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Data-Only Emergency Calls
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Abstract

[RFC 6443](#) 'Framework for Emergency Calling Using Internet Multimedia' describes how devices use the Internet to place emergency calls and how Public Safety Answering Points (PSAPs) can handle Internet multimedia emergency calls natively. The exchange of multimedia traffic typically involves a SIP session establishment starting with a SIP INVITE that negotiates various parameters for that session.

In some cases, however, the transmission of application data is everything that is needed. Examples of such environments include a temperature sensors issuing alerts, or vehicles sending crash data. Often these alerts are conveyed as one-shot data transmissions and in some rare cases they may require a session to be established. These type of interactions are called 'data-only emergency calls'.

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Internet-Draft

Data-Only Emergency Calls

November 2012

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Table of Contents

1.	Introduction	3
2.	Terminology	4
3.	Architectural Overview	5
4.	Protocol Specification	8
4.1.	CAP Transport	8
4.2.	Profiling of the CAP Document Content	8
5.	Error Handling	10
5.1.	425 (Bad Alert Message) Response Code	10
5.2.	The AlertMsg-Error Header Field	10
6.	Example	13
7.	Security Considerations	15
8.	IANA Considerations	17
8.1.	Registration of the 'application/cap+xml' MIME type	17
8.2.	IANA Registration for 425 Response Code	18
8.3.	IANA Registration of New AlertMsg-Error Header Field	18
8.4.	IANA Registration for the SIP AlertMsg-Error Codes	19
9.	Acknowledgments	20
10.	References	21
10.1.	Normative References	21
10.2.	Informative References	21
	Authors' Addresses	23

Internet-Draft

Data-Only Emergency Calls

November 2012

1. Introduction

[RFC 6443](#) [[RFC6443](#)] describes how devices use the Internet to place emergency calls and how Public Safety Answering Points (PSAPs) can handle Internet multimedia emergency calls natively. The exchange of multimedia traffic typically involves a SIP session establishment starting with a SIP INVITE that negotiates various parameters for that session.

In some cases, however, there is only application data to be conveyed from the end devices to a PSAP or some other intermediary. Examples of such environments includes sensors issuing alerts, or vehicles sending crash data. These messages may be one-shot data transmissions (i.e., SIP message handling that requires no establishment of a session) and interactions where a sequence of messages are transmitted in which case a session setup is useful to ensure that all messages are indeed routed to the same PSAP. These type of interactions are called 'data-only emergency calls'.

Data-only emergency calls are nevertheless similar to regular emergency calls in the sense that they require the emergency indications, emergency call routing functionality and may even have the same location requirements. However, the communication interaction will not lead to the exchange of Real-Time Protocol packets, such as voice, video data or real-time text.

The Common Alerting Protocol (CAP) [[cap](#)] is a document format for exchanging emergency alerts and public warnings. CAP is mainly used for conveying alerts and warnings between authorities and from authorities to citizen/individuals.

This document uses the CAP payload to convey the semantic of a data-only emergency call. Note that further data may be added using the already available 'additional data' structure [[I-D.ietf-ecrit-additional-data](#)]. Whenever data can be encoded in the additional data structure it shall be used.

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 [RFC 2119](#) [[RFC2119](#)].

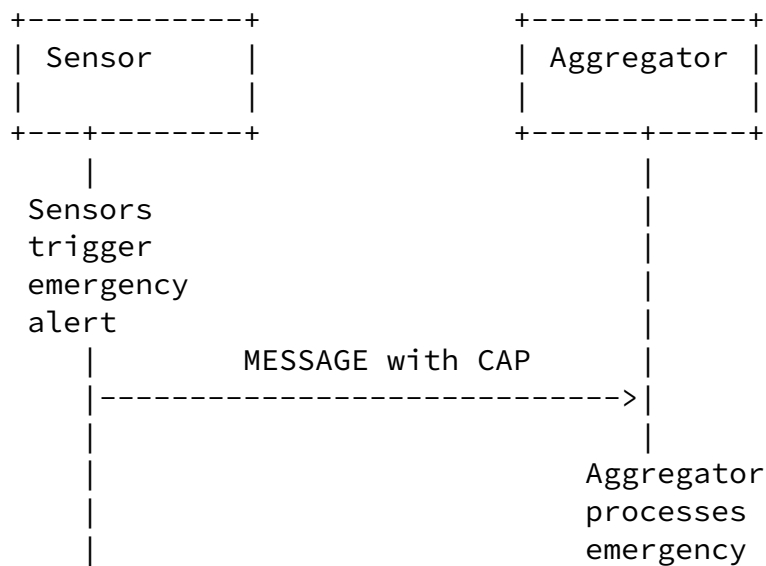
[3.](#) Architectural Overview

This section illustrates two envisioned usage modes; targeted and location-based emergency alert routing.

1. Emergency alerts containing only data are targeted to a recipient responsible for evaluating the next steps, which could include:
 1. Sending an alert containing only data toward a Public Safety Answering Point (PSAP);
 2. Establishing a third-party initiated emergency call that could include audio, video, and data.
2. Emergency alerts targeted to a Service URN used for IP-based emergency calls where the recipient is not known to the originator. In this scenario, the alert may contain only data (e.g., a CAP and a PIDF-LO payload in a SIP MESSAGE).

Figure 1 shows a deployment variant where a sensor, is pre-configured (using techniques outside the scope of this document) to issue an alert to an aggregator that processes these messages and performs

whatever steps are necessary to appropriately react on the alert. For example, a security firm may use different sensor inputs to dispatch their security staff to a building they protect or to initiate a third-party emergency call.



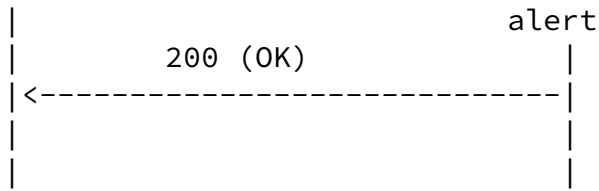
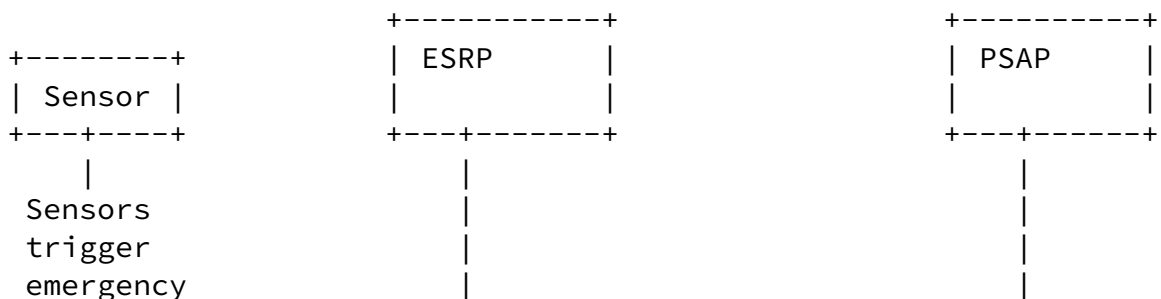


Figure 1: Targeted Emergency Alert Routing

In Figure 2 a scenario is shown whereby the alert is routed using location information and the Service URN. An emergency services routing proxy (ESRP) may use LoST to determine the next hop proxy to route the alert message to. A possible receiver is a PSAP and the recipient of the alert may be call taker. In the generic case, there is very likely no prior relationship between the originator and the receiver, e.g. PSAP. A PSAP, for example, is likely to receive and accept alerts from entities it cannot authorize. This scenario corresponds more to the classical emergency services use case and the description in [[I-D.ietf-ecrit-phonebcp](#)] is applicable.



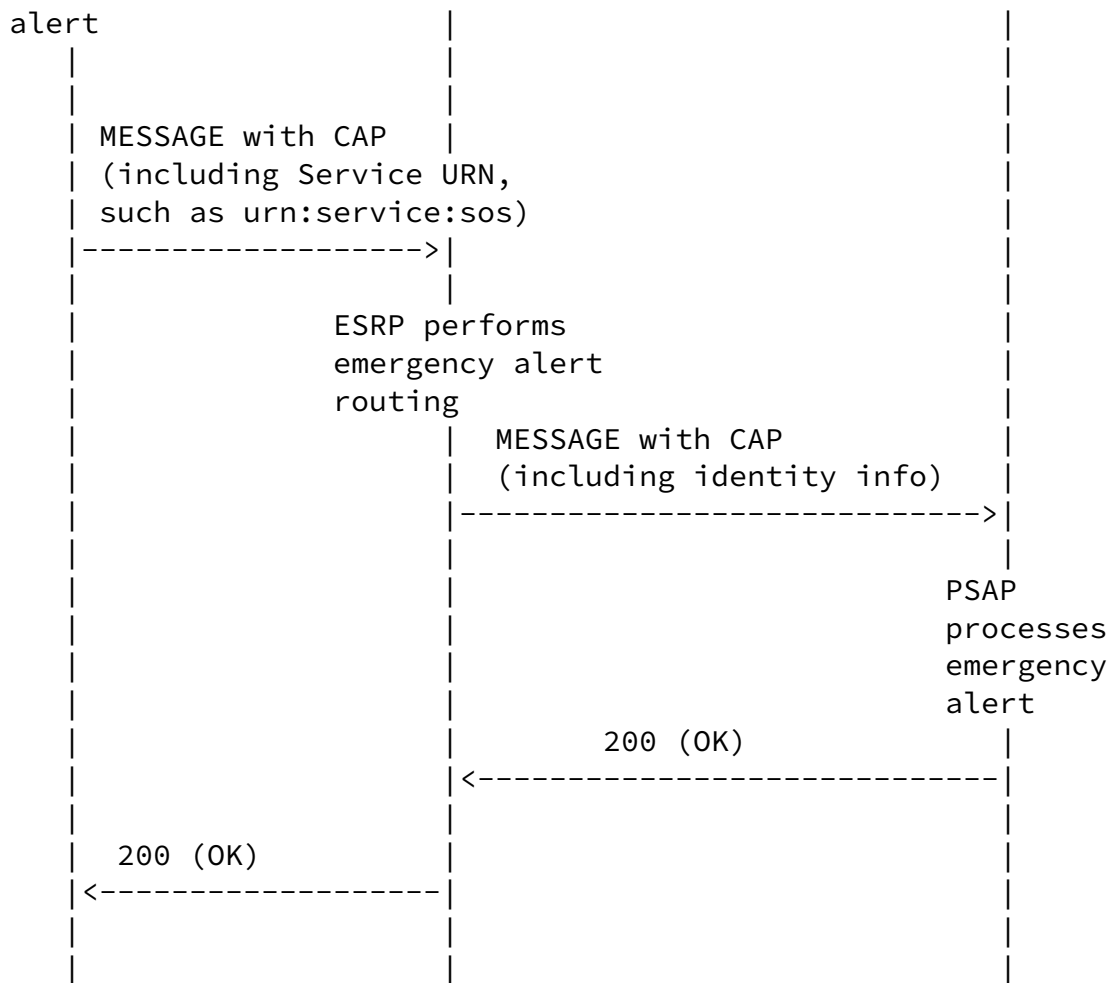


Figure 2: Location-Based Emergency Alert Routing

[4.1.](#) CAP Transport

To convey CAP payloads the SIP MESSAGE [[RFC3428](#)] is used for exchanges where no session establishment is needed, i.e., one-shot message exchange, and the SIP INVITE [[RFC3261](#)] where the establishment of session is useful (e.g., when multiple independent messages have to be logically tied together).

The MIME type is set to 'application/cap+xml'.

If the server does not support the functionality required to fulfill the request then a 501 Not Implemented MUST be returned by [RFC 3261](#) [[RFC3261](#)]. This is the appropriate response when a UAS does not recognize the request method and is not capable of supporting it for any user.

The 415 Unsupported Media Type error MUST be returned by [RFC 3261](#) [[RFC3261](#)] if the server is refusing to service the request because the message body of the request is in a format not supported by the server for the requested method. The server MUST return a list of acceptable formats using the Accept, Accept-Encoding, or Accept-Language header field, depending on the specific problem with the content.

[4.2.](#) Profiling of the CAP Document Content

The usage of CAP MUST conform to the specification provided with [[cap](#)]. For the usage with SIP the following additional requirements are imposed:

sender: A few sub-categories for putting a value in the <sender> element have to be considered:

Originator is a SIP entity, Author indication irrelevant: When the alert was created by a SIP-based originator and it is not useful to be explicit about the author of the alert then the <sender> element MUST be populated with the SIP URI of the user agent.

Originator is a non-SIP entity, Author indication irrelevant: In case that the alert was created by a non-SIP based entity and the identity of this original sender wants to be preserved then this identity MUST be placed into the <sender> element. In this category the it is not useful to be explicit about the author of the alert. The specific type of identity being used will depends on the technology being used by the original

originator.

Author indication relevant: In case the author is different from the actual originator of the message and this distinction wants to be preserved then the <sender> element MUST NOT contain the SIP URI.

incidents: The <incidents> element MUST be present whenever there is a possibility that alert information needs to be updated. The initial message will then contain an incident identifier carried in the <incidents> element. This incident identifier MUST be chosen in such a way that it is unique for a given <sender, expires, incidents> combination. Note that the <expires> element is optional and may not be present.

scope: The value of the <scope> element MUST be set to "Private" as the alert is not meant for public consumption. The <addresses> element is, however, not used by this specification since the message routing is performed by SIP and the respective address information is already available in other SIP headers. Populating information twice into different parts of the message may lead to inconsistency.

parameter: The <parameter> element MAY contain additional information specific to the sensor.

area: It is RECOMMENDED to omit this element when constructing a message. In case that the CAP message already contained an <area> element then the specified location information MUST be copied into the PIDF-LO structure of the 'geolocation' header.

[5.](#) Error Handling

This section defines a new error response code and a header field for additional information.

[5.1.](#) 425 (Bad Alert Message) Response Code

This SIP extension creates a new location-specific response code, defined as follows,

425 (Bad Alert Message)

The 425 response code is a rejection of the request due to its included alert content, indicating that it was malformed or not satisfactory for the recipient's purpose.

A SIP intermediary can also reject an alert it receives from a UA when it understands that the provided alert is malformed.

[Section 5.2](#) describes an AlertMsg-Error header field with more details about what was wrong with the alert message in the request. This header field MUST be included in the 425 response.

It is only appropriate to generate a 425 response when the responding entity has no other information in the request that are usable by the responder.

A 425 response code MUST NOT be sent in response to a request that lacks an alert message entirely, as the user agent in that case may not support this extension at all.

A 425 response is a final response within a transaction, and MUST NOT terminate an existing dialog.

[5.2.](#) The AlertMsg-Error Header Field

The AlertMsg-Error header provides additional information about what was wrong with the original request. In some cases the provided information will be used for debugging purposes.

The AlertMsg-Error header field has the following ABNF [[RFC5234](#)]:

Rosen, et al.

Expires May 13, 2013

[Page 10]

Internet-Draft

Data-Only Emergency Calls

November 2012

```
message-header      /= AlertMsg-Error
                    ; (message-header from 3261)
AlertMsg-Error      = "AlertMsg-Error" HCOLON
                    ErrorValue
ErrorValue           = error-code
                    *(SEMI error-params)
error-code           = 1*3DIGIT
error-params         = error-code-text
                    / generic-param ; from RFC3261
error-code-text     = "code" EQUAL quoted-string ; from RFC3261
```

HCOLON, SEMI, and EQUAL are defined in [RFC3261](#) [[RFC3261](#)]. DIGIT is defined in [RFC5234](#) [[RFC5234](#)].

The AlertMsg-Error header field MUST contain only one ErrorValue to indicate what was wrong with the alert payload the recipient determined was bad.

The ErrorValue contains a 3-digit error code indicating what was wrong with the alert in the request. This error code has a corresponding quoted error text string that is human understandable. The text string are OPTIONAL, but RECOMMENDED for human readability, similar to the string phrase used for SIP response codes. That said, the strings are complete enough for rendering to the user, if so desired. The strings in this document are recommendations, and are not standardized - meaning an operator can change the strings - but MUST NOT change the meaning of the error code. Similar to how [RFC 3261](#) specifies, there MUST NOT be more than one string per error code.

The AlertMsg-Error header field MAY be included in any response as an alert message was in the request part of the same transaction. For

example, a UA includes an alert in an MESSAGE to a PSAP. The PSAP can accept this MESSAGE, thus creating a dialog, even though his UA determined the alert message contained in the MESSAGE was bad. The PSAP merely includes an AlertMsg-Error header value in the 200 OK to the MESSAGE informing the UA that the MESSAGE was accepted but the alert provided was bad.

If, on the other hand, the PSAP cannot accept the MESSAGE without a suitable alert message, a 425 response is sent.

A SIP intermediary that requires the UA's alert message in order to properly process the MESSAGE may also sends a 425 with a AlertMsg-Error code.

This document defines an initial list of error code ranges for any SIP response, including provisional responses (other than 100 Trying)

and the new 425 response. There MUST be no more than one AlertMsg-Error code in a SIP response.

AlertMsg-Error: 100 ; code="Cannot Process the Alert Payload"

AlertMsg-Error: 101 ; code="Alert Payload was not present or could not be found"

AlertMsg-Error: 102 ; code="Not enough information to determine the purpose of the alert"

AlertMsg-Error: 103 ; code="Alert Payload was corrupted"

Additionally, if an LR cannot or chooses not to process the alert message from a SIP request, a 500 (Server Internal Error) SHOULD be used with or without a configurable Retry-After header field.

6. Example

Figure 3 shows a CAP document indicating a BURGLARY alert issued by a sensor called 'sensor1@domain.com'. The location of the sensor can be obtained from the attached location information provided via the 'geolocation' header contained in the SIP MESSAGE structure. Additionally, the sensor provided some data long with the alert message using proprietary information elements only to be processed by the receiver, a SIP entity acting as an aggregator. This example reflects the description in Figure 1.

```
MESSAGE sip:aggregator@domain.com SIP/2.0
Via: SIP/2.0/TCP sensor1.domain.com;branch=z9hG4bK776sgdkse
Max-Forwards: 70
From: sip:sensor1@domain.com;tag=49583
To: sip:aggregator@domain.com
```

Call-ID: asd88asd77a@1.2.3.4
Geolocation: <cid:abcdef@domain.com>
;routing-allowed=yes
Supported: geolocation
Accept: application/pidf+xml, application/cap+xml
CSeq: 1 MESSAGE
Content-Type: multipart/mixed; boundary=boundary1
Content-Length: ...

--boundary1

Content-Type: cap+xml
Content-ID: <abcdef2@domain.com>
<?xml version="1.0" encoding="UTF-8"?>

```
<alert xmlns="urn:oasis:names:tc:emergency:cap:1.1">
  <identifier>S-1</identifier>
  <sender>sip:sensor1@domain.com</sender>
  <sent>2008-11-19T14:57:00-07:00</sent>
  <status>Actual</status>
  <msgType>Alert</msgType>
  <scope>Private</scope>
  <incidents>abc1234</incidents>
  <info>
    <category>Security</category>
    <event>BURGLARY</event>
    <urgency>Expected</urgency>
    <certainty>Likely</certainty>
    <severity>Moderate</severity>
    <senderName>SENSOR 1</senderName>
  </info>
</alert>
```

```
<parameter>
  <valueName>SENSOR-DATA-NAMESPACE1</valueName>
  <value>123</value>
</parameter>
<parameter>
  <valueName>SENSOR-DATA-NAMESPACE2</valueName>
  <value>TRUE</value>
</parameter>
</info>
</alert>
```

```

--boundary1

Content-Type: application/pidf+xml
Content-ID: <abcdef2@domain.com>
<?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:gbp="urn:ietf:params:xml:ns:pidf:geopriv10:basicPolicy"
    xmlns:cl="urn:ietf:params:xml:ns:pidf:geopriv10:civicAddr"
    xmlns:gml="http://www.opengis.net/gml"
    xmlns:dm="urn:ietf:params:xml:ns:pidf:data-model"
    entity="pres:alice@atlanta.example.com">
    <dm:device id="sensor">
      <gp:geopriv>
        <gp:location-info>
          <gml:location>
            <gml:Point srsName="urn:ogc:def:crs:EPSG::4326">
              <gml:pos>32.86726 -97.16054</gml:pos>
            </gml:Point>
          </gml:location>
        </gp:location-info>
        <gp:usage-rules>
          <gbp:retransmission-allowed>>false
          </gbp:retransmission-allowed>
          <gbp:retention-expiry>2010-11-14T20:00:00Z
          </gbp:retention-expiry>
        </gp:usage-rules>
        <gp:method>802.11</gp:method>
      </gp:geopriv>
      <dm:timestamp>2010-11-04T20:57:29Z</dm:timestamp>
    </dm:device>
  </presence>
--boundary1--

```

Figure 3: Example Message conveying an Alert

7. Security Considerations

This section discusses security considerations when SIP user agents issue emergency alerts utilizing CAP. Location specific threats are

not unique to this document and are discussed in [\[I-D.ietf-ecrit-trustworthy-location\]](#) and [\[RFC6442\]](#).

The ECRIT emergency services architecture [\[I-D.ietf-ecrit-phonebcp\]](#) considers classical individual-to-authority emergency calling and the identity of the emergency caller does not play a role at the time of the call establishment itself, i.e., a response to the emergency call will not depend on the identity of the caller. In case of emergency alerts generated by devices, like sensors, the processing may be different in order to reduce the number of falsely generated emergency alerts. Alerts may get triggered based on certain sensor input that may have been caused by other factors than the actual occurrence of an alert relevant event. For example, a sensor may simply be malfunctioning. For this purpose not all alert messages are directly sent to a PSAP but are rather pre-processed by a separate entity, potentially under supervision by a human, to filter alerts and potentially correlate received alerts with others to obtain a larger picture of the ongoing situation. These two message routing examples are shown in Figure 1 and in Figure 2.

In any case, for alerts that are initiated by sensors the identity may play an important role in deciding whether to accept or ignore an incoming alert message. With the scenario shown in Figure 1 it is very likely that only authorized sensor input will be processed. For this purpose it needs to be ensured that no alert messages from an unknown origin are accepted. Two types of information elements can be used for this purpose:

1. SIP itself provides security mechanisms that allow the verification of the originator's identity. These mechanisms can be re-used, such as P-Asserted-Identity [\[RFC3325\]](#) or SIP Identity [\[RFC4474\]](#). The latter provides a cryptographic assurance while the former relies on a chain of trust model.
2. CAP provides additional security mechanisms and the ability to carry additional information about the sender's identity. Section 3.3.2.1 of [\[cap\]](#) specifies the signing algorithms of CAP documents.

In addition to the desire to perform identity-based access control the classical communication security threats need to be considered, including integrity protection to prevent forgery and replay of alert messages in transit. To deal with replay of alerts a CAP document contains the mandatory <identifier>, <sender>, <sent> elements and an

optional <expire> element. These attributes make the CAP document unique for a specific sender and provide time restrictions. An entity that has received a CAP message already within the indicated timeframe is able to detect a replayed message and, if the content of that message is unchanged, then no additional security vulnerability is created. Additionally, it is RECOMMENDED to make use of SIP security mechanisms, such as SIP Identity [[RFC4474](#)], to tie the CAP message to the SIP message. To provide protection of the entire SIP message exchange between neighboring SIP entities the usage of TLS is mandatory.

Note that none of the security mechanism in this document protect against a compromised sensor sending crafted alerts.

Internet-Draft

Data-Only Emergency Calls

November 2012

[8.](#) IANA Considerations

[8.1.](#) Registration of the 'application/cap+xml' MIME type

To: ietf-types@iana.org

Subject: Registration of MIME media type application/ cap+xml

MIME media type name: application

MIME subtype name: cap+xml

Required parameters: (none)

Optional parameters: charset; Indicates the character encoding of enclosed XML. Default is UTF-8 [[RFC3629](#)].

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

Security considerations: This content type is designed to carry payloads of the Common Alerting Protocol (CAP).

Interoperability considerations: This content type provides a way to convey CAP payloads.

Published specification: RFC XXX [Replace by the RFC number of this specification].

Applications which use this media type: Applications that convey alerts and warnings according to the CAP standard.

Additional information: OASIS has published the Common Alerting Protocol at http://www.oasis-open.org/committees/documents.php&wg_abbrev=emergency

Rosen, et al.

Expires May 13, 2013

[Page 17]

Internet-Draft

Data-Only Emergency Calls

November 2012

Person and email address to contact for further information: Hannes Tschofenig, Hannes.Tschofenig@nlnet.nl

Intended usage: Limited use

Author/Change controller: IETF ECRIT working group

Other information: This media type is a specialization of application/xml [RFC 3023](#) [[RFC3023](#)], and many of the considerations described there also apply to application/cap+xml.

[8.2.](#) IANA Registration for 425 Response Code

In the SIP Response Codes registry, the following is added

Reference: RFC-XXXX (i.e., this document)

Response code: 425 (recommended number to assign)

Default reason phrase: Bad Alert Message

Registry:

Response Code	Reference
Request Failure 4xx	
425 Bad Alert Message	[this doc]

This SIP Response code is defined in [Section 5](#).

8.3. IANA Registration of New AlertMsg-Error Header Field

The SIP AlertMsg-error header field is created by this document, with its definition and rules in [Section 5](#), to be added to the IANA sip-parameters registry with two actions:

1. Update the Header Fields registry with

Registry:

Header Name	compact	Reference
-----	-----	-----

Rosen, et al.

Expires May 13, 2013

[Page 18]

Internet-Draft

Data-Only Emergency Calls

November 2012

AlertMsg-Error

[this doc]

2. In the portion titled "Header Field Parameters and Parameter Values", add

Header Field	Parameter Name	Predefined Values	Reference
-----	-----	-----	-----
AlertMsg-Error	code	yes	[this doc]

8.4. IANA Registration for the SIP AlertMsg-Error Codes

This document creates a new registry for SIP, called "AlertMsg-Error Codes". AlertMsg-Error codes provide reason for the error discovered by recipients, categorized by action to be taken by error recipient. The initial values for this registry are shown below.

Registry Name: AlertMsg-Error Codes

Reference: [this doc]

Registration Procedures: Specification Required

Code	Default Reason Phrase	Reference
100	"Cannot Process the Alert Payload"	[this doc]
101	"Alert Payload was not present or could not be found"	[this doc]
102	"Not enough information to determine the purpose of the alert"	[this doc]
103	"Alert Payload was corrupted"	[this doc]

Details of these error codes are in [Section 5](#).

[9](#). Acknowledgments

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Additionally, we would like to thank Martin Thomson, James Winterbottom, Shida Schubert, Bernard Aboba, and Marc Linsner for their review comments.

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Expires May 13, 2013

[Page 21]

Internet-Draft

Data-Only Emergency Calls

November 2012

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