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ECRIT Mapping During Session Initiation Protocol Registration  
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Abstract

This document discusses four different Layer-7 options to solve the problem of getting the appropriate Public Safety Answering Point (PSAP) Session Initiation Protocol (SIP) Uniform Resource Identifier (URI) into an emergency calling capable device prior to it's user calling for help.

## Table of Contents

<a href="#">1.</a>	Introduction . . . . .	<a href="#">2</a>
<a href="#">1.1</a>	Conventions used in this document . . . . .	<a href="#">3</a>
<a href="#">2.</a>	Options for Layer-7 Mapping Prior to Emergency Call . . . . .	<a href="#">3</a>
<a href="#">3.</a>	Requirements on Transaction to Learn PSAP-URI at Layer-7 . . . . .	<a href="#">4</a>
<a href="#">4.</a>	Basic Assumptions About Location . . . . .	<a href="#">5</a>
<a href="#">5.</a>	Transaction Overview . . . . .	<a href="#">6</a>
<a href="#">6.</a>	Option #1 - SIP REGISTER with a PSAP-URI Request Header . . . . .	<a href="#">6</a>
<a href="#">6.1</a>	New PSAP-URI Header in SIP . . . . .	<a href="#">6</a>
<a href="#">6.2</a>	Usage of PSAP-URI Header Field . . . . .	<a href="#">7</a>
<a href="#">6.3</a>	PSAP-URI Option Tag . . . . .	<a href="#">7</a>
<a href="#">6.4</a>	SIP Element Rules . . . . .	<a href="#">7</a>
<a href="#">7.</a>	Option #2 - SIP REGISTER with a new event package . . . . .	<a href="#">10</a>
<a href="#">8.</a>	Option #3 - UA Performs a HTTP Query to a Remote Server . . . . .	<a href="#">11</a>
<a href="#">9.</a>	Option #4 - SIP SUBSCRIBE With a New Event Packet . . . . .	<a href="#">11</a>
<a href="#">10.</a>	Examples of All Four Options . . . . .	<a href="#">11</a>
<a href="#">10.1</a>	Example of PSAP-URI Header Transaction . . . . .	<a href="#">11</a>
<a href="#">10.2</a>	Example of SIP REGISTER Event Package Transaction . . . . .	<a href="#">12</a>
<a href="#">10.3</a>	Example of HTTP Transaction . . . . .	<a href="#">13</a>
<a href="#">10.4</a>	Example of SIP SUBSCRIBE Event Package Transaction . . . . .	<a href="#">13</a>
<a href="#">11.</a>	IANA Considerations . . . . .	<a href="#">13</a>
<a href="#">12.</a>	Security Considerations . . . . .	<a href="#">13</a>
<a href="#">13.</a>	Acknowledgements . . . . .	<a href="#">13</a>
<a href="#">14.</a>	References . . . . .	<a href="#">13</a>
<a href="#">14.1</a>	Normative References . . . . .	<a href="#">13</a>
<a href="#">14.2</a>	Informative References . . . . .	<a href="#">14</a>
	Author's Address . . . . .	<a href="#">14</a>
	Intellectual Property and Copyright Statements . . . . .	<a href="#">15</a>

[1.](#) Introduction

ECRIT Requirements [[ID-ECRIT-REQS](#)] are defining how a emergency capable device requests a binding of a given location in the form of a Presence Information Data Format Location Object (PIDF-L0) [[RFC4119](#)] to a SIP(S)-URI of the appropriate PSAP for that location. [[ID-SOS](#)] defines how a voice call can be identified as an emergency cell set-up message within SIP.

The prevalent model most are working towards is that a user of a SIP user agent (UA) enters a designated (locally, perhaps by law) dialstring into the entry point of said UA, which recognizes this as a locally significant emergency dialstring. Both [[ID-DHC-DIAL](#)] and [[ID-ECRIT-DIAL](#)] provide means that this can be learned from the UA's location at different layers of the network during boot-up time, as well as the UA likely being configured with an appropriate 'home' dialstring the user will have learned from society. For example, in North America the dialstring would be '9-1-1', and it is '9-9-9' in the United Kingdom.

Polk

Expires August 27th, 2006

[Page 2]

---

Internet-Draft

ECRIT Fallback Mapping at Layer-7

Feb 2006

Once the caller enters the appropriate dialstring, the UA sends a specially formed SIP INVITE message with a Request-URI of "urn:service:sos" and includes the location of the UA. Within the network, a SIP server, called an Emergency Services Proxy Server (ESRP) will be the first to understand the concept of emergency calling, and provide a unique routing action with this message. The ESRP will query a remote server with the ECRIT Mapping protocol, yet to be defined, but scoped in [[ID-ECRIT-REQS](#)]. This is ECRIT mapping protocol will return the appropriate PSAP SIP(S)-URI to be placed into this emergency message for routing to the PSAP.

A few have questioned if this is the best time to rely on this Location-to-PSAP routing decision. What if the mapping function fails, what happens to the INVITE message?

[[ID-DHC-URI](#)] defines how a user agent can learn the appropriate PSAP-URI well before the emergency call is placed by the user. Some want the mapping function to have the freshest information. This is ideal, with no doubt. But there are always failures in systems, this document discusses one alternative time in which a UA can learn its PSAP-URI.

For the purposes of clarity, throughout this document the acronyms PSAP SIP(S)-URI and PSAP-URI mean the same thing. The intention is addressing the SIP INVITE with a Request-URI or a (loose) Route header that is destined for the network local to the appropriate PSAP.

[[ID-MAPPING](#)] provides several scenarios in which this location-to-PSAP-URI mapping can occur, and the ideal situation is that the mapping can occur in all the scenarios and not conflict. This is to

show that mapping should be done before an emergency call takes place, as well as during the emergency call. The former transaction provides a fallback mapping result that can be used at any time there is a failure in the primary ECRIT mapping function during the call, without having to send an error back to the UA. The UA may not know what to do with an error of this kind.

### 1.1 Conventions used in this document

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](#)].

## 2. Options for Layer-7 Mapping Prior to Emergency Call

There are four options discussed in this document for how a PSAP-URI can be obtained by a SIP user agent during, or soon after device

Polk

Expires August 27th, 2006

[Page 3]

---

Internet-Draft

ECRIT Fallback Mapping at Layer-7

Feb 2006

registration:

Option #1 - SIP REGISTER with a header in the request

Option #2 - SIP REGISTER with a new event package

Option #3 - UA performs a HTTP Query to a remote server

Option #4 - SIP SUBSCRIBE with a new event packet

The advantages of placing this function in a SIP REGISTER message is that it travels with the device configuration. Meaning the UA would learn of this information at boot time, with appropriate indicators to tell the UA when the Registrar can and cannot perform this task.

Using a new event package creates more flexibility in what information can be provided lateral to the PSAP-URI, for example:

- a service-identifier type of PSAP-URI
- indicating if this is the primary or secondary URI PSAP target

The type of PSAP-URI is important in those countries that today have

more than one emergency dialstring; [[ID-SOS](#)] provides a list of service-id types. For example, in Switzerland, the dialstring '116' is used to contact the police, and '117' is used to contact the fire department. This capability is not available throughout the world, but it is important were it is available now; and may spread to other parts.

The ability to download a primary and secondary PSAP-URI means there is a fallback with this fallback idea. Given that in times of an emergency, preloading however many fallback routes is never a bad idea. But there will likely always be a primary coverage PSAP in any case, and this should be identifiable.

Constructing a request and response for a PSAP-URI is not really that hard, and neither is adding a cursory second piece of information to that URI, but there may be some security risks that some may not want to take on a open public network in transit to an emergency services network. Choosing one of the two ways in a SIP REGISTER Request is open for discussion.

Creating this capability in HTTP should be fairly straight forward, but there have been some issues raised lately that not all HTTP implementations are created equal, and this would force HTTP onto every UA that wanted this capability, which may not be the case, and may not be desired.

Here we talk about an HTTP server being any server running HTTP, and not a necessarily (any or all) traditional Web-server(s).

It is possible that the same, or a similar, event package could be used in a SIP SUBSCRIBE message as is suggested above for a REGISTER message.

### [3.](#) Requirements on Transaction to Learn PSAP-URI at Layer-7

The following are the requirements necessary for a UA to learn its PSAP-URI during a Layer-7 transaction:

Req#1 - A (SIP or HTTP) user agent MUST be able to indicate it requires an PSAP-URI during a transaction with a remote entity (i.e. a SIP Registrar or HTTP server).

- Req#2 - A (SIP or HTTP) user agent SHOULD be able to indicate it requires a secondary PSAP-URI during a transaction with a remote entity (i.e. SIP Registrar or HTTP a server).
- Req#3 - A user agent MUST its location in a PIDF-LO by-reference or by-value in the request for a PSAP-URI. By-value is RECOMMENDED as a dereference transaction can also fail.
- Req#4 - A (SIP or HTTP) user agent SHOULD be able to indicate which service-id type of PSAP-URI it is seeking during a transaction with a remote entity (i.e. only police or only fire).
- Req#5 - A (SIP or HTTP) user agent SHOULD be able to indicate more than one service-id type of PSAP-URI it is seeking during a transaction with a remote entity (i.e. to a general request, respond with all that apply in that location/country).
- Req#6 - A server node (SIP Registrar Server or server running HTTP) MUST recognize a request for a PSAP-URI from a UA, understand to look for the UA's location within the message, then perform an ECRIT Mapping function (query) to learn the appropriate URI for that location.
- Req#7 - A server node (SIP Registrar or HTTP Server) MUST be able to respond with one or more PSAP-URI's for that location, including indicating the service-id type of URI each is in the response of a transaction with the user agent.
- Req#8 - A user agent MUST be able to request and update existing information at any time the device can contact the server.

#### [4.](#) Basic Assumptions About Location

One basic assumption has to be made here: the UA knows its location, either by-value or by-reference. Without this knowledge, any request for the appropriate PSAP-URI would not yield a valid answer,

because there is such a list to choose from. This document does not discuss how the UA was sent, retrieved or knows its location; just that it has to know where it is, at least at a country level, in order to expect a server to plausibly be able to answer this request for information.

## 5. Transaction Overview

Here is the basic message flow of this transaction, regardless of which of the four options are chosen:

Here Alice is registering to a (SIP or HTTP) server.

Alice                                      SIP or HTTP Server

```
[M1] Request
----->
[M2] Response
<-----
```

From a "where in the request is the request indication for the PSAP-URI"? It does not matter from a messaging point of view. The request indication could be in a Header or a new event package message body. The event package could be different for what goes in a SIP REGISTER and SUBSCRIBE Request, the transaction looks the same. It also looks similar to an HTTP transaction, even if the message body is different.

The key facet of the request is two-fold:

- That the message contains location by-value or by-reference, and
- That the message requests what it seeks

This message MAY be at device boot time in each of these messages, or it MAY be after device boot time with any of these messages.

## 6. Option #1 - SIP REGISTER with a PSAP-URI Request Header

### 6.1 New PSAP-URI Header in SIP

Communicating the primary or secondary PSAP-URI in a request or response can be accomplished with a new header. The PSAP-URI header would have the following syntax (The "token-nodot" production is copied from [[RFC3265](#)]):

```
PSAP-URI           = "PSAP-URI " HCOLON PSAP-URI-value *(COMMA
                        PSAP-URI-value)
PSAP-URI-value     = (absoluteURI / option-tag)
option-tag         = string
```

service-id = string

NOTE: we aren't sure this BNF is correct. The goal is to get this Result as a Request:

```
PSAP-URI: <psap-uri; service-id=primary>,
          <psap-uri; service-id=secondary>,
          <psap-uri; service-id=police>,
          <psap-uri; service-id=fire>
```

And this result in a Response:

```
PSAP-URI: <sip:psap1.colleyville.tarrant.tx.us.sos.arpa;
          service-id=primary>
```

## 6.2 Usage of PSAP-URI Header Field

The following table extends the values in Tables 2&3 of [RFC 3261](#) [[RFC3261](#)].

Header field		where proxy	INV	ACK	CAN	BYE	REG	OPT	PRA
PSAP-URI	Rr		-	-	-	-	o	o	-

  

Header field		where proxy	SUB	NOT	UPD	MSG	REF	INF	PUB
PSAP-URI	Rr		o	o	o	o	-	o	-

This header is opaque to proxy servers. It has optional usage in the REG [[RFC3261](#)], OPT [[RFC3261](#)], SUB/NOT [[RFC3265](#)], UPD [[RFC3311](#)], INF [[RFC2976](#)] and MSG [[RFC3428](#)].

## 6.3 PSAP-URI Option Tag

This document creates a new option tag "psap-uri" to be used in Requires, Supported and Unsupported headers in SIP between compliant SIP elements of this extension. At this time, the authors do not see any need for this option tag to be placed in the Proxy-Requires header, as this extension should be opaque to proxies and merely propagated by B2BUAs. This option tag will be IANA registered.

## 6.4 SIP Element Rules

Here are the behaviors of the relevant SIP elements within this operation. This SIP extension is opaque to SIP Proxies, SHOULD be



copied unchanged from receiving request to transmitted request by B2BUAs and SBCs.

Polk

Expires August 27th, 2006

[Page 7]

---

Internet-Draft

ECRIT Fallback Mapping at Layer-7

Feb 2006

#### [6.4.1](#) UAC Behavior with PSAP-URI Header Option

A UAC wanting an appropriate PSAP-URI be returned during registration process will do the following:

- The UAC SHOULD include psap-uri Option-tag in a Requires header, but MAY include option-tag in Supported header to prevent initial 420 if Registrar doesn't understand this extension.
- The UAC MUST include location in the REGISTER Request message, by-value is RECOMMENDED, but MAY send location by-reference in Location header [[ID-SIP-LOC](#)].
- The UAC SHOULD include a Location header in the request, with a cid indication of where location is in the message body, even if there is only one message body part.
- If the UAC has its location by-reference URI, it MUST include this in the Location header of the REGISTER request, unless location by-value is included. Both MUST NOT be included in the same message.
- A UAC requesting an PSAP-URI MUST expect to receive a server identifier in the response.
- The UAC SHOULD use S/MIME to protect the PIDF-LO for e2e confidentiality.
- The UAC MUST use TLS or IPSec for hop-by-hop confidentiality.
- A UAC MAY request this PSAP-URI with every REGISTER Request, include a refresh, to ensure it has the freshest information.
- There may be more than one valid PSAP-URI for where the UAC is at the moment. The UAC MUST be prepared to receive more than one URI in the PSAP-URI header.

#### [6.4.2](#) Server Behavior with Emergency-Dialstring Header Option

A Registrar server understanding the concept of PSAP-URI will do the following:

- The Registrar MUST understand Emergency-Dialstring header and emergency-dialstring option-tag in a Supported or Requires header.
- If the Registrar does not understand the psap-uri option-tag in a Requires header, the Registrar MUST reject the message with a 420 (Bad Extension) Response, including the psap-uri option-tag in an Unsupported header.
- A Registrar MUST respond to an OPTIONS request with psap-uri

Polk

Expires August 27th, 2006

[Page 8]

---

Internet-Draft

ECRIT Fallback Mapping at Layer-7

Feb 2006

option-tag in a Supported header with the psap-uri option-tag in an Unsupported header.

- Having understood the request to perform an ECRIT Mapping Query for a PSAP-URI, the Registrar MUST look for location within the Request message to determine where the UAC is geographically, or contact another server, perhaps using another protocol, that can do this operation.
- The Registrar MUST look for the Location header in the Request message to indicate a location by-reference URI, or a cid value of where the location message body part is in the overall message body [[ID-SIP-LOC](#)].
- The Registrar MUST understand location by-reference, per [[ID-SIP-LOC](#)] and fetch the PIDF-LO from remote server to include the location of the UAC in the ECRIT Mapping Query.
- The Registrar MUST understand the content-type application/pidf+xml to properly parse the PIDF-LO fetched or from the by-value message body.
- The Registrar MUST understand all both parts of the PSAP-URI Header (i.e. also the service-ID part).
- A request for an PSAP-URI MUST include a service identifier in the response, with the default value being 'primary'.
- If more than one PSAP-URI is used or appropriate within the UAC's current location, more than one URI MUST be returned in the

PSAP-URI header, separated by a ',' (comma), with each URI partnered with the respective service identifier

- The Registrar MUST use TLS for hop-by-hop Confidentiality of these Transactions; IPsec usage is optional.
- The Registrar MUST adhere to the location retention and distribution rules set in the PIDF-LO [[RFC4119](#)].

### [6.4.3](#) Error Conditions with Emergency-Dialstring Header Option

#### [6.4.3.1](#) UAC Error Conditions

A user agent client, having included an PSAP-URI in a request message, receives an error response, will do the following:

- If the UAC receives a 420 (Bad Extension), if it placed the psap-uri option tag in a Requires header, it SHOULD resend the REGISTER request, but place the psap-uri option tag in a Supported header.

Polk

Expires August 27th, 2006

[Page 9]

---

Internet-Draft

ECRIT Fallback Mapping at Layer-7

Feb 2006

- If the UAC sent a REGISTER with an psap-uri option tag in a Requires header, and receives a 503 (Service Unavailable) from the Registrar with an psap-uri option tag in a Supported header, it knows the Registrar understood the request, but could not complete URI request. The UAC SHOULD retry registration with the psap-uri option tag in a Supported header.
- If the UAC receives a 415 (Unsupported Media type) from a Registrar to the content-type application/pidf+xml, the UAC SHOULD NOT attempt to send a PIDF-LO again to the Registrar, meaning the UAC cannot ask for its PSAP-URI from that SIP element.

#### [6.4.3.2](#) Registrar Error Conditions to Header

A Registrar server understanding the concept of PSAP-URIs will do the following:

- If the Registrar does not understand the psap-uri option tag in a Requires header, the proper response is a 420 (Bad Extension), including psap-uri

- If the Registrar does not understand the psap-uri option tag in a Supported header, the proper response is to convey a lack of support for the option tag by including this in the Unsupported header in the response message
- If the Registrar does not understand the content-type application/pidf+xml, the proper error response is a 415 (Unsupported Media type)
  - an Unsupported header MUST be in the 415, which includes this option tag
- If a Registrar server understands the concept of PSAP-URIs, and receives a request for an PSAP-URI from a UAC during registration in a Requires header, but for whatever reason cannot complete this part of the transaction, the server MUST return a 503 (Service Unavailable) response to the UAC. The Registrar MUST include the psap-uri option tag in a Supported header to indicate this part of the request was understood, but could not be performed at this time.

## 7. Option #2 - SIP REGISTER with a new event package

The creation of a new SIP REGISTER event package to request and respond with a psap-uri and service identifier in a request or response can be accomplished ...

This section to be completed soon

Polk

Expires August 27th, 2006

[Page 10]

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Internet-Draft

ECRIT Fallback Mapping at Layer-7

Feb 2006

[The authors did not have time prior to the submission cut-off to complete additional options to these requirements. We are sorry!]

## 8. Option #3 - UA Performs a HTTP Query to a Remote Server

The creation of a new HTTP Query to request and respond with a psap-uri and service identifier in a request or response can be accomplished ...

This section to be completed soon

[The authors did not have time prior to the submission cut-off to complete additional options to these requirements. We are sorry!]

## 9. Option #4 - SIP SUBSCRIBE With a New Event Packet

The creation of a new SIP SUBSCRIBE event package to request and respond with a psap-uri and service identifier in a request or response can be accomplished ...

This section to be completed soon

[The authors did not have time prior to the submission cut-off to complete additional options to these requirements. We are sorry!]

## 10. Examples of All Four Options

This section illustrates only one of the four options at this time. As soon as the event packages are completed in XML, they will be incorporated into the text here. However, if any of these options are not considered appropriate by the community, they will be dropped like a burning pan you didn't realize was hot before you picked it up.

Thank you for your patience...

### 10.1 Example of PSAP-URI Header Transaction

Here is Alice's modified registration transaction.

Alice	Registrar Server
[M1] REGISTER (with PIDF-LO, and Requires plus PSAP-URI header)	
----->	
[M2] 200 OK (with PSAP-URI header)	
<-----	

The following message are \*not\* well-formed.

[Message 1 - REGISTER from Alice to Registrar Server]

```
REGISTER registrar-server@example.com SIP/2.0
Via: Alice
To: Alice
From Alice
PSAP-URI: <psap-uri; service-id=primary>
Requires: psap-uri
Location: cid <foo>
Call-ID: 1
Content-type: application/pidf+xml
Content-Length: ...
```

```
cid <foo>
[PIDF-LO message body (not shown)]
```

[Message 2 - 200 OK from Registrar Server to Alice]

```
SIP/2.0 200 OK
Via: Alice
To: Alice
From Alice
PSAP-URI: <sip:psap1.colleyville.tarrant.tx.us.sos.arpa;
  service-id=primary>
Supported: psap-uri
Call-ID: 1
Content-Length: 0
```

Location is sent to the Registrar in the form of the [\[RFC 4119\]](#) PIDF-LO message body in the above example. The Registrar is the destination UAS of this message, so it can read all that is in the message, even if encrypted. The Registrar will generate a ECRIT Mapping Query to learn the PSAP-URI for this location (which is include in the Query). The (hopefully) positive results of the query will be sent to the UA in the 200 OK SIP response. At this point, Alice's UA has a PSAP-URI, which she may refresh at any time, to place (conceivably) in a (loose) Route header of the INVITE request message that is generated if and when Alice calls for emergency help. The exact placement of this URI in the INVITE has not reach consensus in the community, but this is the likely target header for it.

## [10.2](#) Example of SIP REGISTER Event Package Transaction

To be completed...

Internet-Draft

ECRIT Fallback Mapping at Layer-7

Feb 2006

### [10.3](#) Example of HTTP Transaction

To be completed...

### [10.4](#) Example of SIP SUBSCRIBE Event Package Transaction

To be completed...

## [11.](#) IANA Considerations

This document will make IANA Registrations when one or more of the four options to these requirements has been decided upon.

## [12.](#) Security Considerations

A concern with this extension (in its current form) is making sure the header field is not changed in transit between the Registrar server and the UAC, as this could start a chain of events to occur that will have a SIP INVITE fallback to the a bad PSAP-URI if the ESRP Mapping function failed. Therefore, message integrity is necessary. Normal SIP mechanisms, such as using TLS or IPSec for message transmissions, should suffice.

Message body confidentiality needs to be used to protect the PIDF-LO message body to adhere to location information retention and distribution rules. Normal SIP mechanisms, such as using TLS or IPSec for message transmissions, as well as S/MIME encryption of the message body, should suffice.

## [13.](#) Acknowledgements

Your name here

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Polk

Expires August 27th, 2006

[Page 13]

---

Internet-Draft

ECRIT Fallback Mapping at Layer-7

Feb 2006

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Polk

Expires August 27th, 2006

[Page 14]

---

Internet-Draft

ECRIT Fallback Mapping at Layer-7

Feb 2006

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