for the
   authoritative server. However, in the situations described in this
   specification, there may not be an authoritative LoST server, so any
   value put into this attribute would be misleading. In addition to
   this, routing information received in the manner described in this
   specification should not be cached by the receiver, so detailing when
   the routing information expires or was last updated is irrelevant.

4. Mechanism

   The mechanism consists of adding an element to the HELD
   locationRequest and an element to the locationResponse.

   The request element indicates that the requestor wants the LIS to
   provide routing information based on the location of the end device.
   If the routing request is sent with no attribute, then URIs for
   urn:service:sos are returned. If the requestor wants routing
   information for a specific service, then they may include an optional
   service URN. This service MUST exist in the IANA "Service URN
   Labels" repository created by [RFC5031]. If a service is specified,
   and the LIS does not understand the requested service, then URIs for
   urn:service:sos are returned.

   If the LIS understands the routing request and has routing
   information for the location, then it includes the information in a
   routingInformation element returned in the locationResponse. How the
   LIS obtains this information is left to implementation.
   Possibilities are described in Section 3.

   A LIS that does not understand the routing request element ignores it
   and returns the location information in the normal manner.

   A LIS that does support the routing request element MUST support
   returning URIs for urn:service:sos and any regionally defined sub-
   services while following the URN traversal rules defined in
   [RFC5031].

A LIS that does understand the routing request element but can't
obtain any routing information for the end-device's location MUST set
the defaultRoute attribute to "true" and return a default PSAP or
gateway URI along with the determined location information in the
locationResponse.

A LIS that understands the routing request element but not the
specified service URN MUST follow the URN traversal rules defined in
[RFC5031].

A LIS that receives a request for emergency routing information that
it understands MUST return the correct emergency routing information
if it has or is able to acquire the routing information for the
location of the target device.

The routing information in the location response consists of a
service element identified by a service name. The service name is a
URN and might contain a general emergency service URN such as
urn:service:sos or a specific service URN depending on what was
requested and what the LIS is able to provide. A list of one or more
service destinations is provided for the service name. Each
destination is expressed as a URI, and each URI scheme should only
appear once in this list. The routing URIs are intended to be used
at the time they are received. To avoid any risks of using stale
routing URIs, the values MUST NOT be cached by the receiving entity.

5. Modification to Phone BCP

   This section describes the normative updates to Phone BCP [RFC6881].

   It is important for devices and intermediaries to take all steps
   possible to ensure that emergency calls are routed to the correct
   PSAP. An alternative to providing routing information via global
   forest guides or local LoST servers is for local networks to
   configure the PSAP address information in the network location
   server. This specification updates Phone BCP [RFC6881] to provide
   this option. The update requires devices and intermediaries using
   the HELD protocol to always include the HELD routing extension. If
   the LIS is configured with the routing information, it can provide
   it; if it is not, then the device or intermediary tries LoST to
   acquire the PSAP URI.

   Section 6.5 of [RFC6881] defines "End System Location Configuration".
   Requirement ED-23/INT-18/SP-14 is updated when HELD is used as the
   Location Configuration Protocol (LCP) such that "the request MUST
   include the requestRoutingInformation element." The remainder of the
   requirement remains unchanged.

This document adds a new requirement to Section 7 of [RFC6881].

"ED-51a : Endpoints MUST support the HELD requestRoutingInformation
element and be able to interpret and use any routing information
returned in the locationResponse."

This document adds two new requirements to Section 8 of [RFC6881].

"ED-52a : Endpoints that acquire routing information in a HELD
locationResponse SHOULD use this routing information but MAY perform
a LoST findService request if they have a location value."

"ED-52b : Endpoints that acquire routing information in a HELD
locationResponse with a defaultRoute attribute of "true" MUST perform
a LoST findService request if they have a location value. If a route
is provided by the LoST server, then this route MUST be used,
otherwise the routing information provided in the HELD response
SHOULD be used."

This document amends SP-26 from Section 8 of [RFC6881] such that a
LoST mapping need not be requested if non-default routing information
is provided in the HELD locationResponse.

6. HELD Schema Extension

This section describes the schema extension to HELD.

```
<?xml version="1.0"?>
<xs:schema
  targetNamespace="urn:ietf:params:xml:ns:geopriv:held:ri"
  xmlns:xs="http://www.w3.org/2001/XMLSchema"
  xmlns:ri="urn:ietf:params:xml:ns:geopriv:held:ri"
  xmlns:xml="http://www.w3.org/XML/1998/namespace"
  elementFormDefault="qualified" attributeFormDefault="unqualified">

  <xs:element name="requestRoutingInformation">
     <xs:complexType name="empty">
        <xs:attribute name="service" type="xs:anyUri"
            use="optional" default="urn:service:sos"/>
     </xs:complexType>
  </xs:element>

  <xs:complexType name="service">
     <xs:complexContent>
       <xs:restriction base="xs:anyType">
```

```
        <xs:sequence>
          <xs:element name="dest" type="xs:anyURI"
              maxOccurs="unbounded"/>
          <xs:any namespace="##other" processContents="lax"
                minOccurs="0" maxOccurs="unbounded"/>
        </xs:sequence>
        <xs:attribute name="defaultRoute" type="xs:boolean"
                    use="optional" default="false"/>
        <xs:attribute name="serviceUri" type="xs:anyURI"
                    use="required"/>
        <xs:anyAttribute namespace="##any" processContents="lax"/>
      </xs:restriction>
    </xs:complexContent>
  </xs:complexType>

  <xs:element name="routingInformation" type="ri:riType"/>

  <xs:complexType name="riType">
    <xs:complexContent>
      <xs:restriction base="xs:anyType">
        <xs:sequence>
          <xs:element name="service" type="ri:service"/>
          <xs:any namespace="##other" processContents="lax"
                minOccurs="0" maxOccurs="unbounded"/>
        </xs:sequence>
        <xs:anyAttribute namespace="##any" processContents="lax"/>
      </xs:restriction>
    </xs:complexContent>
  </xs:complexType>

</xs:schema>
```

7. Examples

   Figure 3 illustrates a <locationRequest> example that contains IP
   flow information in the request.

```
<locationRequest xmlns="urn:ietf:params:xml:ns:geopriv:held"
                 responseTime="emergencyRouting">

  <requestRoutingInformation
     xmlns="urn:ietf:params:xml:ns:geopriv:held:ri"/>

  <flow xmlns="urn:ietf:params:xml:ns:geopriv:held:flow"
          layer4="tcp" layer3="ipv4">
    <src>
      <address>192.0.2.12</address>
      <port>1024</port>
    </src>
    <dst>
      <address>192.0.2.195</address>
      <port>80</port>
    </dst>
  </flow>
</locationRequest>
```

                   Figure 3: Example Location Request

Figure 4 illustrates the <locationResponse> message containing two
location URIs: an HTTPS and a SIP URI. Additionally, the response
contains routing information.

```
<locationResponse xmlns="urn:ietf:params:xml:ns:geopriv:held">
  <locationUriSet expires="2006-01-01T13:00:00.0Z">
    <locationURI>
               https://ls.example.com:9768/357yc6s64ceyoiuy5ax3o
       </locationURI>
    <locationURI>
               sip:9769+357yc6s64ceyoiuy5ax3o@ls.example.com
    </locationURI>
  </locationUriSet>

  <routingInformation
      xmlns="urn:ietf:params:xml:ns:geopriv:held:ri">
    <service serviceUri="urn:service:sos">
      <dest>sip:112@example.com</dest>
      <dest>sips:112@example.com</dest>
      <dest>xmpp:112@example.com</dest>
    </service>
  </routingInformation>

</locationResponse>
```

                   Figure 4: Example Location Response

Figure 5 illustrates the <locationResponse> message containing
default routing information and an HTTPS location URI.

```
<locationResponse xmlns="urn:ietf:params:xml:ns:geopriv:held">
   <locationUriSet expires="2016-01-01T13:00:00.0Z">
      <locationURI>
            https://ls.example.com:9768/357yc6s64ceyoiuy5ax3o
         </locationURI>
   </locationUriSet>

   <routingInformation
         xmlns="urn:ietf:params:xml:ns:geopriv:held:ri">
      <service defaultRoute="true" serviceUri="urn:service:sos">
         <dest>sip:112@example.com</dest>
         <dest>sips:112@example.com</dest>
         <dest>xmpp:112@example.com</dest>
      </service>
   </routingInformation>

</locationResponse>
```

Figure 5: Example Location Response with Default Routing Information

8. Privacy Considerations

   This document makes no changes that require privacy considerations
   beyond those already described in [RFC5985]. It does, however,
   extend those described in [RFC6155].

   [RFC5985] describes the privacy considerations surrounding the HELD
   location configuration protocol, and this document makes no specific
   changes to these considerations.

   [RFC6155] extends HELD beyond a simple LCP by enabling authorized
   third parties to acquire location information and describing the
   issues in Section 4. The HELD routing extension supports returning
   URIs that represent specific services operating in the Target's
   vicinity. This represents additional information about the Target;
   as a consequence, it is recommended that this option only be used
   when the LIS returns a location URI, not a location value.

9. Security Considerations

   This document imposes no additional security considerations beyond
   those already described in [RFC5985] and [RFC6155].

10. IANA Considerations

10.1. URN Sub-Namespace Registration for
       'urn:ietf:params:xml:ns:geopriv:held:ri'

   Per this document, IANA has registered a new XML namespace, following
   the guidelines in [RFC3688].

   URI: urn:ietf:params:xml:ns:geopriv:held:ri

   Registrant Contact: IETF ECRIT working group (ecrit@ietf.org),
      James Winterbottom (a.james.winterbottom@gmail.com).

   XML:

   BEGIN
    <?xml version="1.0"?>
    <!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Strict//EN"
     "http://www.w3.org/TR/xhtml1/DTD/xhtml1-strict.dtd">
    <html xmlns="http://www.w3.org/1999/xhtml" xml:lang="en">
     <head>
       <title>HELD Routing Information Extensions</title>
     </head>
     <body>
      <h1>Additional Element for HELD Routing Information</h1>
      <h2>urn:ietf:params:xml:ns:geopriv:held:ri</h2>
      <p>See
         RFC 7840.</p>
     </body>
    </html>
   END

10.2. XML Schema Registration

   This section registers an XML schema as per the procedures in
   [RFC3688].

   URI: urn:ietf:params:xml:schema:geopriv:held:ri

   Registrant Contact: IETF ECRIT working group (ecrit@ietf.org),
      James Winterbottom (a.james.winterbottom@gmail.com).

   XML: The XML for this schema can be found as the entirety of
      Section 6 of this document.

11. References

11.1. Normative References

   [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate
              Requirement Levels", BCP 14, RFC 2119,
              DOI 10.17487/RFC2119, March 1997,
              <http://www.rfc-editor.org/info/rfc2119>.

   [RFC5985] Barnes, M., Ed., "HTTP-Enabled Location Delivery (HELD)",
              RFC 5985, DOI 10.17487/RFC5985, September 2010,
              <http://www.rfc-editor.org/info/rfc5985>.

   [RFC6881] Rosen, B. and J. Polk, "Best Current Practice for
              Communications Services in Support of Emergency Calling",
              BCP 181, RFC 6881, DOI 10.17487/RFC6881, March 2013,
              <http://www.rfc-editor.org/info/rfc6881>.

11.2. Informative References

   [M493]   European Telecommunications Standards Institute,
              "Functional architecture to support European requirements
              on emergency caller location determination and transport",
              ES 203 178, V1.1.1, February 2015.

   [RFC3688] Mealling, M., "The IETF XML Registry", BCP 81, RFC 3688,
              DOI 10.17487/RFC3688, January 2004,
              <http://www.rfc-editor.org/info/rfc3688>.

   [RFC5031] Schulzrinne, H., "A Uniform Resource Name (URN) for
              Emergency and Other Well-Known Services", RFC 5031,
              DOI 10.17487/RFC5031, January 2008,
              <http://www.rfc-editor.org/info/rfc5031>.

   [RFC5222] Hardie, T., Newton, A., Schulzrinne, H., and H.
              Tschofenig, "LoST: A Location-to-Service Translation
              Protocol", RFC 5222, DOI 10.17487/RFC5222, August 2008,
              <http://www.rfc-editor.org/info/rfc5222>.

   [RFC5582] Schulzrinne, H., "Location-to-URL Mapping Architecture and
              Framework", RFC 5582, DOI 10.17487/RFC5582, September
              2009, <http://www.rfc-editor.org/info/rfc5582>.

   [RFC5687] Tschofenig, H. and H. Schulzrinne, "GEOPRIV Layer 7
              Location Configuration Protocol: Problem Statement and
              Requirements", RFC 5687, DOI 10.17487/RFC5687, March 2010,
              <http://www.rfc-editor.org/info/rfc5687>.

   [RFC5986] Thomson, M. and J. Winterbottom, "Discovering the Local
              Location Information Server (LIS)", RFC 5986,
              DOI 10.17487/RFC5986, September 2010,
              <http://www.rfc-editor.org/info/rfc5986>.

   [RFC6155] Winterbottom, J., Thomson, M., Tschofenig, H., and R.
              Barnes, "Use of Device Identity in HTTP-Enabled Location
              Delivery (HELD)", RFC 6155, DOI 10.17487/RFC6155, March
              2011, <http://www.rfc-editor.org/info/rfc6155>.

   [RFC6443] Rosen, B., Schulzrinne, H., Polk, J., and A. Newton,
              "Framework for Emergency Calling Using Internet
              Multimedia", RFC 6443, DOI 10.17487/RFC6443, December
              2011, <http://www.rfc-editor.org/info/rfc6443>.

   [RFC6915] Bellis, R., "Flow Identity Extension for HTTP-Enabled
              Location Delivery (HELD)", RFC 6915, DOI 10.17487/RFC6915,
              April 2013, <http://www.rfc-editor.org/info/rfc6915>.

   [RFC7216] Thomson, M. and R. Bellis, "Location Information Server
              (LIS) Discovery Using IP Addresses and Reverse DNS",
              RFC 7216, DOI 10.17487/RFC7216, April 2014,
              <http://www.rfc-editor.org/info/rfc7216>.

Acknowledgements

Authors' Addresses

   James Winterbottom
   Winterb Consulting Services
   Gwynneville, NSW 2500
   Australia

   Phone: +61 448 266004
   Email: a.james.winterbottom@gmail.com

   Hannes Tschofenig
   Hall in Tirol 6060
   Austria

   Email: Hannes.Tschofenig@gmx.net
   URI: http://www.tschofenig.priv.at

   Laura Liess
   Deutsche Telekom Networks
   Deutsche Telekom Allee 7
   Darmstadt, Hessen 64295
   Germany

   Email: L.Liess@telekom.de
   URI: http://www.telekom.de