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Additional Data related to an Emergency Call
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Abstract

When an emergency call is sent to a Public Safety Answering Point (PSAP), the device that sends it, as well as any application service provider in the path of the call, or access network provider through which the call originated may have information about the call, the caller or the location which the PSAP may be able to use. This document describes data structures and a mechanism to convey such data to the PSAP. The mechanism uses a Uniform Resource Identifier (URI), which may point to either an external resource or an object in the body of the SIP message. The mechanism thus allows the data to be passed by reference (when the URI points to an external resource) or by value (when it points into the body of the message). This follows the tradition of prior emergency services standardization work where data can be conveyed by value within the call signaling (i.e., in body of the SIP message) and also by reference.

Status of This Memo

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1. Introduction

When an IP-based emergency call is initiated, a rich set of data from multiple data sources is conveyed to the Public Safety Answering Point (PSAP). This data includes information about the calling party identity, the multimedia capabilities of the device, the emergency service number, location information, and meta-data about the sources of the data. The device, the access network provider, and any service provider in the call path may have even more information useful for a PSAP. This document extends the basic set of data communicated with an IP-based emergency call, as described in [RFC6443] and [RFC6881], in order to carry additional data which may be useful to an entity or call taker handling the call. This data is "additional" to the basic information found in the emergency call signaling used.

In general, there are three categories of this additional data that may be transmitted with an emergency call:

Data Associated with a Location: Primary location data is conveyed in the Presence Information Data Format Location Object (PIDF-LO) data structure as defined in RFC 4119 [RFC4119] and extended by RFC 5139 [RFC5139] and RFC 6848 [RFC6848] (for civic location

information), RFC 5491 [RFC5491] and RFC 5962 [RFC5962] (for geodetic location information), and [I-D.ietf-geopriv-relative-location] (for relative location). This primary location data identifies the location or estimated location of the caller. However, there may exist additional, secondary data which is specific to the location, such as floor plans, tenant and building owner contact data, heating, ventilation and air conditioning (HVAC) status, etc. Such secondary location data is not included in the location data structure but can be transmitted using the mechanisms defined in this document; although this document does not define any structures for such data, future documents may do so following the procedures defined here.

Data Associated with a Call: While some information is carried in the call setup procedure itself (as part of the SIP headers as well as in the body of the SIP message), there is additional data known by the device making the call and/or a service provider along the path of the call. This information may include the service provider contact information, subscriber identity and contact information, the type of service the service provider and the access network provider offer, what type of device is being used, etc. Some data is broadly applicable, while other data is dependent on the type of device or service. For example, a medical monitoring device may have sensor data. The data structures defined in this document (Data Provider Information, Device Information, and Owner/Subscriber Information) all fall into this category ("Data Associated with a Call").

Data Associated with a Caller: This is personal data about a caller, such as medical information and emergency contact data. Although this document does not define any structures within this category, future documents may do so following the procedures defined here.

While this document defines data structures only within the category of Data Associated with a Call, by establishing the overall framework of Additional Data, along with general mechanisms for transport of such data, extension points and procedures for future extensions, it minimizes the work needed to carry data in the other categories. Other specifications may make use of the facilities provided here.

For interoperability, there needs to be a common way for the information conveyed to a PSAP to be encoded and identified. Identification allows emergency services authorities to know during call processing which types of data are present and to determine if they wish to access it. A common encoding allows the data to be successfully accessed.

This document defines an extensible set of data structures, and mechanisms to transmit this data either by value or by reference, either in the Session Initiation Protocol (SIP) call signaling or in the Presence Information Data Format Location Object (PIDF-LO). The data structures are usable by other communication systems and transports as well. The data structures are defined in Section 3, and the transport mechanisms (using SIP and HTTPS) are defined in Section 4.

Each data structure described in this document is encoded as a "block" of information. Each block is an XML structure with an associated Multipurpose Internet Mail Extensions (MIME) type for identification within transport such as SIP and HTTPS. The set of blocks is extensible. Registries are defined to identify the block types that may be used and to allow blocks to be included in emergency call signaling.

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].

This document also uses terminology from [RFC5012]. We use the term service provider to refer to an Application Service Provider (ASP). A Voice Service Provider (VSP) is a special type of ASP. With the term "Access Network Provider" we refer to the Internet Access Provider (IAP) and the Internet Service Provider (ISP) without further distinguishing these two entities, since the difference between the two is not relevant for this document. Note that the roles of ASP and access network provider may be provided by a single company.

Within each data block definition (see Section 3), the values for the "Use:" label are specified as one of the following:

'Required': means it MUST be present in the data structure.

'Conditional': means it MUST be present if the specified condition(s) is met. It MAY be present if the condition(s) is not met.

'Optional': means it MAY be present.

vCard is a data format for representing and exchanging a variety of information about individuals and other entities. For applications that use XML the format defined in vCard is not immediately applicable. For this purpose an XML-based encoding of the

information elements defined in the vCard specification has been defined and the name of that specification is xCard. Since the term vCard is more familiar to most readers, we use the term xCard and vCard interchangeably.

3. Data Structures

This section defines the following five data structures, each as a data block. For each block we define the MIME type, and the XML encoding. The five data structures are:

'Data Provider': This block supplies name and contact information for the entity that created the data. Section 3.1 provides the details.

'Service Information': This block supplies information about the service. The description can be found in Section 3.2.

'Device Information': This block supplies information about the device placing the call. Device information can be found in Section 3.3.

'Owner/Subscriber': This block supplies information about the owner of the device or about the subscriber. Details can be found in Section 3.4.

'Comment': This block provides a way to supply free form human readable text to the PSAP or emergency responders. This simple structure is defined in Section 3.5.

Each block contains a mandatory <DataProviderReference> element. The purpose of the <DataProviderReference> element is to associate all blocks added by the same data provider as a unit. The <DataProviderReference> element associates the data provider block to each of the other blocks added as a unit. Consequently, when a data provider adds additional data to an emergency call (such as device information) it MUST add information about itself (via the data provider block) and the blocks added contain the same value in the <DataProviderReference> element. All blocks added by a single entity at the same time MUST have the same <DataProviderReference> value. The value of the <DataProviderReference> element has the same syntax and properties (specifically, world-uniqueness) as the value of the "Content-ID" message body header field specified in RFC 2045 [RFC2045] except that the <DataProviderReference> element is not enclosed in brackets (the "<" and ">" symbols are omitted). In other words, the value of an <DataProviderReference> element is syntactically an addr-spec as specified in RFC 822 [RFC0822].

Note that the xCard format is re-used in some of the data structures to provide contact information. In an xCard there is no way to specify a "main" telephone number. These numbers are useful to emergency responders who are called to a large enterprise. This document adds a new property value to the "tel" property of the TYPE parameter called "main". It can be used in any xCard in additional data.

3.1. Data Provider Information

This block is intended to be supplied by any service provider in the path of the call or the access network provider. It includes identification and contact information. This block SHOULD be supplied by every service provider in the call path, and by the access network provider. Devices MAY use this block to provide identifying information. The MIME subtype is "application/EmergencyCallData.ProviderInfo+xml". An access network provider SHOULD provide this block either by value or by reference in the Provided-By section of a PIDF-LO

3.1.1. Data Provider String

Data Element: Data Provider String

Use: Required

XML Element: <DataProviderString>

Description: This is a plain text string suitable for displaying the name of the service provider that supplied the data structure. If the device creates the structure, it SHOULD use the value of the contact header in the SIP INVITE.

Reason for Need: Inform the call taker of the identity of the entity providing the data.

How Used by Call Taker: Allows the call taker to interpret the data in this structure. The source of the information often influences how the information is used, believed or verified.

3.1.2. Data Provider ID

Data Element: Data Provider ID

Use: Conditional. This data SHOULD be provided if the service provider or access provider is located in a jurisdiction that maintains such IDs. For example, in North America, this would be a NENA Company ID.

XML Element: <ProviderID>

Description: A jurisdiction-specific code for the access network provider or service provider shown in the <DataProvidedBy> element that created the structure. NOTE: In the US, the provider's NENA Company ID MUST appear here. Additional information can be found at NENA Company Identifier Program [1] or NENA Company ID [2]. The NENA Company ID MUST be in the form of a URI in the following format: urn:nena:companyid:<NENA Company ID>

Reason for Need: Inform the call taker of the identity of the entity providing the data.

How Used by Call Taker: Where jurisdictions have lists of providers the Data Provider ID provides useful information about the data source.

3.1.3. Data Provider ID Series

Data Element: Data Provider ID Series

Use: Conditional. If Data Provider ID is provided, Data Provider ID Series is required.

XML Element: <ProviderIDSeries>

Description: Identifies the issuer of the ProviderId. The Provider ID Series Registry (see Section 9.1) initially contains the following valid entries:

- * NENA

- * EENA

Reason for Need: Identifies how to interpret the Data Provider ID.

How Used by Call Taker: Determines which provider ID registry to consult for more information

3.1.4. Type of Data Provider

Data Element: Type of Data Provider ID

Use: Conditional. If Data Provider ID is provided, Type of Data Provider ID is required.

XML Element: <TypeOfProviderID>

Description: Identifies the type of data provider ID being supplied in the ProviderID data element. A registry with an initial set of values is shown in Figure 1 (see also Section 9.1).

| Token | Description |
|--------------------------------|--|
| Access Network Provider | Access network service provider |
| Telecom Provider | Calling or origination telecom SP |
| Telematics Provider | A sensor based service provider, especially vehicle based |
| Language Translation Provider | A spoken language translation SP |
| Emergency Service Provider | An emergency service provider conveying information to another emergency service provider. |
| Emergency Modality Translation | An emergency call specific modality translation service e.g., for sign language |
| Relay Provider | A interpretation SP, for example, video relay for sign language interpreting |
| Other | Any other type of service provider |

Figure 1: Type of Data Provider ID Registry.

Reason for Need: Identifies the category of data provider.

How Used by Call Taker: This information may be helpful when deciding whom to contact when further information is needed.

3.1.5. Data Provider Contact URI

Data Element: Data Provider Contact URI

Use: Required

XML Element: <ContactURI>

Description: When provided by a service provider or an access network provider, this information MUST be a URI to a 24/7 support organization tasked to provide PSAP support for this emergency call. If the call is from a device, this SHOULD be the contact information of the owner of the device. If a telephone number is the contact address then it MUST be a tel URI. If it is provided as a SIP URI then it MUST be in the form of sip:telephonenumber@serviceprovider:user=phone. Note that this contact information is not used by PSAPs for callbacks (a call

from a PSAP directly related to a recently terminated emergency call, placed by the PSAP using a SIP Priority header field set to "psap-callback", as described in [I-D.ietf-ecrit-psap-callback]).

Reason for Need: Additional data providers may need to be contacted in error cases or other unusual circumstances.

How Used by Call Taker: To contact the supplier of the additional data for assistance in handling the call.

3.1.6. Data Provider Languages(s) Supported

Data Element: Data Provider Language(s) supported

Use: Required.

XML Element: <Language>

Description: The language used by the entity at the Data Provider Contact URI, as an alpha 2-character code as defined in ISO 639-1:2002 Codes for the representation of names of languages -- Part 1: Alpha-2 code Multiple instances of this element may occur. Order is significant; preferred language should appear first. The content MUST reflect the languages supported at the contact URI.

Note that the 'language' media feature tag, defined in RFC 3840 [RFC3840] and the more extensive language negotiation mechanism proposed with [I-D.gellens-negotiating-human-language] are independent of this data provider language indication.

Reason for Need: This information indicates if the emergency service authority can directly communicate with the service provider or if an interpreter will be needed.

How Used by Call Taker: If call taker cannot speak language(s) supported by the service provider, a translation service will need to be added to the conversation. Alternatively, other persons at the PSAP, besides the call taker, might be consulted for help (depending on the urgency and the type of interaction).

3.1.7. xCard of Data Provider

Data Element: xCard of Data Provider

Use: Optional

XML Element: <DataProviderContact>

Description: There are many fields in the xCard and the creator of the data structure is encouraged to provide as much information as they have available. N, ORG, ADR, TEL, EMAIL are suggested at a minimum. N SHOULD contain the name of the support group or device owner as appropriate. If more than one TEL property is provided, a parameter from the vCard Property Value registry MUST be specified on each TEL. For encoding of the xCard this specification uses the XML-based encoding specified in [RFC6351], referred to in this document as "xCard"

Reason for Need: Information needed to determine additional contact information.

How Used by Call Taker: Assists call taker by providing additional contact information that may not be included in the SIP invite or the PIDF-LO.

3.1.1.8. Subcontractor Principal

When the entity providing the data is a subcontractor, the Data Provider Type is set to that of the primary service provider and this entry is supplied to provide information regarding the subcontracting entity.

Data Element: Subcontractor Principal

Use: Conditional. This data is required if the entity providing the data is a subcontractor.

XML Element: <SubcontratorPrincipal>

Description: Some providers outsource their obligations to handle aspects of emergency services to specialized providers. If the data provider is a subcontractor to another provider this element contains the DataProviderString of the service provider to indicate which provider the subcontractor is working for.

Reason for Need: Identify the entity the subcontractor works for.

How Used by Call Taker: Allows the call taker to understand what the relationship between data providers and the service providers in the path of the call are.

3.1.9. Subcontractor Priority

Data Element: Subcontractor Priority

Use: Conditional. This element is required if the Data Provider type is set to "Subcontractor".

XML Element: <SubcontractorPriority>

Description: If the subcontractor has to be contacted first then this element MUST have the value "sub". If the provider the subcontractor is working for has to be contacted first then this element MUST have the value "main".

Reason for Need: Inform the call taker whom to contact first, if support is needed.

How Used by Call Taker: To decide which entity to contact first if assistance is needed.

3.1.10. ProviderInfo Example

```
<?xml version="1.0" encoding="UTF-8"?>
<ad:EmergencyCallData.ProviderInfo
  xmlns:ad="urn:ietf:params:xml:ns:EmergencyCallData:ProviderInfo"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <ad:id>12345</ad:id>
  <ad:DataProviderReference>string0987654321@example.org
</ad:DataProviderReference>
  <ad:DataProviderString>Example VoIP Provider
</ad:DataProviderString>
  <ad:ProviderID>urn:nena:companyid:ID123</ad:ProviderID>
  <ad:ProviderIDSeries>NENA</ad:ProviderIDSeries>
  <ad:TypeOfProvider>Service Provider</ad:TypeOfProvider>
  <ad:ContactURI>sip:voip-provider@example.com</ad:ContactURI>
  <ad:Language>EN</ad:Language>
  <ad:DataProviderContact
    xmlns="urn:ietf:params:xml:ns:vcard-4.0">
    <vcard>
      <fn><text>Hannes Tschofenig</text></fn>
      <n>
        <surname>Hannes</surname>
        <given>Tschofenig</given>
        <additional/>
        <prefix/>
        <suffix>Dipl. Ing.</suffix>
      </n>
    </vcard>
  </ad:DataProviderContact>
</ad:EmergencyCallData.ProviderInfo>
```

```
<bday><date>--0203</date></bday>
<anniversary>
  <date-time>20090808T1430-0500</date-time>
</anniversary>
<gender><sex>M</sex></gender>
<lang>
  <parameters><pref><integer>1</integer></pref>
  </parameters>
  <language-tag>de</language-tag>
</lang>
<lang>
  <parameters><pref><integer>2</integer></pref>
  </parameters>
  <language-tag>en</language-tag>
</lang>
<org>
  <parameters><type><text>work</text></type>
  </parameters>
  <text>Example VoIP Provider</text>
</org>
<adr>
  <parameters>
    <type><text>work</text></type>
    <label><text>Hannes Tschofenig
      Linnoitustie 6
      Espoo , Finland
      02600</text></label>
  </parameters>
  <pobox/>
  <ext/>
  <street>Linnoitustie 6</street>
  <locality>Espoo</locality>
  <region>Uusimaa</region>
  <code>02600</code>
  <country>Finland</country>
</adr>
<tel>
  <parameters>
    <type>
      <text>work</text>
      <text>voice</text>
    </type>
  </parameters>
  <uri>tel:+358 50 4871445</uri>
</tel>
<email>
  <parameters><type><text>work</text></type>
  </parameters>
```

```

        <text>hannes.tschofenig@nsn.com</text>
    </email>
    <geo>
        <parameters><type><text>work</text></type>
        </parameters>
        <uri>geo:60.210796,24.812924</uri>
    </geo>
    <key>
        <parameters><type><text>home</text></type>
        </parameters>
        <uri>
            http://www.tschofenig.priv.at/key.asc
        </uri>
    </key>
    <tz><text>Finland/Helsinki</text></tz>
    <url>
        <parameters><type><text>home</text></type>
        </parameters>
        <uri>http://www.tschofenig.priv.at</uri>
    </url>
    </vcard>
</ad:DataProviderContact>
</ad:EmergencyCallData.ProviderInfo>

```

Figure 2: EmergencyCallData.ProviderInfo Example.

3.2. Service Information

This block describes the service that the service provider provides to the caller. It SHOULD be included by all SPs in the path of the call. The mime subtype is "application/EmergencyCallData.ServiceInfo+xml".

3.2.1. Service Environment

Data Element: Service Environment

Use: Required

XML Element: <ServiceEnvironment>

Description: This element defines whether a call is from a business or residence caller. Currently, the only valid entries are 'Business' or 'Residence'. New values can be defined via the registry created in Figure 22.

Reason for Need: To assist in determining equipment and manpower requirements.

How Used by Call Taker: Information may be used to assist in determining equipment and manpower requirements for emergency responders. As the information is not always available, and the registry is not all encompassing, this is at best advisory information, but since it mimics a similar capability in some current emergency calling systems, it is known to be valuable. The service provider uses its best information (such as a rate plan, facilities used to deliver service or service description) to determine the information and is not responsible for determining the actual characteristics of the location where the call originates from.

3.2.2. Service Type

Data Element: Service Delivered by Provider to End User

Use: Required

XML Element: <ServiceType>

Description: This defines the type of service over which the call is placed. The implied mobility of this service cannot be relied upon. A registry with an initial set of values is defined in Figure 3.

| Name | Description |
|-------------------|---|
| wireless | Wireless Telephone Service: Includes CDMA, GSM, Wi-Fi, WiMAX, LTE (but not satellite) |
| coin | Fixed public pay/coin telephones: Any coin or credit card operated device |
| one-way | One way outbound service |
| prison | Inmate call/service |
| temp | Soft dialtone/quick service/warm disconnect/suspended |
| MLTS | Multi-line telephone system: Includes all PBX, Centrex, key systems, Shared Tenant Service |
| sensor-unattended | These are devices that generate DATA ONLY. This is a one-way information transmit without interactive media |
| sensor-attended | Devices that are supported by a monitoring service provider or that are capable of supporting interactive |

| | |
|--------|--|
| | media |
| POTS | Wireline: Plain Old Telephone Service |
| VOIP | An over-the-top service that provides communication over arbitrary Internet access (fixed, nomadic, mobile) |
| remote | Off premise extension |
| relay | A service where there is a human third party agent who provides additional assistance. This includes sign language relay and telematics services that provide a human on the call. |

Figure 3: Service Delivered by Provider to End User Registry.

More than one value MAY be returned. For example, a VoIP inmate telephone service is a reasonable combination.

Reason for Need: Knowing the type of service may assist the PSAP with the handling of the call.

How Used by Call Taker: Call takers often use this information to determine what kinds of questions to ask callers, and how much to rely on supportive information. An emergency call from a prison is treated differently than a call from a sensor device. As the information is not always available, and the registry is not all encompassing, this is at best advisory information, but since it mimics a similar capability in some current emergency calling systems, it is known to be valuable.

3.2.3. Service Mobility Environment

Data Element: Service Mobility Environment

Use: Required

XML Element: <ServiceMobility>

Description: This provides the service provider's view of the mobility of the caller. As the service provider may not know the characteristics of the actual device or access network used, the value MUST NOT be relied upon. A registry reflects the following initial valid entries:

- * Mobile: the device should be able to move at any time

- * Fixed: the device is not expected to move unless the service is relocated
- * Nomadic: the device is not expected to change its point of attachment while on a call
- * Unknown: no information is known about the service mobility environment for the device

Reason for Need: Knowing the service provider's belief of mobility may assist the PSAP with the handling of the call.

How Used by Call Taker: To determine whether to assume the location of the caller might change.

3.2.4. EmergencyCallData.ServiceInfo Example

```
<?xml version="1.0" encoding="UTF-8"?>
<svc:EmergencyCallData.ServiceInfo
  xmlns:svc="urn:ietf:params:xml:ns:EmergencyCallData.ServiceInfo"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <svc:DataProviderReference>string0987654321@example.org
  </svc:DataProviderReference>
  <svc:id>12345</svc:id>
  <svc:ServiceEnvironment>Business</svc:ServiceEnvironment>
  <svc:ServiceType>MLTS</svc:ServiceType>
  <svc:ServiceMobility>Fixed</svc:ServiceMobility>
</svc:EmergencyCallData.ServiceInfo>
```

Figure 4: EmergencyCallData.ServiceInfo Example.

3.3. Device Information

This block provides information about the device used to place the call. It should be provided by any service provider that knows what device is being used, and by the device itself. The mime subtype is "application/EmergencyCallData.DeviceInfo+xml".

3.3.1. Device Classification

Data Element: Device Classification

Use: Optional

XML Element: <DeviceClassification>

Description: This data element defines the kind of device making the emergency call. If the device provides the data structure, the device information SHOULD be provided. If the service provider provides the structure and it knows what the device is, the service provider SHOULD provide the device information. Often the carrier does not know what the device is. It is possible to receive two Additional Data Associated with a Call data structures, one created by the device and one created by the service provider. This information describes the device, not how it is being used. This data element defines the kind of device making the emergency call. The registry with the initial set of values is shown in Figure 5.

| Token | Description |
|-----------------|--|
| cordless | Cordless handset |
| fixed | Fixed phone |
| satellite | Satellite phone |
| sensor-fixed | Fixed (non mobile) sensor/alarm device |
| desktop | Desktop PC |
| laptop | Laptop computing device |
| tablet | Tablet computing device |
| alarm-monitored | Alarm system |
| sensor-mobile | Mobile sensor device |
| aircraft | Aircraft telematics device |
| automobile | Automobile/cycle/off-road telematics |
| truck | Truck/construction telematics |
| farm | Farm equipment telematics |
| marine | Marine telematics |
| personal | Personal telematics device |
| feature-phone | Feature (not smart-) cellular phone |
| smart-phone | Smart-phone cellular phone |
| game | Gaming console |
| text-only | Other text device |
| NA | Not Available |

Figure 5: Device Classification Registry.

Reason for Need: The device classification implies the capability of the calling device and assists in identifying the meaning of the emergency call location information that is being presented. For example, does the device require human intervention to initiate a call or is this call the result of programmed instructions? Does the calling device have the ability to update location or condition changes? Is this device interactive or a one-way reporting device?

How Used by Call Taker: May assist with location of caller. For example, a cordless handset may be outside or next door. May provide the calltaker some context about the caller, the capabilities of the device used for the call or the environment the device is being used in.

3.3.2. Device Manufacturer

Data Element: Device Manufacturer

Use: Optional

XML Element: <DeviceMfgr>

Description: The plain language name of the manufacturer of the device.

Reason for Need: Used by PSAP management for post-mortem investigation/resolution.

How Used by Call Taker: Probably not used by the calltaker, but by PSAP management.

3.3.3. Device Model Number

Data Element: Device Model Number

Use: Optional

XML Element: <DeviceModelNr>

Description: Model number of the device.

Reason for Need: Used by PSAP management for after action investigation/resolution.

How Used by Call Taker: Probably not used by the calltaker, but by PSAP management.

3.3.4. Unique Device Identifier

Data Element: Unique Device Identifier

Use: Optional

XML Element: <UniqueDeviceID>

XML Attribute: <TypeOfDeviceID>

Description: A string that identifies the specific device (or the device's current SIM) making the call or creating an event. Note that more than one <UniqueDeviceID> may be present, to supply more than one of the identifying values.

The <TypeOfDeviceID> attribute identifies the type of device identifier. A registry with an initial set of values can be seen in Figure 6.

| Token | Description |
|-------|--|
| MEID | Mobile Equipment Identifier (CDMA) |
| ESN | Electronic Serial Number (GSM) |
| MAC | Media Access Control Address (IEEE) |
| WiMAX | Device Certificate Unique ID |
| IMEI | International Mobile Equipment ID (GSM) |
| IMSI | International Mobile Subscriber ID (GSM) |
| UDI | Unique Device Identifier |
| RFID | Radio Frequency Identification |
| SN | Manufacturer Serial Number |

Figure 6: Registry with Device Identifier Types.

Reason for Need: Uniquely identifies the device (or, in the case of IMSI, a SIM), independent of any signaling identifiers present in the call signaling stream.

How Used by Call Taker: Probably not used by the call taker; may be used by PSAP management during an investigation.

Example: <UniqueDeviceID TypeOfDeviceID="SN">12345</UniqueDeviceID>

3.3.5. Device/Service Specific Additional Data Structure

Data Element: Device/service specific additional data structure

Use: Optional

XML Element: <DeviceSpecificData>

Description: A URI representing additional data whose schema is specific to the device or service which created it. (For example, a medical device or medical device monitoring service may have a defined set of medical data.) The URI, when dereferenced, MUST yield a data structure defined by the Device/service specific additional data type value. Different data may be created by each classification; e.g., a medical device created data set.

Reason for Need: Provides device/service specific data that may be used by the call taker and/or responders.

How Used by Call Taker: Provide information to guide call takers to select appropriate responders, give appropriate pre-arrival instructions to callers, and advise responders of what to be prepared for. May be used by responders to guide assistance provided.

3.3.6. Device/Service Specific Additional Data Structure Type

Data Element: Type of device/service specific additional data structure

Use: Conditional. MUST be provided when device/service specific additional URI is provided

XML Element: <DeviceSpecificType>

Description: Value from a registry defined by this document to describe the type of data that can be retrieved from the device/service specific additional data structure. Initial values are:

* IEEE 1512

IEEE 1512 is the USDOT model for traffic incidents.

Reason for Need: This data element allows identification of externally defined schemas, which may have additional data that may assist in emergency response.

How Used by Call Taker: This data element allows the end user (calltaker or first responder) to know what type of additional data may be available to aid in providing the needed emergency services.

Note: Information which is specific to a location or a caller (person) should not be placed in this section.

3.3.7. Issues with getting new types of data into use

This document describes two mechanisms which allow extension of the kind of data provided with an emergency call: define a new block or define a new service specific additional data URL for the DeviceInfo block. While defining new data types and getting a new device or application to send the new data may be easy, getting PSAPs and responders to actually retrieve the data and use it will be difficult. New mechanism providers should understand that acquiring and using new forms of data usually require software upgrades at the PSAP and/or responders, as well as training of call takers and responders in how to interpret and use the information. Legal and operational review may also be needed. Overwhelming a call taker or responder with too much information is highly discouraged. Thus, the barrier to supporting new data is quite high.

The mechanisms this document describes are meant to encourage development of widely supported, common data formats for classes of devices. If all manufacturers of a class of device use the same format, and the data can be shown to improve outcomes, then PSAPs and responders may be encouraged to upgrade their systems and train their staff to use the data. Variations, however well intentioned, are unlikely to be supported.

Implementers should consider that data from sensor-based devices in some cases may not be useful to call takers or PSAPs (and privacy or other considerations may preclude the PSAP from touching the data), but may be of use to responders. Some standards being developed by other organizations to carry data from the PSAP to responders are designed to carry all additional data supplied in the call that conform to this document, even if the PSAP does not fetch or interpret the data. This allows responders to get the data even if the PSAP does not.

3.3.8. Choosing between defining a new type of block or new type of device/service specific additional data

For devices that have device or service specific data, there are two choices to carry it. A new block can be defined, or the device/service specific additional data URL the DeviceInfo block can be used and a new type for it defined. The data passed would likely be the same in both cases. Considerations for choosing which mechanism to register under include:

Applicability: Information which will be carried by many kinds of devices or services are more appropriately defined as separate blocks.

Privacy: Information which may contain private data may be better sent in the DeviceInfo block, rather than a new block so that implementations are not tempted to send the data by value, and thus having more exposure to the data than forcing the data to be retrieved via the URL in DeviceInfo.

Size: Information which may be very may be better sent in the DeviceInfo block, rather than a new block so that implementations are not tempted to send the data by value. Conversely, data which is small may best be sent in a separate block so that it can be sent by value

Availability of a server: Providing the data via the device block requires a server be made available to retrieve the data. Providing the data via new block allows it to be sent by value (CID).

3.3.9. EmergencyCallData.DeviceInfo Example

```
<?xml version="1.0" encoding="UTF-8"?>
<dev:EmergencyCallData.DeviceInfo
  xmlns:dev="urn:ietf:params:xml:ns:EmergencyCallData:DeviceInfo"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <dev:DataProviderReference>string0987654321@example.org
</dev:DataProviderReference>
  <dev:id>12345</dev:id>
  <dev:DeviceClassification>Fixed phone</dev:DeviceClassification>
  <dev:DeviceMfgr>Nokia</dev:DeviceMfgr>
  <dev:DeviceModelNr>Lumia 800</dev:DeviceModelNr>
  <dev:UniqueDeviceID TypeOfDeviceID="IMEI">35788104
</dev:UniqueDeviceID>
</dev:EmergencyCallData.DeviceInfo>
```

Figure 7: EmergencyCallData.DeviceInfo Example.

3.4. Owner/Subscriber Information

This block describes the owner of the device (if provided by the device) or the subscriber information, if provided by a service provider. The contact location is not necessarily the location of the caller or incident, but is rather the nominal contact address. The mime subtype is "application/EmergencyCallData.Subscriber+xml".

In some jurisdictions some or all parts of the subscriber-specific information are subject to privacy constraints. These constraints vary but dictate what information and be displayed and logged. A general privacy indicator expressing a desire for privacy is

provided. The interpretation of how this is applied is left to the receiving jurisdiction as the custodians of the local regulatory requirements.

3.4.1. Subscriber Data Privacy Indicator

Attribute: `privacyRequested`, boolean.

Use: Conditional. This attribute MUST be provided if the owner/subscriber information block is not empty.

Description: The subscriber data privacy indicator specifically expresses the subscriber's desire for privacy. In some jurisdictions subscriber services can have a specific "Type of Service" which prohibits information, such as the name of the subscriber, from being displayed. This attribute should be used to explicitly indicate whether the subscriber service includes such constraints.

Reason for Need: Some jurisdictions require subscriber privacy to be observed.

How Used by Call Taker: Where privacy is indicated the call taker may not have access to some aspects of the subscriber information.

3.4.2. xCard for Subscriber's Data

Data Element: `xCARD` for Subscriber's Data

Use: Conditional. Subscriber data is provided unless it is not available. Some services, for example prepaid phones, non-initialized phones, etc., do not have information about the subscriber.

XML Element: `<SubscriberData>`

Description: Information known by the service provider or device about the subscriber; e.g., Name, Address, Individual Telephone Number, Main Telephone Number and any other data. N, ORG (if appropriate), ADR, TEL, EMAIL are suggested at a minimum. If more than one TEL property is provided, a parameter from the vCard Property Value registry MUST be specified on each TEL.

Reason for Need: When the caller is unable to provide information, this data may be used to obtain it

How Used by Call Taker: Obtaining critical information about the caller and possibly the location when it is not able to be obtained otherwise.

3.4.3. EmergencyCallData.SubscriberInfo Example

```
<?xml version="1.0" encoding="UTF-8"?>
<sub:EmergencyCallData.SubscriberInfo
  xmlns:sub="urn:ietf:params:xml:ns:EmergencyCallData:SubscriberInfo"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
  privacyRequested="false">
  <sub:DataProviderReference>string0987654321@example.org
</sub:DataProviderReference>
  <sub:SubscriberData xmlns="urn:ietf:params:xml:ns:vcard-4.0">
    <vcards>
      <vcard>
        <fn><text>Simon Perreault</text></fn>
        <n>
          <surname>Perreault</surname>
          <given>Simon</given>
          <additional/>
          <prefix/>
          <suffix>ing. jr</suffix>
          <suffix>M.Sc.</suffix>
        </n>
        <bday><date>--0203</date></bday>
        <anniversary>
          <date-time>20090808T1430-0500</date-time>
        </anniversary>
        <gender><sex>M</sex></gender>
        <lang>
          <parameters><pref><integer>1</integer></pref>
          </parameters>
          <language-tag>fr</language-tag>
        </lang>
        <lang>
          <parameters><pref><integer>2</integer></pref>
          </parameters>
          <language-tag>en</language-tag>
        </lang>
        <org>
          <parameters><type><text>work</text></type>
          </parameters>
          <text>Viagenie</text>
        </org>
        <adr>
          <parameters>
```

```
<type><text>work</text></type>
<label><text>Simon Perreault
      2875 boul. Laurier, suite D2-630
      Quebec, QC, Canada
      G1V 2M2</text></label>
</parameters>
<pobox/>
<ext/>
<street>2875 boul. Laurier, suite D2-630</street>
<locality>Quebec</locality>
<region>QC</region>
<code>G1V 2M2</code>
<country>Canada</country>
</adr>
<tel>
  <parameters>
    <type>
      <text>work</text>
      <text>voice</text>
    </type>
  </parameters>
  <uri>tel:+1-418-656-9254;ext=102</uri>
</tel>
<tel>
  <parameters>
    <type>
      <text>work</text>
      <text>text</text>
      <text>voice</text>
      <text>cell</text>
      <text>video</text>
    </type>
  </parameters>
  <uri>tel:+1-418-262-6501</uri>
</tel>
<email>
  <parameters><type><text>work</text></type>
</parameters>
  <text>simon.perreault@viagenie.ca</text>
</email>
<geo>
  <parameters><type><text>work</text></type>
</parameters>
  <uri>geo:46.766336,-71.28955</uri>
</geo>
<key>
  <parameters><type><text>work</text></type>
</parameters>
```

```

        <uri>
        http://www.viagenie.ca/simon.perreault/simon.asc
        </uri>
    </key>
    <tz><text>America/Montreal</text></tz>
    <url>
        <parameters><type><text>home</text></type>
        </parameters>
        <uri>http://nomis80.org</uri>
    </url>
</vcard>
</vcards>
</sub:SubscriberData>
</sub:EmergencyCallData.SubscriberInfo>

```

Figure 8: EmergencyCallData.SubscriberInfo Example.

3.5. Comment

This block provides a mechanism for the data provider to supply extra, human readable information to the PSAP. It is not intended for a general purpose extension mechanism nor does it aim to provide machine-readable content. The mime subtype is "application/EmergencyCallData.Comment+xml"

3.5.1. Comment

Data Element: EmergencyCallData.Comment

Use: Optional

XML Element: <Comment>

Description: Human readable text providing additional information to the PSAP staff.

Reason for Need: Explanatory information for values in the data structure

How Used by Call Taker: To interpret the data provided

3.5.2. EmergencyCallData.Comment Example

```

<?xml version="1.0" encoding="UTF-8"?>
<com:EmergencyCallData.Comment
  xmlns:sub="urn:ietf:params:xml:ns:EmergencyCallData:Comment"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">

```

```
<com:DataProviderReference>string0987654321@example.org
</com:DataProviderReference>
<com:Comment xml:lang="en">This is an example text.</com:Comment>
</com:EmergencyCallData.Comment>
```

Figure 9: EmergencyCallData.Comment Example.

4. Data Transport Mechanisms

This section defines how to convey additional data to an emergency service provider. Two different means are specified: the first uses the call signaling; the second uses the <provided-by> element of a PIDF-LO [RFC4119].

1. First, the ability to embed a Uniform Resource Identifier (URI) in an existing SIP header field, the Call-Info header, is defined. The URI points to the additional data structure. The Call-Info header is specified in Section 20.9 of [RFC3261]. This document adds a new compound token starting with the value 'EmergencyCallData' for the Call-Info "purpose" parameter. If the "purpose" parameter is set to a value starting with 'EmergencyCallData', then the Call-Info header contains either an HTTPS URL pointing to an external resource or a CID (content indirection) URI that allows the data structure to be placed in the body of the SIP message. The "purpose" parameter also indicates the kind of data (by its MIME type) that is available at the URI. As the data is conveyed using a URI in the SIP signaling, the data itself may reside on an external resource, or may be contained within the body of the SIP message. When the URI refers to data at an external resource, the data is said to be passed by reference. When the URI refers to data contained within the body of the SIP message, the data is said to be passed by value. A PSAP or emergency responder is able to examine the type of data provided and selectively inspect the data it is interested in, while forwarding all of it (the values or references) to downstream entities. To be conveyed in a SIP body, additional data about a call is defined as a series of MIME objects. Each block defined in this document is an XML data structure identified by its MIME type. (Blocks defined by others may be encoded in XML or not, as identified by their MIME registration.) As usual, whenever more than one MIME part is included in the body of a message, MIME-multipart (i.e., 'multipart/mixed') encloses them all. This document defines a set of XML schemas and MIME types used for each block defined here. When additional data is passed by value in the SIP signaling, each CID URL points to one block in the body. Multiple URIs are used within a Call-Info header field (or multiple Call-Info header fields) to point to multiple blocks.

When additional data is provided by reference (in SIP signaling or Provided-By), each HTTPS URL references one block; the data is retrieved with an HTTPS GET operation, which returns one of the blocks as an object (the blocks defined here are returned as XML objects).

2. Second, the ability to embed additional data structures in the <provided-by> element of a PIDF-LO [RFC4119] is defined. Besides a service provider in the call path, the access network provider may also have similar information that may be valuable to the PSAP. The access network provider may provide location in the form of a PIDF-LO from a location server via a location configuration protocol. The data structures described in this document are not specific to the location itself, but rather provides descriptive information having to do with the immediate circumstances about the provision of the location (who the access network is, how to contact that entity, what kind of service the access network provides, subscriber information, etc.). This data is similar in nearly every respect to the data known by service providers in the path of the call. When the access network provider and service provider are separate entities, the access network does not participate in the application layer signaling (and hence cannot add a Call-Info header field to the SIP message), but may provide location information to assist in locating the caller's device. The <provided-by> element of the PIDF-LO is a mechanism for the access network provider to supply the information about the entity or organization that supplied this location information. For this reason, this document describes a namespace per RFC 4119 for inclusion in the <provided-by> element of a PIDF-LO for adding information known to the access network provider.

One or more blocks of data registered in the Emergency Call Additional Data registry, as defined in Section 9.1, may be included or referenced in the SIP signaling (using the Call-Info header field) or in the <provided-by> element of a PIDF-LO. Every block must be one of the types in the registry. Since the data of an emergency call may come from multiple sources, the data itself needs information describing the source. Consequently, each entity adding additional data MUST supply the "Data Provider" block. All other blocks are optional, but each entity SHOULD supply any blocks where it has at least some of the information in the block.

4.1. Transmitting Blocks using the Call-Info Header

A URI to a block MAY be inserted in a SIP request or response method (most often INVITE or MESSAGE) with a Call-Info header field containing a purpose value starting with 'EmergencyCallData' and the type of data available at the URI. The type of data is denoted by including the root of the MIME type (not including the 'EmergencyCallData' prefix and any suffix such as '+xml') with a '.' separator. For example, when referencing a block with MIME type 'application/EmergencyCallData.ProviderInfo+xml', the 'purpose' parameter is set to 'EmergencyCallData.ProviderInfo'. An example "Call-Info" header field for this would be:

```
Call-Info: https://www.example.com/23sedde3;  
          purpose="EmergencyCallData.ProviderInfo"
```

A Call-info header with a purpose value starting with 'EmergencyCallData' MUST only be sent on an emergency call, which can be ascertained by the presence of an emergency service urn in a Route header of a SIP message.

If the data is provided by reference, an HTTPS URI MUST be included and consequently Transport Layer Security (TLS) protection is applied for protecting the retrieval of the information.

The data may also be supplied by value in a SIP message. In this case, Content Indirection (CID) [RFC2392] is used, with the CID URL referencing the MIME body part.

More than one Call-Info header with a purpose value starting with 'EmergencyCallData' can be expected, but at least one MUST be provided. The device MUST provide one if it knows no service provider is in the path of the call. The device MAY insert one if it uses a service provider. Any service provider in the path of the call MUST insert its own. For example, a device, a telematics service provider in the call path, as well as the mobile carrier handling the call will each provide one. There may be circumstances where there is a service provider who is unaware that the call is an emergency call and cannot reasonably be expected to determine that it is an emergency call. In that case, that service provider is not expected to provide EmergencyCallData.

4.2. Transmitting Blocks by Reference using the Provided-By Element

The 'EmergencyCallDataReference' element is used to transmit an additional data block by reference within a 'Provided-By' element of a PIDF-LO. The 'EmergencyCallDataReference' element has two attributes: 'ref' to specify the URL, and 'purpose' to indicate the

type of data block referenced. The value of 'ref' is an HTTPS URL that resolves to a data structure with information about the call. The value of 'purpose' is the same as used in a 'Call-Info' header field (as specified in Section 4.1).

For example, to reference a block with MIME type 'application/EmergencyCallData.ProviderInfo+xml', the 'purpose' parameter is set to 'EmergencyCallData.ProviderInfo'. An example 'EmergencyCallDataReference' element for this would be:

```
<EmergencyCallDataReference ref="https://www.example.com/23sedde3"
  purpose="EmergencyCallData.ProviderInfo"/>
```

4.3. Transmitting Blocks by Value using the Provided-By Element

It is RECOMMENDED that access networks supply the data specified in this document by reference, but they MAY provide the data by value.

The 'EmergencyCallDataValue' element is used to transmit an additional data block by value within a 'Provided-By' element of a PIDF-LO. The 'EmergencyCallDataValue' element has one attribute: 'purpose' to indicate the type of data block contained. The value of 'purpose' is the same as used in a 'Call-Info' header field (as specified in Section 4.1, and in Section 4.1). The same XML structure as would be contained in the corresponding MIME type body part is placed inside the 'EmergencyCallDataValue' element.

For example:

```
<provided-by
  xmlns="urn:ietf:params:xml:ns:EmergencyCallData">
  <EmergencyCallData>
    <byRef purpose="EmergencyCallData.ServiceInfo"
      ref="https://example.com/ref2"/>
    <sub:EmergencyCallData.Comment
      xmlns:sub="urn:ietf:params:xml:ns:EmergencyCallData.Comment">
      <sub:Comment xml:lang="en">This is an example text.
    </sub:Comment>
    </sub:EmergencyCallData.Comment>
  </EmergencyCallData>
  <EmergencyCallDataValue
    purpose="EmergencyCallData.ProviderInfo">
    <ProviderID>Test</ProviderID>
    <ProviderIDSeries>NENA</ProviderIDSeries>
    <TypeOfProviderID>Access Infrastructure Provider
  </TypeOfProviderID>
    <ContactURI>sip:15555550987@burf.example.com;user=phone
```



```
</ContactURI>
</EmergencyCallDataValue>
</provided-by>
```

Example Provided-By by Value.

4.4. The Content-Disposition Parameter

RFC 5621 [RFC5621] discusses the handling of message bodies in SIP. It updates and clarifies handling originally defined in RFC 3261 [RFC3261] based on implementation experience. While RFC 3261 did not mandate support for 'multipart' message bodies, 'multipart/mixed' MIME bodies are used by many extensions (including this document) today. For example, adding a PIDF-LO, SDP, and additional data in body of a SIP message requires a 'multipart' message body.

RFC 3204 [RFC3204] and RFC 3459 [RFC3459] define the 'handling' parameter for the Content-Disposition header field. These RFCs describe how a UAS reacts if it receives a message body whose content type or disposition type it does not understand. If the 'handling' parameter has the value "optional", the UAS ignores the message body. If the 'handling' parameter has the value "required", the UAS returns a 415 (Unsupported Media Type) response. The 'by-reference' disposition type allows a SIP message to contain a reference to the body part, and the SIP UA processes the body part according to the reference. This is the case for the Call-info header containing a Content Indirection (CID) URL.

As an example, a SIP message indicates the Content-Disposition parameter in the body of the SIP message as shown in Figure 10.

```
Content-Type: application/sdp

...Omit Content-Disposition here; defaults are ok
...SDP goes in here

--boundary1

Content-Type: application/pidf+xml
Content-ID: <target123@atlanta.example.com>
Content-Disposition: by-reference;handling=optional

...PIDF-LO goes in here

--boundary1--
```

```

Content-Type: application/EmergencyCallData.ProviderInfo+xml
Content-ID: <1234567890@atlanta.example.com>
Content-Disposition: by-reference; handling=optional

...Data provider information data goes in here

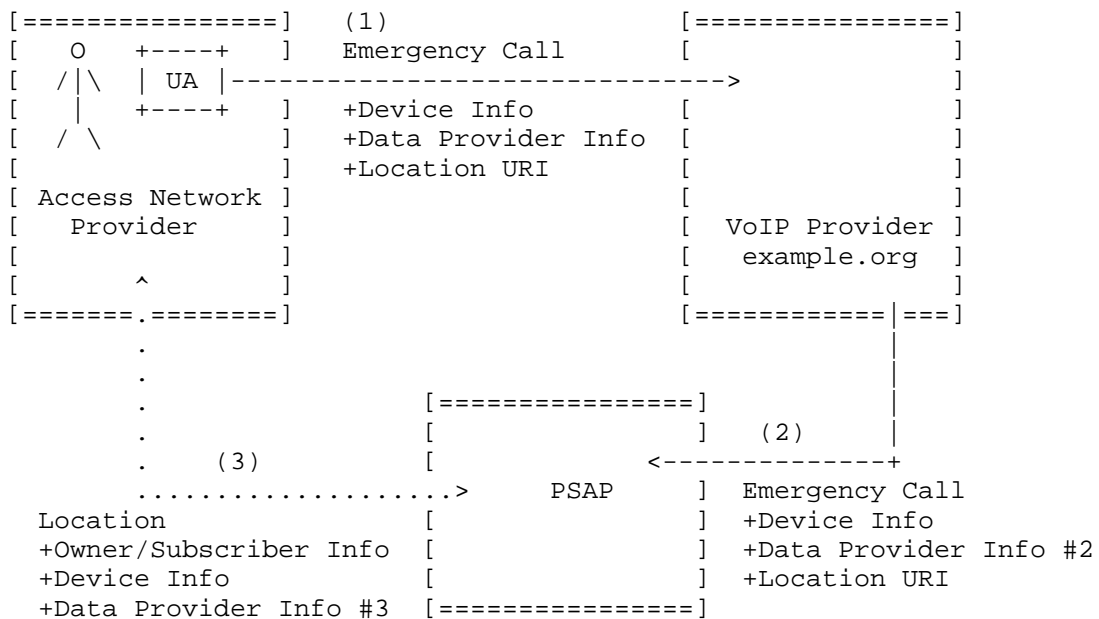
--boundary1--

```

Figure 10: Example for use of the Content-Disposition Parameter in SIP.

5. Examples

This section illustrates a longer and more complex example, as shown in Figure 11. In this example additional data is added by the end device, included by the VoIP provider (via the PIDF-LO), and provided by the access network provider.



Legend:

```

--- Emergency Call Setup Procedure
... Location Retrieval/Response

```

Figure 11: Additional Data Example Flow

The example scenario starts with the end device itself adding device information, owner/subscriber information, a location URI, and data provider information to the outgoing emergency call setup message (see step #1 in Figure 11). The SIP INVITE example is shown in Figure 12.

```

INVITE urn:service:sos SIP/2.0
Via: SIPS/2.0/TLS server.example.com;branch=z9hG4bK74bf9
Max-Forwards: 70
To: <urn:service:sos>
From: Hannes Tschofenig <sips:hannes@example.com>;tag=9fxced76sl
Call-ID: 3848276298220188511@example.com
Call-Info: <http://www.example.com/hannes/photo.jpg> ;purpose=icon,
           <http://www.example.com/hannes/> ;purpose=info,
           <cid:1234567890@atlanta.example.com>
           ;purpose=EmergencyCallData.ProviderInfo,
           <cid:0123456789@atlanta.example.com>
           ;purpose=EmergencyCallData.DeviceInfo
Geolocation: <https://ls.example.net:9768/357yc6s64ceyoiuy5ax3o>
Geolocation-Routing: yes
Accept: application/sdp, application/pidf+xml,
       application/EmergencyCallData.ProviderInfo+xml
CSeq: 31862 INVITE
Contact: <sips:hannes@example.com>
Content-Type: multipart/mixed; boundary=boundary1

Content-Length: ...

--boundary1

Content-Type: application/sdp

...SDP goes here

--boundary1--

Content-Type: application/EmergencyCallData.DeviceInfo+xml
Content-ID: <0123456789@atlanta.example.com>
Content-Disposition: by-reference;handling=optional
<?xml version="1.0" encoding="UTF-8"?>

<dev:EmergencyCallData.DeviceInfo
  xmlns:dev="urn:ietf:params:xml:ns:EmergencyCallData:DeviceInfo"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <dev:DataProviderReference>string0987654321@example.org

```

```

    </dev:DataProviderReference>
    <dev:DeviceClassification>SoftPhn</dev:DeviceClassification>
    <dev:UniqueDeviceID
      TypeOfDeviceID="MAC">00-0d-4b-30-72-df</dev:UniqueDeviceID>
  </dev:EmergencyCallData.DeviceInfo>

```

```
--boundary1--
```

```

Content-Type: application/EmergencyCallData.ProviderInfo+xml
Content-ID: <1234567890@atlanta.example.com>
Content-Disposition: by-reference;handling=optional
<?xml version="1.0" encoding="UTF-8"?>
<pi:EmergencyCallData.ProviderInfo
  xmlns:pi="urn:ietf:params:xml:ns:EmergencyCallData:ProviderInfo"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <pi:id>12345</pi:id>
  <pi:DataProviderReference>string0987654321@example.org
</pi:DataProviderReference>
  <pi:DataProviderString>Hannes Tschofenig
</pi:DataProviderString>
<pi:TypeOfProvider>Other</pi:TypeOfProvider>
<pi:ContactURI>sip:hannes@example.com</pi:ContactURI>
<pi:Language>EN</pi:Language>
<xc:DataProviderContact
  xmlns:xc="urn:ietf:params:xml:ns:vcard-4.0">
  <vcard>
    <fn><text>Hannes Tschofenig</text></fn>
    <n>
      <surname>Hannes</surname>
      <given>Tschofenig</given>
      <additional/>
      <prefix/>
      <suffix>Dipl. Ing.</suffix>
    </n>
    <bday><date>--0203</date></bday>
    <anniversary>
      <date-time>20090808T1430-0500</date-time>
    </anniversary>
    <gender><sex>M</sex></gender>
    <lang>
      <parameters><pref><integer>1</integer></pref>
      </parameters>
      <language-tag>de</language-tag>
    </lang>
    <lang>
      <parameters><pref><integer>2</integer></pref>
      </parameters>

```

```
<language-tag>en</language-tag>
</lang>
<adr>
  <parameters>
    <type><text>work</text></type>
    <label><text>Hannes Tschofenig
      Linnoitustie 6
      Espoo, Finland
      02600</text></label>
  </parameters>
  <pobox/>
  <ext/>
  <street>Linnoitustie 6</street>
  <locality>Espoo</locality>
  <region>Uusimaa</region>
  <code>02600</code>
  <country>Finland</country>
</adr>
<tel>
  <parameters>
    <type>
      <text>work</text>
      <text>voice</text>
    </type>
  </parameters>
  <uri>tel:+358 50 4871445</uri>
</tel>
<email>
  <parameters><type><text>work</text></type>
  </parameters>
  <text>hannes.tschofenig@nsn.com</text>
</email>
<geo>
  <parameters><type><text>work</text></type>
  </parameters>
  <uri>geo:60.210796,24.812924</uri>
</geo>
<key>
  <parameters>
    <type><text>home</text></type>
  </parameters>
  <uri>https://www.example.com/key.asc
    </uri>
</key>
<tz><text>Finland/Helsinki</text></tz>
<url>
  <parameters><type><text>home</text></type>
  </parameters>
```

```

        <uri>http://example.com/hannes.tschofenig</uri>
      </url>
    </vcard>
  </xc:DataProviderContact>
</pi:EmergencyCallData.ProviderInfo>
--boundary1--

```

Figure 12: End Device sending SIP INVITE with Additional Data.

In this example, information available to the access network operator is included in the call setup message only indirectly via the use of the location reference. The PSAP has to retrieve it via a separate look-up step. Since the access network provider and the VoIP service provider are two independent entities in this scenario, the access network operator is not involved in application layer exchanges; the SIP INVITE transits the access network transparently, as illustrated in step #1. No change to the SIP INVITE is applied.

When the VoIP service provider receives the message and determines based on the Service URN that the incoming request is an emergency call. It performs the typical emergency services related tasks, including location-based routing, and adds additional data, namely service and subscriber information, to the outgoing message. For the example we assume a VoIP service provider that deploys a back-to-back user agent allowing additional data to be included in the body of the SIP message (rather than per reference in the header), which allows us to illustrate the use of multiple data provider info blocks. The resulting message is shown in Figure 13.

```

INVITE sips:psap@example.org SIP/2.0
Via: SIP/2.0/TLS server.example.com;branch=z9hG4bK74bf9
Max-Forwards: 70
To: <urn:service:sos>
From: Hannes Tschofenig <sips:hannes@example.com>;tag=9fxced76s1
Call-ID: 3848276298220188511@example.com
Call-Info: <http://www.example.com/hannes/photo.jpg> ;purpose=icon,
  <http://www.example.com/hannes/> ;purpose=info,
  <cid:1234567890@atlanta.example.com>
  ;purpose=EmergencyCallData.ProviderInfo
  <cid:0123456789@atlanta.example.com>
  ;purpose=EmergencyCallData.DeviceInfo
Call-Info: <cid:bloorpyhex@atlanta.example.com>
  ;purpose=EmergencyCallData.ServiceInfo
Call-Info: <cid:aaabbb@atlanta.example.com>
  ;purpose=EmergencyCallData.ProviderInfo
Geolocation: <https://ls.example.net:9768/357yc6s64ceyoiuy5ax3o>
Geolocation-Routing: yes

```

```
Accept: application/sdp, application/pidf+xml,
       application/EmergencyCallData.ProviderInfo+xml
CSeq: 31862 INVITE
Contact: <sips:hannes@example.com>
Content-Type: multipart/mixed; boundary=boundary1

Content-Length: ...

--boundary1

Content-Type: application/sdp

...SDP goes here

--boundary1--

Content-Type: application/EmergencyCallData.DeviceInfo+xml
Content-ID: <0123456789@atlanta.example.com>
Content-Disposition: by-reference;handling=optional
<?xml version="1.0" encoding="UTF-8"?>

<dev:EmergencyCallData.DeviceInfo
  xmlns:dev="urn:ietf:params:xml:ns:EmergencyCallData:DeviceInfo"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <dev:DataProviderReference>string0987654321@example.org
</dev:DataProviderReference>
  <dev:DeviceClassification>SoftPhn</dev:DeviceClassification>
  <dev:UniqueDeviceID
    TypeOfDeviceID="MAC">00-0d-4b-30-72-df</dev:UniqueDeviceID>
</dev:EmergencyCallData.DeviceInfo>

--boundary1--

Content-Type: application/EmergencyCallData.ProviderInfo+xml
Content-ID: <1234567890@atlanta.example.com>
Content-Disposition: by-reference;handling=optional
<?xml version="1.0" encoding="UTF-8"?>
<pi:EmergencyCallData.ProviderInfo
  xmlns:pi="urn:ietf:params:xml:ns:EmergencyCallData:ProviderInfo"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <pi:DataProviderReference>string0987654321@example.org
</pi:DataProviderReference>
    <pi:DataProviderString>Hannes Tschofenig
  </pi:DataProviderString>
  <pi:TypeOfProvider>Other</pi:TypeOfProvider>
  <pi:ContactURI>sip:hannes@example.com</pi:ContactURI>
  <pi:Language>EN</pi:Language>
  <xc:DataProviderContact
```

```
xmlns:xc="urn:ietf:params:xml:ns:vcard-4.0">
  <vcard>
    <fn><text>Hannes Tschofenig</text></fn>
    <n>
      <surname>Hannes</surname>
      <given>Tschofenig</given>
      <additional/>
      <prefix/>
      <suffix>Dipl. Ing.</suffix>
    </n>
    <bday><date>--0203</date></bday>
    <anniversary>
      <date-time>20090808T1430-0500</date-time>
    </anniversary>
    <gender><sex>M</sex></gender>
    <lang>
      <parameters><pref><integer>1</integer></pref>
      </parameters>
      <language-tag>de</language-tag>
    </lang>
    <lang>
      <parameters><pref><integer>2</integer></pref>
      </parameters>
      <language-tag>en</language-tag>
    </lang>
    <adr>
      <parameters>
        <type><text>work</text></type>
        <label><text>Hannes Tschofenig
          Linnoitustie 6
          Espoo, Finland
          02600</text></label>
      </parameters>
      <pobox/>
      <ext/>
      <street>Linnoitustie 6</street>
      <locality>Espoo</locality>
      <region>Uusimaa</region>
      <code>02600</code>
      <country>Finland</country>
    </adr>
    <tel>
      <parameters>
        <type>
          <text>work</text>
          <text>voice</text>
        </type>
      </parameters>
```



```
<uri>tel:+358 50 4871445</uri>
</tel>
<email>
  <parameters><type><text>work</text></type>
</parameters>
  <text>hannes.tschofenig@nsn.com</text>
</email>
<geo>
  <parameters><type><text>work</text></type>
</parameters>
  <uri>geo:60.210796,24.812924</uri>
</geo>
<key>
  <parameters>
    <type><text>home</text></type>
  </parameters>
  <uri>https://www.example.com/key.asc
    </uri>
</key>
<tz><text>Finland/Helsinki</text></tz>
<url>
  <parameters><type><text>home</text></type>
</parameters>
  <uri>http://example.com/hannes.tschofenig</uri>
</url>
</vcard>
</xc:DataProviderContact>
</pi:EmergencyCallData.ProviderInfo>
```

--boundary1--

```
Content-Type: application/EmergencyCallData.ServiceInfo+xml
Content-ID: <bloorpyhex@atlanta.example.com>
Content-Disposition: by-reference;handling=optional
<?xml version="1.0" encoding="UTF-8"?>
<svc:EmergencyCallData.ServiceInfo
  xmlns:svc="urn:ietf:params:xml:ns:EmergencyCallData.ServiceInfo"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <svc:DataProviderReference>string0987654321@example.org
</svc:DataProviderReference>
  <svc:ServiceEnvironment>Residence</svc:ServiceEnvironment>
  <svc:ServiceType>VOIP</svc:ServiceType>
  <svc:ServiceMobility>Unknown</svc:ServiceMobility>
</svc:EmergencyCallData.ServiceInfo>
```

--boundary1--

```
Content-Type: application/EmergencyCallData.ProviderInfo+xml
```

```
Content-ID: <aaabbb@atlanta.example.com>
Content-Disposition: by-reference;handling=optional
<?xml version="1.0" encoding="UTF-8"?>
<pi:EmergencyCallData.ProviderInfo
  xmlns:pi="urn:ietf:params:xml:ns:EmergencyCallData:ProviderInfo"
  xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <pi:DataProviderReference>string0987654321@example.org
</pi:DataProviderReference>
  <pi:DataProviderString>Example VoIP Provider
</pi:DataProviderString>
  <pi:ProviderID>urn:nena:companyid:ID123</pi:ProviderID>
  <pi:ProviderIDSeries>NENA</pi:ProviderIDSeries>
  <pi:TypeOfProvider>Service Provider</pi:TypeOfProvider>
  <pi:ContactURI>sip:voip-provider@example.com</pi:ContactURI>
  <pi:Language>EN</pi:Language>
  <xc:DataProviderContact
    xmlns:xc="urn:ietf:params:xml:ns:vcard-4.0">
    <vcard>
      <fn><text>John Doe</text></fn>
      <n>
        <surname>John</surname>
        <given>Doe</given>
        <additional/>
        <prefix/>
        <suffix/>
      </n>
      <bday><date>--0203</date></bday>
      <anniversary>
        <date-time>20090808T1430-0500</date-time>
      </anniversary>
      <gender><sex>M</sex></gender>
      <lang>
        <parameters><pref><integer>1</integer></pref>
        </parameters>
        <language-tag>en</language-tag>
      </lang>
      <org>
        <parameters><type><text>work</text></type>
        </parameters>
        <text>Example VoIP Provider</text>
      </org>
      <adr>
        <parameters>
          <type><text>work</text></type>
          <label><text>John Doe
            Downing Street 10
            London, UK</text></label>
        </parameters>
```

```

        <pobox/>
        <ext/>
        <street>Downing Street 10</street>
        <locality>London</locality>
        <region/>
        <code>SW1A 2AA</code>
        <country>UK</country>
    </adr>
    <tel>
        <parameters>
            <type>
                <text>work</text>
                <text>voice</text>
            </type>
        </parameters>
        <uri>sips:john.doe@example.com</uri>
    </tel>
    <email>
        <parameters><type><text>work</text></type>
        </parameters>
        <text>john.doe@example.com</text>
    </email>
    <geo>
        <parameters><type><text>work</text></type>
        </parameters>
        <uri>geo:51.503396, 0.127640</uri>
    </geo>
    <tz><text>Europe/London</text></tz>
    <url>
        <parameters><type><text>home</text></type>
        </parameters>
        <uri>http://www.example.com/john.doe</uri>
    </url>
</vcard>
</xc:DataProviderContact>
</pi:EmergencyCallData.ProviderInfo>

```

Figure 13: VoIP Provider sending SIP INVITE with Additional Data.

Finally, the PSAP requests location information from the access network operator. The response is shown in Figure 14. Along with the location information additional data is provided in the <Provided-By> element of the PIDF-LO.

```

<?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:dm="urn:ietf:params:xml:ns:pidf:data-model"
entity="pres:alice@atlanta.example.com">
  <dm:device id="target123-1">
    <gp:geopriv>
      <gp:location-info>
        <civicAddress
xmlns="urn:ietf:params:xml:ns:pidf:geopriv10:civicAddr">
          <country>AU</country>
          <A1>NSW</A1>
          <A3>Wollongong</A3>
          <A4>North Wollongong</A4>
          <RD>Flinders</RD>
          <STS>Street</STS>
          <RDBR>Campbell Street</RDBR>
          <LMK>Gilligan's Island</LMK>
          <LOC>Corner</LOC>
          <NAM>Video Rental Store</NAM>
          <PC>2500</PC>
          <ROOM>Westerns and Classics</ROOM>
          <PLC>store</PLC>
          <POBOX>Private Box 15</POBOX>
        </civicAddress>
      </gp:location-info>
      <gp:usage-rules>
        <gbp:retransmission-allowed>true
        </gbp:retransmission-allowed>
        <gbp:retention-expiry>2013-12-10T20:00:00Z
        </gbp:retention-expiry>
      </gp:usage-rules>
      <gp:method>802.11</gp:method>

      <provided-by
xmlns="urn:ietf:params:xml:ns:EmergencyCallData">

        <EmergencyCallDataReference purpose="EmergencyCallData.ServiceInfo"
          ref="https://example.com/ref2"/>

        <EmergencyCallDataValue>
          <EmergencyCallData.ProviderInfo
xmlns="urn:ietf:params:xml:ns:EmergencyCallData:ProviderInfo">
            <DataProviderReference>string0987654321@example.org
            </DataProviderReference>
            <DataProviderString>University of California, Irvine
            </DataProviderString>
            <ProviderID>urn:nena:companyid:uci</ProviderID>
            <ProviderIDSeries>NENA</ProviderIDSeries>
            <TypeOfProvider>Other</TypeOfProvider>

```

```

        <ContactURI>tel:+1 9498245222</ContactURI>
        <Language>EN</Language>
    </EmergencyCallData.ProviderInfo>

    <EmergencyCallData.Comment
        xmlns="urn:ietf:params:xml:ns:EmergencyCallData:Comment">
        <DataProviderReference>string0987654321@example.org
        </DataProviderReference>
        <Comment xml:lang="en">This is an example text.</Comment>
    </EmergencyCallData.Comment>

</EmergencyCallDataValue>
</provided-by>
</gp:geopriv>
<dm:deviceID>mac:00-0d-4b-30-72-df</dm:deviceID>
<dm:timestamp>2013-07-09T20:57:29Z</dm:timestamp>
</dm:device>
</presence>

```

Figure 14: Access Network Provider returning PIDF-LO with Additional Data.

6. XML Schemas

This section defines the XML schemas of the five data blocks. Additionally, the Provided-By schema is specified.

6.1. EmergencyCallData.ProviderInfo XML Schema

```

<?xml version="1.0"?>
<xs:schema
    targetNamespace=
        "urn:ietf:params:xml:ns:EmergencyCallData:ProviderInfo"
    xmlns:xs="http://www.w3.org/2001/XMLSchema"
    xmlns:pi="urn:ietf:params:xml:ns:EmergencyCallData:ProviderInfo"
    xmlns:xml="http://www.w3.org/XML/1998/namespace"
    xmlns:xc="urn:ietf:params:xml:ns:vcard-4.0"
    elementFormDefault="qualified"
    attributeFormDefault="unqualified">

    <xs:import namespace="http://www.w3.org/XML/1998/namespace"
        schemaLocation="http://www.w3.org/2001/xml.xsd"/>

    <xs:import namespace="urn:ietf:params:xml:ns:vcard-4.0">

    <xs:simpleType name="iso3166a2">

```

```
<xs:restriction base="xs:token">
  <xs:pattern value="[A-Z]{2}" />
</xs:restriction>
</xs:simpleType>

<xs:element
  name="EmergencyCallData.ProviderInfo"
  type="pi:ProviderInfoType" />

<xs:element name="DataProviderReference"
  type="xs:token" minOccurs="1" maxOccurs="1" />

<xs:simpleType name="SubcontractorPriorityType">
  <xs:restriction base="xs:string">
    <xs:enumeration value="sub" />
    <xs:enumeration value="main" />
  </xs:restriction>
</xs:simpleType>

  <xs:complexType name="ProviderInfoType">
    <xs:sequence>
      <xs:element name="id"
        type="xs:string" minOccurs="1" maxOccurs="1" />

      <xs:element name="DataProviderString"
        type="xs:string" minOccurs="1" maxOccurs="1" />

      <xs:element name="ProviderID"
        type="xs:string" minOccurs="0" maxOccurs="1" />

      <xs:element name="ProviderIDSeries"
        type="xs:string" minOccurs="0" maxOccurs="1" />

      <xs:element name="TypeOfProvider"
        type="xs:string" minOccurs="0" maxOccurs="1" />

      <xs:element name="ContactURI" type="xs:anyURI"
        minOccurs="1" maxOccurs="1" />

      <xs:element name="Language" type="pi:iso3166a2"
        minOccurs="0" maxOccurs="unbounded" />

      <xs:element name="DataProviderContact"
        type="xc:vcardType" minOccurs="0"
        maxOccurs="1" />

      <xs:element name="SubcontratorPrincipal"
        type="xs:string" minOccurs="0" maxOccurs="1" />
```

```

        <xs:element name="SubcontractorPriority"
            type="pi:SubcontractorPriorityType" minOccurs="0" maxOccurs="1"/>

        <xs:sequence>
            <xs:element namespace="##other" processContents="lax"
                minOccurs="0" maxOccurs="unbounded"/>
        </xs:sequence>
    </xs:complexType>

</xs:schema>

```

Figure 15: EmergencyCallData.ProviderInfo XML Schema.

6.2. EmergencyCallData.ServiceInfo XML Schema

```

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

    <xs:import namespace="http://www.w3.org/XML/1998/namespace"
        schemaLocation="http://www.w3.org/2001/xml.xsd"/>

    <xs:element name="EmergencyCallData.ServiceInfo" type="svc:ServiceInfoType"/>

    <xs:complexType name="ServiceInfoType">
        <xs:sequence>
            <xs:element name="DataProviderReference"
                type="xs:token" minOccurs="1" maxOccurs="1"/>

            <xs:element name="ServiceEnvironment"
                type="xs:string" minOccurs="1" maxOccurs="1"/>

            <xs:element name="ServiceType"
                type="xs:string" minOccurs="1" maxOccurs="1"/>

            <xs:element name="ServiceMobility"
                type="xs:string" minOccurs="1" maxOccurs="1"/>

            <xs:element name="Link"
                type="xs:string" minOccurs="0" maxOccurs="1"/>

            <xs:any namespace="##other" processContents="lax"
                minOccurs="0" maxOccurs="unbounded"/>
        </xs:sequence>
    </xs:complexType>

```

```

        </xs:sequence>
    </xs:complexType>

</xs:schema>

```

Figure 16: EmergencyCallData.ServiceInfo XML Schema.

6.3. EmergencyCallData.DeviceInfo XML Schema

```

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

    <xs:import namespace="http://www.w3.org/XML/1998/namespace"
        schemaLocation="http://www.w3.org/2001/xml.xsd"/>

    <xs:element name="EmergencyCallData.DeviceInfo" type="dev:DeviceInfoType"
/>

    <xs:complexType name="DeviceInfoType">
        <xs:sequence>
            <xs:element name="DataProviderReference"
                type="xs:token" minOccurs="1" maxOccurs="1"/>

            <xs:element name="DeviceClassification"
                type="xs:string" minOccurs="0" maxOccurs="1"/>

            <xs:element name="DeviceMfgr"
                type="xs:string" minOccurs="0" maxOccurs="1"/>

            <xs:element name="DeviceModelNr"
                type="xs:string" minOccurs="0" maxOccurs="1"/>

            <xs:element name="UniqueDeviceID" minOccurs="0"
                maxOccurs="unbounded">
                <xs:complexType>
                    <xs:simpleContent>
                        <xs:extension base="xs:string">
                            <xs:attribute name="TypeOfDeviceID"
                                type="xs:string"
                                use="required"/>
                        </xs:extension>
                    </xs:simpleContent>
                </xs:complexType>
            </xs:element>
        </xs:sequence>
    </xs:complexType>

```



```

</xs:element>

<xs:element name="DeviceSpecificData"
  type="xs:anyURI" minOccurs="0" maxOccurs="1"/>

<xs:element name="DeviceSpecificType"
  type="xs:string" minOccurs="0" maxOccurs="1"/>

<xs:any namespace="##other" processContents="lax"
  minOccurs="0" maxOccurs="unbounded"/>
</xs:sequence>
</xs:complexType>

</xs:schema>

```

Figure 17: EmergencyCallData.DeviceInfo XML Schema.

6.4. EmergencyCallData.SubscriberInfo XML Schema

```

<?xml version="1.0"?>
<xs:schema
  targetNamespace=
    "urn:ietf:params:xml:ns:EmergencyCallData:SubscriberInf
o"
  xmlns:xs="http://www.w3.org/2001/XMLSchema"
  xmlns:sub="urn:ietf:params:xml:ns:EmergencyCallData:SubscriberInfo"
  xmlns:xc="urn:ietf:params:xml:ns:vcard-4.0"
  xmlns:xml="http://www.w3.org/XML/1998/namespace"
  elementFormDefault="qualified" attributeFormDefault="unqualified">

  <xs:import namespace="http://www.w3.org/XML/1998/namespace"
    schemaLocation="http://www.w3.org/2001/xml.xsd"/>

  <xs:import namespace="urn:ietf:params:xml:ns:vcard-4.0"/>

  <xs:element name="EmergencyCallData.SubscriberInfo" type="sub:SubscriberI
nfoType"/>

  <xs:complexType name="SubscriberInfoType">
    <xs:complexContent>
      <xs:sequence>
        <xs:element name="DataProviderReference"
          type="xs:token" minOccurs="1" maxOccurs="1"/>

        <xs:element name="SubscriberData" type="xc:vcardType"
          minOccurs="0" maxOccurs="1" />

        <xs:any namespace="##other" processContents="lax"
          minOccurs="0" maxOccurs="unbounded"/>

```

```

        </xs:sequence>
        <xs:attribute name="privacyRequested" type="xs:boolean" use="required"/>
    </xs:complexContent>
</xs:complexType>

</xs:schema>

```

Figure 18: EmergencyCallData.SubscriberInfo XML Schema.

6.5. EmergencyCallData.Comment XML Schema

```

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

  <xs:import namespace="http://www.w3.org/XML/1998/namespace"
    schemaLocation="http://www.w3.org/2001/xml.xsd"/>

  <xs:element name="EmergencyCallData.Comment" type="com:CommentType"/>

  <xs:complexType name="CommentType">
    <xs:sequence>
      <xs:element name="DataProviderReference"
        type="xs:token" minOccurs="1" maxOccurs="1"/>

      <xs:element name="Comment"
        type="com:CommentSubType" minOccurs="0"
        maxOccurs="unbounded"/>

      <xs:any namespace="##other" processContents="lax"
        minOccurs="0" maxOccurs="unbounded"/>
    </xs:sequence>
  </xs:complexType>

  <xs:complexType name="CommentSubType">
    <xs:simpleContent>
      <xs:extension base="xs:string">
        <xs:attribute ref="xml:lang"/>
      </xs:extension>
    </xs:simpleContent>
  </xs:complexType>

```

```
</xs:schema>
```

Figure 19: EmergencyCallData.Comment XML Schema.

6.6. Provided-By XML Schema

This section defines the Provided-By schema.

```
<?xml version="1.0"?>
<xs:schema
  targetNamespace=
    "urn:ietf:params:xml:ns:EmergencyCallData"
  xmlns:xs="http://www.w3.org/2001/XMLSchema"
  xmlns:ad="urn:ietf:params:xml:ns:EmergencyCallData"
  xmlns:xml="http://www.w3.org/XML/1998/namespace"
  xmlns:pi="urn:ietf:params:xml:ns:EmergencyCallData:ProviderInfo"
  xmlns:svc="urn:ietf:params:xml:ns:EmergencyCallData:ServiceInfo"
  xmlns:dev="urn:ietf:params:xml:ns:EmergencyCallData:DeviceInfo"
  xmlns:sub="urn:ietf:params:xml:ns:EmergencyCallData:SubscriberInfo"
  xmlns:com="urn:ietf:params:xml:ns:EmergencyCallData:Comment"
  elementFormDefault="qualified" attributeFormDefault="unqualified">

  <xs:import namespace="urn:ietf:params:xml:ns:EmergencyCallData:ProviderIn
fo"/>
  <xs:import namespace="urn:ietf:params:xml:ns:EmergencyCallData:ServiceInf
o"/>
  <xs:import namespace="urn:ietf:params:xml:ns:EmergencyCallData:DeviceInfo
"/>
  <xs:import namespace="urn:ietf:params:xml:ns:EmergencyCallData:Subscriber
Info"/>
  <xs:import namespace="urn:ietf:params:xml:ns:EmergencyCallData:Comment"/>

  <xs:element name="provided-by" type="ad:provided-by-Type"/>

  <xs:complexType name="provided-by-Type">
    <xs:sequence>
      <xs:element name="DataProviderReference"
        type="xs:token" minOccurs="1" maxOccurs="1"/>

      <xs:element name="EmergencyCallDataReference"
        type="ad:ByRefType"
        minOccurs="0" maxOccurs="unbounded"/>

      <xs:element name="EmergencyCallDataValue"
        type="ad:EmergencyCallDataValueType"
        minOccurs="0" maxOccurs="unbounded"/>

      <xs:any namespace="##other" processContents="lax"
        minOccurs="0" maxOccurs="unbounded"/>
    </xs:sequence>
```

```
</xs:complexType>

<!-- Additional Data By Reference -->

<xs:complexType name="ByRefType">
  <xs:complexContent>
    <xs:restriction base="xs:anyType">
      <xs:sequence>
        <xs:any namespace="##other" minOccurs="0"
          maxOccurs="unbounded" processContents="lax"/>
      </xs:sequence>
      <xs:attribute name="purpose" type="xs:anyURI"
        use="required"/>
      <xs:attribute name="ref" type="xs:anyURI"
        use="required"/>
    </xs:restriction>
  </xs:complexContent>
</xs:complexType>

<!-- Additional Data By Value -->

<xs:complexType name="EmergencyCallDataValueType">
  <xs:sequence>
    <xs:element name="EmergencyCallData.ProviderInfo"
      type="pi:ProviderInfoType"
      minOccurs="0" maxOccurs="unbounded"/>
    <xs:element name="EmergencyCallData.ServiceInfo"
      type="svc:ServiceInfoType"
      minOccurs="0" maxOccurs="unbounded"/>
    <xs:element name="EmergencyCallData.DeviceInfo"
      type="dev:DeviceInfoType"
      minOccurs="0" maxOccurs="unbounded"/>
    <xs:element name="EmergencyCallData.SubscriberInfo"
      type="sub:SubscriberInfoType"
      minOccurs="0" maxOccurs="unbounded"/>
    <xs:element name="EmergencyCallData.Comment"
      type="com:CommentType"
      minOccurs="0" maxOccurs="unbounded"/>

    <xs:any namespace="##other" processContents="lax"
      minOccurs="0" maxOccurs="unbounded"/>

  </xs:sequence>
</xs:complexType>

</xs:schema>
```

Figure 20: Provided-By XML Schema.

7. Security Considerations

The information in this data structure will usually be considered private. HTTPS is specified to require the provider of the information to validate the credentials of the requester. While the creation of a public key infrastructure (PKI) that has global scope may be difficult, the alternatives to creating devices and services that can provide critical information securely are more daunting. The provider may enforce any policy it wishes to use, but PSAPs and responder agencies should deploy a PKI so that providers of additional data can check the certificate of the client and decide the appropriate policy to enforce based on that certificate.

Ideally, the PSAP and emergency responders will be given credentials signed by an authority trusted by the data provider. In most circumstances, nationally recognized credentials would be sufficient, and if the emergency services arranges a PKI, data providers could be provisioned with the root CA public key for a given nation. Some nations are developing a PKI for this, and related, purposes. Since calls could be made from devices where the device and/or the service provider(s) are not local to the emergency authorities, globally recognized credentials are useful. This might be accomplished by extending the notion of the "forest guide" described in [RFC5222] to allow the forest guide to provide the credential of the PKI root for areas that it has coverage information for, but standards for such a mechanism are not yet available. In its absence, the data provider will need to obtain the root CA credentials for any areas it is willing to provide additional data by out of band means. With the credential of the root CA for a national emergency services PKI, the data provider server can validate the credentials of an entity requesting additional data by reference.

The data provider also needs a credential that can be verified by the emergency services to know that it is receiving data from the right server. The emergency authorities could provide credentials, distinguishable from credentials it provides to emergency responders and PSAPs, which could be used to validate data providers. Such credentials would have to be acceptable to any PSAP or responder that could receive a call with additional data supplied by that provider. This would be extensible to global credential validation using the forest guide as above. In the absence of such credentials, the emergency authorities could maintain a list of local data providers' credentials provided to it out of band. At a minimum, the emergency authorities could obtain a credential from the DNS entry of the domain in the Additional Data URI to at least validate that the server is known to the domain providing the URI.

Data provided by devices by reference have similar credential validation issues to service providers, and the solutions are the same.

8. Privacy Considerations

This document enables functionality for conveying additional information about the caller to the callee. Some of this information is personal data and therefore privacy concerns arise. An explicit privacy indicator for information directly relating to the callers identity is defined and use is mandatory. However, observance of this request for privacy and what information it relates to is controlled by the destination jurisdiction.

There are a number of privacy concerns with regular real-time communication services that are also applicable to emergency calling. Data protection regulation world-wide has, however, decided to create exceptions for emergency services since the drawbacks of disclosing personal data in comparison to the benefit for the emergency caller are often towards the latter. Hence, the data protection rights of individuals are often waived for emergency situations. There are, however, still various countries that offer some degree of anonymity for the caller towards PSAP call takers.

The functionality defined in this document, however, far exceeds the amount of information sharing found in the Plain old telephone system (POTS). For this reason there are additional privacy threats to consider, which are described in more detail in [RFC6973].

Stored Data Compromise: First, there is an increased risk of stored data compromise since additional data is collected and stored in databases. Without adequate measures to secure stored data from unauthorized or inappropriate access at access network operators, service providers, end devices, as well as PSAPs individuals are exposed to potential financial, reputational, or physical harm.

Misattribution: If the personal data collected and conveyed is incorrect or inaccurate then this may lead to misattribution. Misattribution occurs when data or communications related to one individual are attributed to another.

Identification: By the nature of the additional data and its capability to provide much richer information about the caller, the call, and the location the calling party is identified in a much better way. Some users may feel uncomfortable with this degree of information sharing even in emergency services situations.

Secondary Use: Furthermore, there is the risk of secondary use.

Secondary use is the use of collected information about an individual without the individual's consent for a purpose different from that for which the information was collected. The stated purpose of the additional data is for emergency services purposes but theoretically the same information could be used for any other call as well. Additionally, parties involved in the emergency call may retain the obtained information and may re-use it for other, non-emergency services purposes.

Disclosure: When the data defined in this document is not properly security (while in transit with traditional communication security techniques, and while at rest using access control mechanisms) there is the risk of disclosure, which is the revelation of information about an individual that affects the way others judge the individual.

To mitigate these privacy risks the following countermeasures can be taken.

In regions where callers can elect to suppress certain personally identifying information, the network or PSAP functionality can inspect privacy flags within the SIP headers to determine what information may be passed, stored, or displayed to comply with local policy or law. RFC 3325 [RFC3325] defines the "id" priv-value token. The presence of this privacy type in a Privacy header field indicates that the user would like the network asserted identity to be kept private with respect to SIP entities outside the trust domain with which the user authenticated, including the PSAP.

This document defines various data structures that constitutes personal data. Local regulations may govern what data must be provided in emergency calls, but in general, the emergency call system is often aided by the kinds of information described in this document. There is a tradeoff between the privacy considerations and the utility of the data. For adequate protection this specification requires all data exchanges to be secured via communication security techniques (namely TLS) against eavesdropping and inception. Furthermore, security safeguards are required to prevent unauthorized access to data at rest. Various security incidents over the last 10 years have shown data breaches are not uncommon and are often caused by lack of proper access control frameworks, software bugs (buffer overflows), or missing input parsing (SQL injection attacks). The risks of data breaches is increased with the obligation for emergency services to retain emergency call related data for extended periods, e.g., several years are the norm.

Finally, it is also worth to highlight the nature of the SIP communication architecture, which introduces additional complications for privacy. Some forms of data can be sent by value in the SIP signaling or by value (URL in SIP signaling). When data is sent by value, all intermediaries have access to the data. As such, these intermediaries may also introduce additional privacy risk. Therefore, in situations where the conveyed information raises privacy concerns and intermediaries are involved transmitting a reference is more appropriate (assuming proper access control policies are available for distinguishing the different entities dereferencing the reference). Without access control policies any party in possession of the reference is able to resolve the reference and to obtain the data, including intermediaries.

9. IANA Considerations

9.1. Registry creation

This document creates a new registry called 'Emergency Call Additional Data'. The following sub-registries are created for this registry.

9.1.1. Provider ID Series Registry

This document creates a new sub-registry called 'Additional Call Data Provider ID Series'. As defined in [RFC5226], this registry operates under "Expert Review" rules. The expert should determine that the entity requesting a new value is a legitimate issuer of service provider IDs suitable for use in Additional Call Data.

The content of this registry includes:

Name: The identifier which will be used in the ProviderIDSeries element

Source: The full name of the organization issuing the identifiers

URL: A URL to the organization for further information

The initial set of values is listed in Figure 21.

| Name | Source | URL |
|------|---------------------------------------|---|
| NENA | National Emergency Number Association | http://www.nena.org |
| EENA | European Emergency Number Association | http://www.eena.org |

+-----+-----+-----+-----+-----+-----+-----+-----+

Figure 21: Provider ID Series Registry.

9.1.2. Service Environment Registry

This document creates a new sub-registry called 'Additional Call Service Environment'. As defined in [RFC5226], this registry operates under "Expert Review" rules. The expert should determine that the entity requesting a new value is relevant for this service element.

The content of this registry includes:

Token: The value to be used in <ServiceEnvironment> element.

Description: A short description of the token.

The initial set of values is listed in Figure 22.

| Token | Description |
|-----------|--------------|
| Business | [[This RFC]] |
| Residence | [[This RFC]] |

Figure 22: Service Environment Registry.

9.1.3. Service Provider Type Registry

This document creates a new sub-registry called 'Service Provider Type'. As defined in [RFC5226], this registry operates under "Expert Review". The expert should determine that the proposed new value is distinct from existing values and appropriate for use in the TypeOfServiceProvider element

The content of this registry includes:

Name: The value to be used in TypeOfServiceProvider.

Description: A short description of the type of service provider

The initial set of values is defined in Figure 1.

9.1.4. Service Delivered Registry

This document creates a new sub-registry called 'Service Delivered'. As defined in [RFC5226], this registry operates under "Expert Review" rules. The expert should consider whether the proposed service is unique from existing services and the definition of the service will be clear to implementors and PSAPS/responders.

The content of this registry includes:

Name: Enumeration token of the service.

Description: Short description identifying the service.

The initial set of values are defined in Figure 3.

9.1.5. Device Classification Registry

This document creates a new sub-registry called 'Device Classification'. As defined in [RFC5226], this registry operates under "Expert Review" rules. The expert should consider whether the proposed class is unique from existing classes and the definition of the class will be clear to implementors and PSAPS/responders.

The content of this registry includes:

Name: Enumeration token of the device classification.

Description: Short description identifying the device type.

The initial set of values are defined in Figure 5.

9.1.6. Device ID Type Type Registry

This document creates a new sub-registry called 'Additional Call Data Device ID Type'. As defined in [RFC5226], this registry operates under "Expert Review" rules. The expert should ascertain that the proposed type is well understood, and provides the information useful to PSAPs and responders to uniquely identify a device.

The content of this registry includes:

Name: Enumeration token of the device id type.

Description: Short description identifying type of device id.

The initial set of values are defined in Figure 6.

9.1.7. Device/Service Data Type Registry

This document creates a new sub-registry called 'Device/Service Data Type Registry'. As defined in [RFC5226], this registry operates under "Expert Review" and "Specification Required" rules. The expert should ascertain that the proposed type is well understood, and provides information useful to PSAPs and responders. The specification must contain a complete description of the data, and a precise format specification suitable to allow interoperable implementations.

The content of this registry includes:

Name: Enumeration token of the data type.

Description: Short description identifying the the data.

Specification: Citation for the specification of the data.

The initial set of values are listed in Figure 23.

| Token | Description | Specification |
|---------|--|----------------|
| IEE1512 | Common Incident Management Message Set | IEEE 1512-2006 |

Figure 23: Device/Service Data Type Registry.

9.1.1.8. Additional Data Blocks Registry

This document creates a new sub-registry called 'Additional Data Blocks' in the purpose registry established by RFC 3261 [RFC3261]. As defined in [RFC5226], this registry operates under "Expert Review" and "Specification Required" rules. The expert is responsible for verifying that the document contains a complete and clear specification and the proposed functionality does not obviously duplicate existing functionality.

The content of this registry includes:

Name: Element Name of enclosing block.

Reference: The document that describes the block

The initial set of values are listed in Figure 24.

| Token | Reference |
|-------|-----------|
|-------|-----------|

| | | |
|--------------|------------|--|
| ProviderInfo | [This RFC] | |
| ServiceInfo | [This RFC] | |
| DeviceInfo | [This RFC] | |
| Subscriber | [This RFC] | |
| Comment | [This RFC] | |
| +-----+ | | |

Figure 24: Additional Data Blocks Registry.

9.2. 'EmergencyCallData' Purpose Parameter Value

This document defines the 'EmergencyCallData' value for the "purpose" parameter of the Call-Info header field. The Call-Info header and the corresponding registry for the 'purpose' parameter was established with RFC 3261 [RFC3261].

| Header Field | Parameter Name | New Value | Reference |
|-----------------|-------------------|-------------------|------------|
| ----- | ----- | ----- | ----- |
| Call-Info | purpose | EmergencyCallData | [This RFC] |

9.3. URN Sub-Namespace Registration for provided-by Registry Entry

This section registers the namespace specified in Section 9.5.1 in the provided-by registry established by RFC 4119, for usage within the <provided-by> element of a PIDF-LO.

The schema for the provided-by schema used by this document is specified in Section 6.6.

9.4. MIME Registrations

9.4.1. MIME Content-type Registration for 'application/ EmergencyCallData.ProviderInfo+xml'

This specification requests the registration of a new MIME type according to the procedures of RFC 4288 [RFC4288] and guidelines in RFC 3023 [RFC3023].

MIME media type name: application

MIME subtype name: EmergencyCallData.ProviderInfo+xml

Mandatory parameters: none

Optional parameters: charset Indicates the character encoding of enclosed XML.

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

Security considerations: This content type is designed to carry the data provider information, which is a sub-category of additional data about an emergency call. Since this data contains personal information appropriate precautions have to be taken to limit unauthorized access, inappropriate disclosure to third parties, and eavesdropping of this information. Please refer to Section 7 and Section 8 for more information.

Interoperability considerations: None

Published specification: [TBD: This specification]

Applications which use this media type: Emergency Services

Additional information: Magic Number: None File Extension: .xml
Macintosh file type code: 'TEXT'

Person and email address for further information: Hannes
Tschofenig, Hannes.Tschofenig@gmx.net

Intended usage: LIMITED USE

Author: This specification is a work item of the IETF ECRIT working group, with mailing list address <ecrit@ietf.org>.

Change controller: The IESG <ietf@ietf.org>

9.4.2. MIME Content-type Registration for 'application/ EmergencyCallData.ServiceInfo+xml'

This specification requests the registration of a new MIME type according to the procedures of RFC 4288 [RFC4288] and guidelines in RFC 3023 [RFC3023].

MIME media type name: application

MIME subtype name: EmergencyCallData.ServiceInfo+xml

Mandatory parameters: none

Optional parameters: charset Indicates the character encoding of enclosed XML.

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

Security considerations: This content type is designed to carry the service information, which is a sub-category of additional data about an emergency call. Since this data contains personal information appropriate precautions have to be taken to limit unauthorized access, inappropriate disclosure to third parties, and eavesdropping of this information. Please refer to Section 7 and Section 8 for more information.

Interoperability considerations: None

Published specification: [TBD: This specification]

Applications which use this media type: Emergency Services

Additional information: Magic Number: None File Extension: .xml
Macintosh file type code: 'TEXT'

Person and email address for further information: Hannes
Tschofenig, Hannes.Tschofenig@gmx.net

Intended usage: LIMITED USE

Author: This specification is a work item of the IETF ECRIT working group, with mailing list address <ecrit@ietf.org>.

Change controller: The IESG <ietf@ietf.org>

9.4.3. MIME Content-type Registration for 'application/ EmergencyCallData.DeviceInfo+xml'

This specification requests the registration of a new MIME type according to the procedures of RFC 4288 [RFC4288] and guidelines in RFC 3023 [RFC3023].

MIME media type name: application

MIME subtype name: EmergencyCallData.DeviceInfo+xml

Mandatory parameters: none

Optional parameters: charset Indicates the character encoding of enclosed XML.

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

Security considerations: This content type is designed to carry the device information information, which is a sub-category of additional data about an emergency call. Since this data contains personal information appropriate precautions have to be taken to limit unauthorized access, inappropriate disclosure to third parties, and eavesdropping of this information. Please refer to Section 7 and Section 8 for more information.

Interoperability considerations: None

Published specification: [TBD: This specification]

Applications which use this media type: Emergency Services

Additional information: Magic Number: None File Extension: .xml
Macintosh file type code: 'TEXT'

Person and email address for further information: Hannes
Tschofenig, Hannes.Tschofenig@gmx.net

Intended usage: LIMITED USE

Author: This specification is a work item of the IETF ECRIT working group, with mailing list address <ecrit@ietf.org>.

Change controller: The IESG <ietf@ietf.org>

9.4.4. MIME Content-type Registration for 'application/ EmergencyCallData.SubscriberInfo+xml'

This specification requests the registration of a new MIME type according to the procedures of RFC 4288 [RFC4288] and guidelines in RFC 3023 [RFC3023].

MIME media type name: application

MIME subtype name: EmergencyCallData.SubscriberInfo+xml

Mandatory parameters: none

Optional parameters: charset Indicates the character encoding of enclosed XML.

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

Security considerations: This content type is designed to carry owner/subscriber information, which is a sub-category of additional data about an emergency call. Since this data contains personal information appropriate precautions have to be taken to limit unauthorized access, inappropriate disclosure to third parties, and eavesdropping of this information. Please refer to Section 7 and Section 8 for more information.

Interoperability considerations: None

Published specification: [TBD: This specification]

Applications which use this media type: Emergency Services

Additional information: Magic Number: None File Extension: .xml
Macintosh file type code: 'TEXT'

Person and email address for further information: Hannes
Tschofenig, Hannes.Tschofenig@gmx.net

Intended usage: LIMITED USE

Author: This specification is a work item of the IETF ECRIT working group, with mailing list address <ecrit@ietf.org>.

Change controller: The IESG <ietf@ietf.org>

9.4.5. MIME Content-type Registration for 'application/ EmergencyCallData.Comment+xml'

This specification requests the registration of a new MIME type according to the procedures of RFC 4288 [RFC4288] and guidelines in RFC 3023 [RFC3023].

MIME media type name: application

MIME subtype name: EmergencyCallData.Comment+xml

Mandatory parameters: none

Optional parameters: charset Indicates the character encoding of enclosed XML.

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

Security considerations: This content type is designed to carry a comment, which is a sub-category of additional data about an emergency call. This data may contain personal information. Appropriate precautions may have to be taken to limit unauthorized access, inappropriate disclosure to third parties, and eavesdropping of this information. Please refer to Section 7 and Section 8 for more information.

Interoperability considerations: None

Published specification: [TBD: This specification]

Applications which use this media type: Emergency Services

Additional information: Magic Number: None File Extension: .xml
Macintosh file type code: 'TEXT'

Person and email address for further information: Hannes
Tschofenig, Hannes.Tschofenig@gmx.net

Intended usage: LIMITED USE

Author: This specification is a work item of the IETF ECRIT working group, with mailing list address <ecrit@ietf.org>.

Change controller: The IESG <ietf@ietf.org>

9.5. URN Sub-Namespace Registration

9.5.1. Registration for urn:ietf:params:xml:ns:EmergencyCallData

This section registers a new XML namespace, as per the guidelines in RFC 3688 [RFC3688].

URI: urn:ietf:params:xml:ns:EmergencyCallData

Registrant Contact: IETF, ECRIT working group, <ecrit@ietf.org>, as delegated by the IESG <iesg@ietf.org>.

XML:

```
BEGIN
<?xml version="1.0"?>
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML Basic 1.0//EN"
  "http://www.w3.org/TR/xhtml-basic/xhtml-basic10.dtd">
<html xmlns="http://www.w3.org/1999/xhtml">
<head>
  <meta http-equiv="content-type"
    content="text/html; charset=iso-8859-1"/>
  <title>Namespace for Additional Emergency Call Data</title>
</head>
<body>
  <h1>Namespace for Additional Data related to an Emergency Call</h1>
<p>See [TBD: This document].</p>
</body>
</html>
END
```

9.5.2. Registration for
urn:ietf:params:xml:ns:EmergencyCallData:ProviderInfo

This section registers a new XML namespace, as per the guidelines in RFC 3688 [RFC3688].

URI: urn:ietf:params:xml:ns:EmergencyCallData:ProviderInfo

Registrant Contact: IETF, ECRIT working group, <ecrit@ietf.org>, as delegated by the IESG <iesg@ietf.org>.

XML:

```
BEGIN
<?xml version="1.0"?>
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML Basic 1.0//EN"
  "http://www.w3.org/TR/xhtml-basic/xhtml-basic10.dtd">
<html xmlns="http://www.w3.org/1999/xhtml">
<head>
  <meta http-equiv="content-type"
    content="text/html; charset=iso-8859-1"/>
  <title>Namespace for Additional Emergency Call Data:
    Data Provider Information</title>
</head>
<body>
  <h1>Namespace for Additional Data related to an Emergency Call</h1>
  <h2>Data Provider Information</h2>
<p>See [TBD: This document].</p>
</body>
```

```
</html>
END
```

9.5.3. Registration for urn:ietf:params:xml:ns:EmergencyCallData:ServiceInfo

This section registers a new XML namespace, as per the guidelines in RFC 3688 [RFC3688].

URI: urn:ietf:params:xml:ns:EmergencyCallData:ServiceInfo

Registrant Contact: IETF, ECRIT working group, <ecrit@ietf.org>, as delegated by the IESG <iesg@ietf.org>.

XML:

```
BEGIN
<?xml version="1.0"?>
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML Basic 1.0//EN"
  "http://www.w3.org/TR/xhtml-basic/xhtml-basic10.dtd">
<html xmlns="http://www.w3.org/1999/xhtml">
<head>
  <meta http-equiv="content-type"
    content="text/html; charset=iso-8859-1"/>
  <title>Namespace for Additional Emergency Call Data:
    Service Information</title>
</head>
<body>
  <h1>Namespace for Additional Data related to an Emergency Call</h1>
  <h2>Service Information</h2>
  <p>See [TBD: This document].</p>
</body>
</html>
END
```

9.5.4. Registration for urn:ietf:params:xml:ns:EmergencyCallData:DeviceInfo

This section registers a new XML namespace, as per the guidelines in RFC 3688 [RFC3688].

URI: urn:ietf:params:xml:ns:EmergencyCallData:DeviceInfo

Registrant Contact: IETF, ECRIT working group, <ecrit@ietf.org>, as delegated by the IESG <iesg@ietf.org>.

XML:

```
BEGIN
<?xml version="1.0"?>
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML Basic 1.0//EN"
  "http://www.w3.org/TR/xhtml-basic/xhtml-basic10.dtd">
<html xmlns="http://www.w3.org/1999/xhtml">
<head>
  <meta http-equiv="content-type"
    content="text/html; charset=iso-8859-1"/>
  <title>Namespace for Additional Emergency Call Data:
    Device Information</title>
</head>
<body>
  <h1>Namespace for Additional Data related to an Emergency Call</h1>
  <h2>Device Information</h2>
  <p>See [TBD: This document].</p>
</body>
</html>
END
```

9.5.5. Registration for

urn:ietf:params:xml:ns:EmergencyCallData:SubscriberInfo

This section registers a new XML namespace, as per the guidelines in RFC 3688 [RFC3688].

URI: urn:ietf:params:xml:ns:EmergencyCallData:SubscriberInfo

Registrant Contact: IETF, ECRIT working group, <ecrit@ietf.org>, as delegated by the IESG <iesg@ietf.org>.

XML:

```
BEGIN
<?xml version="1.0"?>
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML Basic 1.0//EN"
  "http://www.w3.org/TR/xhtml-basic/xhtml-basic10.dtd">
<html xmlns="http://www.w3.org/1999/xhtml">
<head>
  <meta http-equiv="content-type"
    content="text/html; charset=iso-8859-1"/>
  <title>Namespace for Additional Emergency Call Data:
    Owner/Subscriber Information</title>
</head>
```

```
<body>
  <h1>Namespace for Additional Data related to an Emergency Call</h1>
  <h2> Owner/Subscriber Information</h2>
  <p>See [TBD: This document].</p>
</body>
</html>
END
```

9.5.6. Registration for

urn:ietf:params:xml:ns:EmergencyCallData:Comment

This section registers a new XML namespace, as per the guidelines in RFC 3688 [RFC3688].

URI: urn:ietf:params:xml:ns:EmergencyCallData:Comment

Registrant Contact: IETF, ECRIT working group, <ecrit@ietf.org>, as delegated by the IESG <iesg@ietf.org>.

XML:

```
BEGIN
<?xml version="1.0"?>
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML Basic 1.0//EN"
  "http://www.w3.org/TR/xhtml-basic/xhtml-basic10.dtd">
<html xmlns="http://www.w3.org/1999/xhtml">
<head>
  <meta http-equiv="content-type"
    content="text/html; charset=iso-8859-1"/>
  <title>Namespace for Additional Emergency Call Data:Comment</title>
</head>
<body>
  <h1>Namespace for Additional Data related to an Emergency Call</h1>
  <h2> Comment</h2>
  <p>See [TBD: This document].</p>
</body>
</html>
END
```

9.6. Schema Registrations

This specification registers five schemas, as per the guidelines in RFC 3688 [RFC3688].

URI: urn:ietf:params:xml:schema:emergencycalldata:ProviderInfo

Registrant Contact: IETF, ECRIT Working Group (ecrit@ietf.org), as delegated by the IESG (iesg@ietf.org).

XML: The XML schema can be found in Figure 15.

URI: urn:ietf:params:xml:schema:emergencycalldata:ServiceInfo

Registrant Contact: IETF, ECRIT Working Group (ectit@ietf.org), as delegated by the IESG (iesg@ietf.org).

XML: The XML schema can be found in Figure 16.

URI: urn:ietf:params:xml:schema:emergencycalldata:DeviceInfo

Registrant Contact: IETF, ECRIT Working Group (ecrit@ietf.org), as delegated by the IESG (iesg@ietf.org).

XML: The XML schema can be found in Figure 17.

URI: urn:ietf:params:xml:schema:emergencycalldata:SubscriberInfo

Registrant Contact: IETF, ECRIT Working Group (ecrit@ietf.org), as delegated by the IESG (iesg@ietf.org).

XML: The XML schema can be found in Section 6.4.

URI: urn:ietf:params:xml:schema:emergencycalldata:comment

Registrant Contact: IETF, ECRIT Working Group (ecrit@ietf.org), as delegated by the IESG (iesg@ietf.org).

XML: The XML schema can be found in Section 6.5.

9.7. VCard Parameter Value Registration

This document registers a new value in the vCARD Parameter Values registry as defined by [RFC6350] with the following template:

Value: main

Purpose: The main telephone number, typically of an enterprise, as opposed to a direct dial number of an individual employee

Conformance: This value can be used with the "TYPE" parameter applied on the "TEL" property.

Example(s): TEL;VALUE=uri;TYPE="main,voice";PREF=1:tel:+1-418-656-9000

10. Acknowledgments

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Appendix A. XML Schema for vCard/xCard

This section contains the vCard/xCard XML schema version of the Relax NG schema defined in RFC 6351 [RFC6351] for simplified use with the XML schemas defined in this document. The schema in RFC 6351 [RFC6351] is the normative source and this section is informative only.

```
<?xml version="1.0" encoding="UTF-8"?>
<xs:schema xmlns:xs="http://www.w3.org/2001/XMLSchema"
  elementFormDefault="qualified"
  targetNamespace="urn:ietf:params:xml:ns:vcard-4.0"
  xmlns:ns1="urn:ietf:params:xml:ns:vcard-4.0">
  <!--

    3.3
    iana-token = xs:string { pattern = "[a-zA-Z0-9-]+" }
    x-name = xs:string { pattern = "x-[a-zA-Z0-9-]+" }
  -->
  <xs:simpleType name="iana-token">
    <xs:annotation>
      <xs:documentation>vCard Format Specification
    </xs:documentation>
    </xs:annotation>
    <xs:restriction base="xs:string"/>
  </xs:simpleType>
  <xs:simpleType name="x-name">
    <xs:restriction base="xs:string"/>
  </xs:simpleType>
  <!--

    4.1
  -->
  <xs:element name="text" type="xs:string"/>
  <xs:group name="value-text-list">
    <xs:sequence>
      <xs:element maxOccurs="unbounded" ref="ns1:text"/>
    </xs:sequence>
  </xs:group>
  <!-- 4.2 -->
  <xs:element name="uri" type="xs:anyURI"/>
  <!-- 4.3.1 -->
  <xs:element name="date"
    substitutionGroup="ns1:value-date-and-or-time">
    <xs:simpleType>
      <xs:restriction base="xs:string">
        <xs:pattern value="\d{8}|\d{4}-\d\d|
```

```
        --\d\d(\d\d)?|---\d\d"/>
      </xs:restriction>
    </xs:simpleType>
  </xs:element>
<!-- 4.3.2 -->
<xs:element name="time"
substitutionGroup="ns1:value-date-and-or-time">
  <xs:simpleType>
    <xs:restriction base="xs:string">
      <xs:pattern value="(\d\d(\d\d(\d\d)?)?|-\d\d(\d\d?)|--\d\d)
(Z|[\+-]\d\d(\d\d)?)" />
    </xs:restriction>
  </xs:simpleType>
</xs:element>
<!-- 4.3.3 -->
<xs:element name="date-time"
substitutionGroup="ns1:value-date-and-or-time">
  <xs:simpleType>
    <xs:restriction base="xs:string">
      <xs:pattern value=
"(\d{8}|--\d{4}|---\d\d)T
\d\d(\d\d(\d\d)?)?(Z|[\+-]\d\d(\d\d)?)" />
    </xs:restriction>
  </xs:simpleType>
</xs:element>
<!-- 4.3.4 -->
<xs:element name="value-date-and-or-time" abstract="true"/>
<!-- 4.3.5 -->
<xs:complexType name="value-timestamp">
  <xs:sequence>
    <xs:element ref="ns1:timestamp"/>
  </xs:sequence>
</xs:complexType>
<xs:element name="timestamp">
  <xs:simpleType>
    <xs:restriction base="xs:string">
      <xs:pattern value="\d{8}T\d{6}(Z|[\+-]\d\d(\d\d)?)" />
    </xs:restriction>
  </xs:simpleType>
</xs:element>
<!-- 4.4 -->
<xs:element name="boolean" type="xs:boolean"/>
<!-- 4.5 -->
<xs:element name="integer" type="xs:integer"/>
<!-- 4.6 -->
<xs:element name="float" type="xs:float"/>
<!-- 4.7 -->
<xs:element name="utc-offset">
```

```

    <xs:simpleType>
      <xs:restriction base="xs:string">
        <xs:pattern value="[+\\-]\\d\\d(\\d\\d)?"/>
      </xs:restriction>
    </xs:simpleType>
  </xs:element>
<!-- 4.8 -->
<xs:element name="language-tag">
  <xs:simpleType>
    <xs:restriction base="xs:string">
      <xs:pattern
        value="([a-z]{2,3}((-[a-z]{3}){0,3})?|[a-z]{4,8})
        (-[a-z]{4})?(-([a-z]{2}|\\d{3}))?(-([0-9a-z]{5,8}|
        \\d{0-9a-z}{3}))*(-([0-9a-wyz](-[0-9a-z]{2,8})+)*
        (-x(-[0-9a-z]{1,8})+)?|x(-[0-9a-z]{1,8})+|[a-z]{1,3}
        (-[0-9a-z]{2,8}){1,2})"/>
    </xs:restriction>
  </xs:simpleType>
</xs:element>
<!--

5.1
-->
<xs:group name="param-language">
  <xs:annotation>
    <xs:documentation>Section 5: Parameters</xs:documentation>
  </xs:annotation>
  <xs:sequence>
    <xs:element minOccurs="0" ref="ns1:language"/>
  </xs:sequence>
</xs:group>
<xs:element name="language">
  <xs:complexType>
    <xs:sequence>
      <xs:element ref="ns1:language-tag"/>
    </xs:sequence>
  </xs:complexType>
</xs:element>
<!-- 5.2 -->
<xs:group name="param-pref">
  <xs:sequence>
    <xs:element minOccurs="0" ref="ns1:pref"/>
  </xs:sequence>
</xs:group>
<xs:element name="pref">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="integer">

```

```
        <xs:simpleType>
          <xs:restriction base="xs:integer">
            <xs:minInclusive value="1"/>
            <xs:maxInclusive value="100"/>
          </xs:restriction>
        </xs:simpleType>
      </xs:element>
    </xs:sequence>
  </xs:complexType>
</xs:element>
<!-- 5.4 -->
<xs:group name="param-altid">
  <xs:sequence>
    <xs:element minOccurs="0" ref="ns1:altid"/>
  </xs:sequence>
</xs:group>
<xs:element name="altid">
  <xs:complexType>
    <xs:sequence>
      <xs:element ref="ns1:text"/>
    </xs:sequence>
  </xs:complexType>
</xs:element>
<!-- 5.5 -->
<xs:group name="param-pid">
  <xs:sequence>
    <xs:element minOccurs="0" ref="ns1:pid"/>
  </xs:sequence>
</xs:group>
<xs:element name="pid">
  <xs:complexType>
    <xs:sequence>
      <xs:element maxOccurs="unbounded" name="text">
        <xs:simpleType>
          <xs:restriction base="xs:string">
            <xs:pattern value="\d+(\.\d+)?"/>
          </xs:restriction>
        </xs:simpleType>
      </xs:element>
    </xs:sequence>
  </xs:complexType>
</xs:element>
<!-- 5.6 -->
<xs:group name="param-type">
  <xs:sequence>
    <xs:element minOccurs="0" ref="ns1:type"/>
  </xs:sequence>
</xs:group>
```

```
<xs:element name="type">
  <xs:complexType>
    <xs:sequence>
      <xs:element maxOccurs="unbounded" name="text">
        <xs:simpleType>
          <xs:restriction base="xs:token">
            <xs:enumeration value="work"/>
            <xs:enumeration value="home"/>
          </xs:restriction>
        </xs:simpleType>
      </xs:element>
    </xs:sequence>
  </xs:complexType>
</xs:element>
<!-- 5.7 -->
<xs:group name="param-mediatype">
  <xs:sequence>
    <xs:element minOccurs="0" ref="ns1:mediatype"/>
  </xs:sequence>
</xs:group>
<xs:element name="mediatype">
  <xs:complexType>
    <xs:sequence>
      <xs:element ref="ns1:text"/>
    </xs:sequence>
  </xs:complexType>
</xs:element>
<!-- 5.8 -->
<xs:group name="param-calscale">
  <xs:sequence>
    <xs:element minOccurs="0" ref="ns1:calscale"/>
  </xs:sequence>
</xs:group>
<xs:element name="calscale">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="text">
        <xs:simpleType>
          <xs:restriction base="xs:token">
            <xs:enumeration value="gregorian"/>
          </xs:restriction>
        </xs:simpleType>
      </xs:element>
    </xs:sequence>
  </xs:complexType>
</xs:element>
<!-- 5.9 -->
<xs:group name="param-sort-as">
```

```

    <xs:sequence>
      <xs:element minOccurs="0" ref="ns1:sort-as"/>
    </xs:sequence>
  </xs:group>
  <xs:element name="sort-as">
    <xs:complexType>
      <xs:sequence>
        <xs:element maxOccurs="unbounded" ref="ns1:text"/>
      </xs:sequence>
    </xs:complexType>
  </xs:element>
<!-- 5.10 -->
<xs:group name="param-geo">
  <xs:sequence>
    <xs:element minOccurs="0" name="geo">
      <xs:complexType>
        <xs:sequence>
          <xs:element ref="ns1:uri"/>
        </xs:sequence>
      </xs:complexType>
    </xs:element>
  </xs:sequence>
</xs:group>
<!-- 5.11 -->
<xs:group name="param-tz">
  <xs:sequence>
    <xs:element minOccurs="0" name="tz">
      <xs:complexType>
        <xs:choice>
          <xs:element ref="ns1:text"/>
          <xs:element ref="ns1:uri"/>
        </xs:choice>
      </xs:complexType>
    </xs:element>
  </xs:sequence>
</xs:group>
<!--

6.1.3
-->
<xs:element name="source">
  <xs:complexType>
    <xs:sequence>
      <xs:element name="parameters">
        <xs:complexType>
          <xs:sequence>
            <xs:group ref="ns1:param-altid"/>
            <xs:group ref="ns1:param-pid"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
    </xs:sequence>
  </xs:complexType>
</xs:element>

```

```
        <xs:group ref="ns1:param-pref"/>
        <xs:group ref="ns1:param-mediatype"/>
      </xs:sequence>
    </xs:complexType>
  </xs:element>
  <xs:element ref="ns1:uri"/>
</xs:sequence>
</xs:complexType>
</xs:element>
<!-- 6.1.4 -->
<xs:element name="kind">
  <xs:complexType>
    <xs:sequence>
      <xs:element minOccurs="0" maxOccurs="unbounded" name="text">
        <xs:simpleType>
          <xs:union memberTypes="ns1:x-name ns1:iana-token">
            <xs:simpleType>
              <xs:restriction base="xs:token">
                <xs:enumeration value="individual"/>
              </xs:restriction>
            </xs:simpleType>
            <xs:simpleType>
              <xs:restriction base="xs:token">
                <xs:enumeration value="group"/>
              </xs:restriction>
            </xs:simpleType>
            <xs:simpleType>
              <xs:restriction base="xs:token">
                <xs:enumeration value="org"/>
              </xs:restriction>
            </xs:simpleType>
            <xs:simpleType>
              <xs:restriction base="xs:token">
                <xs:enumeration value="location"/>
              </xs:restriction>
            </xs:simpleType>
          </xs:union>
        </xs:simpleType>
      </xs:element>
    </xs:sequence>
  </xs:complexType>
</xs:element>
<!-- 6.2.1 -->
<xs:element name="fn">
  <xs:complexType>
    <xs:sequence>
      <xs:element minOccurs="0" name="parameters">
        <xs:complexType>
```



```
<xs:sequence>
  <xs:group ref="ns1:param-language"/>
  <xs:group ref="ns1:param-altid"/>
  <xs:group ref="ns1:param-pid"/>
  <xs:group ref="ns1:param-pref"/>
  <xs:group ref="ns1:param-type"/>
</xs:sequence>
</xs:complexType>
</xs:element>
<xs:element ref="ns1:text"/>
</xs:sequence>
</xs:complexType>
</xs:element>
<!-- 6.2.2 -->
<xs:element name="n">
  <xs:complexType>
    <xs:sequence>
      <xs:element minOccurs="0" name="parameters">
        <xs:complexType>
          <xs:sequence>
            <xs:group ref="ns1:param-language"/>
            <xs:group ref="ns1:param-sort-as"/>
            <xs:group ref="ns1:param-altid"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
      <xs:element maxOccurs="unbounded" ref="ns1:surname"/>
      <xs:element maxOccurs="unbounded" ref="ns1:given"/>
      <xs:element maxOccurs="unbounded" ref="ns1:additional"/>
      <xs:element maxOccurs="unbounded" ref="ns1:prefix"/>
      <xs:element maxOccurs="unbounded" ref="ns1:suffix"/>
    </xs:sequence>
  </xs:complexType>
</xs:element>
<xs:element name="surname" type="xs:string"/>
<xs:element name="given" type="xs:string"/>
<xs:element name="additional" type="xs:string"/>
<xs:element name="prefix" type="xs:string"/>
<xs:element name="suffix" type="xs:string"/>
<!-- 6.2.3 -->
<xs:element name="nickname">
  <xs:complexType>
    <xs:sequence>
      <xs:element minOccurs="0" name="parameters">
        <xs:complexType>
          <xs:sequence>
            <xs:group ref="ns1:param-language"/>
            <xs:group ref="ns1:param-altid"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
    </xs:sequence>
  </xs:complexType>
</xs:element>
```

```
        <xs:group ref="ns1:param-pid"/>
        <xs:group ref="ns1:param-pref"/>
        <xs:group ref="ns1:param-type"/>
    </xs:sequence>
</xs:complexType>
</xs:element>
    <xs:group ref="ns1:value-text-list"/>
</xs:sequence>
</xs:complexType>
</xs:element>
<!-- 6.2.4 -->
<xs:element name="photo">
    <xs:complexType>
        <xs:sequence>
            <xs:element minOccurs="0" name="parameters">
                <xs:complexType>
                    <xs:sequence>
                        <xs:group ref="ns1:param-altid"/>
                        <xs:group ref="ns1:param-pid"/>
                        <xs:group ref="ns1:param-pref"/>
                        <xs:group ref="ns1:param-type"/>
                        <xs:group ref="ns1:param-mediatype"/>
                    </xs:sequence>
                </xs:complexType>
            </xs:element>
            <xs:element ref="ns1:uri"/>
        </xs:sequence>
    </xs:complexType>
</xs:element>
<!-- 6.2.5 -->
<xs:element name="bday">
    <xs:complexType>
        <xs:sequence>
            <xs:element minOccurs="0" name="parameters">
                <xs:complexType>
                    <xs:sequence>
                        <xs:group ref="ns1:param-altid"/>
                        <xs:group ref="ns1:param-calscale"/>
                    </xs:sequence>
                </xs:complexType>
            </xs:element>
            <xs:choice>
                <xs:element ref="ns1:value-date-and-or-time"/>
                <xs:element ref="ns1:text"/>
            </xs:choice>
        </xs:sequence>
    </xs:complexType>
</xs:element>
```

```
<!-- 6.2.6 -->
<xs:element name="anniversary">
  <xs:complexType>
    <xs:sequence>
      <xs:element minOccurs="0" name="parameters">
        <xs:complexType>
          <xs:sequence>
            <xs:group ref="ns1:param-altid"/>
            <xs:group ref="ns1:param-calscale"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
      <xs:choice>
        <xs:element ref="ns1:value-date-and-or-time"/>
        <xs:element ref="ns1:text"/>
      </xs:choice>
    </xs:sequence>
  </xs:complexType>
</xs:element>
<!-- 6.2.7 -->
<xs:element name="gender">
  <xs:complexType>
    <xs:sequence>
      <xs:element ref="ns1:sex"/>
      <xs:element minOccurs="0" ref="ns1:identity"/>
    </xs:sequence>
  </xs:complexType>
</xs:element>
<xs:element name="sex">
  <xs:simpleType>
    <xs:restriction base="xs:token">
      <xs:enumeration value=""/>
      <xs:enumeration value="M"/>
      <xs:enumeration value="F"/>
      <xs:enumeration value="O"/>
      <xs:enumeration value="N"/>
      <xs:enumeration value="U"/>
    </xs:restriction>
  </xs:simpleType>
</xs:element>
<xs:element name="identity" type="xs:string"/>
<!-- 6.3.1 -->
<xs:group name="param-label">
  <xs:sequence>
    <xs:element minOccurs="0" ref="ns1:label"/>
  </xs:sequence>
</xs:group>
<xs:element name="label">
```

```
<xs:complexType>
  <xs:sequence>
    <xs:element ref="ns1:text"/>
  </xs:sequence>
</xs:complexType>
</xs:element>
<xs:element name="adr">
  <xs:complexType>
    <xs:sequence>
      <xs:element minOccurs="0" name="parameters">
        <xs:complexType>
          <xs:sequence>
            <xs:group ref="ns1:param-language"/>
            <xs:group ref="ns1:param-altid"/>
            <xs:group ref="ns1:param-pid"/>
            <xs:group ref="ns1:param-pref"/>
            <xs:group ref="ns1:param-type"/>
            <xs:group ref="ns1:param-geo"/>
            <xs:group ref="ns1:param-tz"/>
            <xs:group ref="ns1:param-label"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
      <xs:element maxOccurs="unbounded" ref="ns1:pobox"/>
      <xs:element maxOccurs="unbounded" ref="ns1:ext"/>
      <xs:element maxOccurs="unbounded" ref="ns1:street"/>
      <xs:element maxOccurs="unbounded" ref="ns1:locality"/>
      <xs:element maxOccurs="unbounded" ref="ns1:region"/>
      <xs:element maxOccurs="unbounded" ref="ns1:code"/>
      <xs:element maxOccurs="unbounded" ref="ns1:country"/>
    </xs:sequence>
  </xs:complexType>
</xs:element>
<xs:element name="pobox" type="xs:string"/>
<xs:element name="ext" type="xs:string"/>
<xs:element name="street" type="xs:string"/>
<xs:element name="locality" type="xs:string"/>
<xs:element name="region" type="xs:string"/>
<xs:element name="code" type="xs:string"/>
<xs:element name="country" type="xs:string"/>
<!-- 6.4.1 -->
<xs:element name="tel">
  <xs:complexType>
    <xs:sequence>
      <xs:element minOccurs="0" name="parameters">
        <xs:complexType>
          <xs:sequence>
            <xs:group ref="ns1:param-altid"/>

```

```
<xs:group ref="ns1:param-pid"/>
<xs:group ref="ns1:param-pref"/>
<xs:element minOccurs="0" name="type">
  <xs:complexType>
    <xs:sequence>
      <xs:element maxOccurs="unbounded" name="text">
        <xs:simpleType>
          <xs:restriction base="xs:token">
            <xs:enumeration value="work"/>
            <xs:enumeration value="home"/>
            <xs:enumeration value="text"/>
            <xs:enumeration value="voice"/>
            <xs:enumeration value="fax"/>
            <xs:enumeration value="cell"/>
            <xs:enumeration value="video"/>
            <xs:enumeration value="pager"/>
            <xs:enumeration value="textphone"/>
          </xs:restriction>
        </xs:simpleType>
      </xs:element>
    </xs:sequence>
  </xs:complexType>
</xs:element>
<xs:group ref="ns1:param-mediatype"/>
</xs:sequence>
</xs:complexType>
</xs:element>
<xs:choice>
  <xs:element ref="ns1:text"/>
  <xs:element ref="ns1:uri"/>
</xs:choice>
</xs:sequence>
</xs:complexType>
</xs:element>
<!-- 6.4.2 -->
<xs:element name="email">
  <xs:complexType>
    <xs:sequence>
      <xs:element minOccurs="0" name="parameters">
        <xs:complexType>
          <xs:sequence>
            <xs:group ref="ns1:param-altid"/>
            <xs:group ref="ns1:param-pid"/>
            <xs:group ref="ns1:param-pref"/>
            <xs:group ref="ns1:param-type"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
    </xs:sequence>
  </xs:complexType>
</xs:element>
```

```
        <xs:element ref="ns1:text"/>
      </xs:sequence>
    </xs:complexType>
  </xs:element>
  <!-- 6.4.3 -->
  <xs:element name="impp">
    <xs:complexType>
      <xs:sequence>
        <xs:element minOccurs="0" name="parameters">
          <xs:complexType>
            <xs:sequence>
              <xs:group ref="ns1:param-altid"/>
              <xs:group ref="ns1:param-pid"/>
              <xs:group ref="ns1:param-pref"/>
              <xs:group ref="ns1:param-type"/>
              <xs:group ref="ns1:param-mediatype"/>
            </xs:sequence>
          </xs:complexType>
        </xs:element>
        <xs:element ref="ns1:uri"/>
      </xs:sequence>
    </xs:complexType>
  </xs:element>
  <!-- 6.4.4 -->
  <xs:element name="lang">
    <xs:complexType>
      <xs:sequence>
        <xs:element minOccurs="0" name="parameters">
          <xs:complexType>
            <xs:sequence>
              <xs:group ref="ns1:param-altid"/>
              <xs:group ref="ns1:param-pid"/>
              <xs:group ref="ns1:param-pref"/>
              <xs:group ref="ns1:param-type"/>
            </xs:sequence>
          </xs:complexType>
        </xs:element>
        <xs:element ref="ns1:language-tag"/>
      </xs:sequence>
    </xs:complexType>
  </xs:element>
  <!-- 6.5.1 -->
  <xs:group name="property-tz">
    <xs:sequence>
      <xs:element name="tz">
        <xs:complexType>
          <xs:sequence>
            <xs:element minOccurs="0" name="parameters">
```

```
<xs:complexType>
  <xs:sequence>
    <xs:group ref="ns1:param-altid"/>
    <xs:group ref="ns1:param-pid"/>
    <xs:group ref="ns1:param-pref"/>
    <xs:group ref="ns1:param-type"/>
    <xs:group ref="ns1:param-mediatype"/>
  </xs:sequence>
</xs:complexType>
</xs:element>
<xs:choice>
  <xs:element ref="ns1:text"/>
  <xs:element ref="ns1:uri"/>
  <xs:element ref="ns1:utc-offset"/>
</xs:choice>
</xs:sequence>
</xs:complexType>
</xs:element>
</xs:sequence>
</xs:group>
<!-- 6.5.2 -->
<xs:group name="property-geo">
  <xs:sequence>
    <xs:element name="geo">
      <xs:complexType>
        <xs:sequence>
          <xs:element minOccurs="0" name="parameters">
            <xs:complexType>
              <xs:sequence>
                <xs:group ref="ns1:param-altid"/>
                <xs:group ref="ns1:param-pid"/>
                <xs:group ref="ns1:param-pref"/>
                <xs:group ref="ns1:param-type"/>
                <xs:group ref="ns1:param-mediatype"/>
              </xs:sequence>
            </xs:complexType>
          </xs:element>
          <xs:element ref="ns1:uri"/>
        </xs:sequence>
      </xs:complexType>
    </xs:element>
  </xs:sequence>
</xs:group>
<!-- 6.6.1 -->
<xs:element name="title">
  <xs:complexType>
    <xs:sequence>
      <xs:element minOccurs="0" name="parameters">
```

```
<xs:complexType>
  <xs:sequence>
    <xs:group ref="ns1:param-language"/>
    <xs:group ref="ns1:param-altid"/>
    <xs:group ref="ns1:param-pid"/>
    <xs:group ref="ns1:param-pref"/>
    <xs:group ref="ns1:param-type"/>
  </xs:sequence>
</xs:complexType>
</xs:element>
<xs:element ref="ns1:text"/>
</xs:sequence>
</xs:complexType>
</xs:element>
<!-- 6.6.2 -->
<xs:element name="role">
  <xs:complexType>
    <xs:sequence>
      <xs:element minOccurs="0" name="parameters">
        <xs:complexType>
          <xs:sequence>
            <xs:group ref="ns1:param-language"/>
            <xs:group ref="ns1:param-altid"/>
            <xs:group ref="ns1:param-pid"/>
            <xs:group ref="ns1:param-pref"/>
            <xs:group ref="ns1:param-type"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
      <xs:element ref="ns1:text"/>
    </xs:sequence>
  </xs:complexType>
</xs:element>
<!-- 6.6.3 -->
<xs:element name="logo">
  <xs:complexType>
    <xs:sequence>
      <xs:element minOccurs="0" name="parameters">
        <xs:complexType>
          <xs:sequence>
            <xs:group ref="ns1:param-language"/>
            <xs:group ref="ns1:param-altid"/>
            <xs:group ref="ns1:param-pid"/>
            <xs:group ref="ns1:param-pref"/>
            <xs:group ref="ns1:param-type"/>
            <xs:group ref="ns1:param-mediatype"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
    </xs:sequence>
  </xs:complexType>
</xs:element>
```



```
        </xs:element>
        <xs:element ref="ns1:uri"/>
    </xs:sequence>
</xs:complexType>
</xs:element>
<!-- 6.6.4 -->
<xs:element name="org">
    <xs:complexType>
        <xs:sequence>
            <xs:element minOccurs="0" name="parameters">
                <xs:complexType>
                    <xs:sequence>
                        <xs:group ref="ns1:param-language"/>
                        <xs:group ref="ns1:param-altid"/>
                        <xs:group ref="ns1:param-pid"/>
                        <xs:group ref="ns1:param-pref"/>
                        <xs:group ref="ns1:param-type"/>
                        <xs:group ref="ns1:param-sort-as"/>
                    </xs:sequence>
                </xs:complexType>
            </xs:element>
            <xs:group ref="ns1:value-text-list"/>
        </xs:sequence>
    </xs:complexType>
</xs:element>
<!-- 6.6.5 -->
<xs:element name="member">
    <xs:complexType>
        <xs:sequence>
            <xs:element minOccurs="0" name="parameters">
                <xs:complexType>
                    <xs:sequence>
                        <xs:group ref="ns1:param-altid"/>
                        <xs:group ref="ns1:param-pid"/>
                        <xs:group ref="ns1:param-pref"/>
                        <xs:group ref="ns1:param-mediatype"/>
                    </xs:sequence>
                </xs:complexType>
            </xs:element>
            <xs:element ref="ns1:uri"/>
        </xs:sequence>
    </xs:complexType>
</xs:element>
<!-- 6.6.6 -->
<xs:element name="related">
    <xs:complexType>
        <xs:sequence>
            <xs:element minOccurs="0" name="parameters">
```

```
<xs:complexType>
  <xs:sequence>
    <xs:group ref="ns1:param-altid"/>
    <xs:group ref="ns1:param-pid"/>
    <xs:group ref="ns1:param-pref"/>
    <xs:element minOccurs="0" name="type">
      <xs:complexType>
        <xs:sequence>
          <xs:element maxOccurs="unbounded" name="text">
            <xs:simpleType>
              <xs:restriction base="xs:token">
                <xs:enumeration value="work"/>
                <xs:enumeration value="home"/>
                <xs:enumeration value="contact"/>
                <xs:enumeration value="acquaintance"/>
                <xs:enumeration value="friend"/>
                <xs:enumeration value="met"/>
                <xs:enumeration value="co-worker"/>
                <xs:enumeration value="colleague"/>
                <xs:enumeration value="co-resident"/>
                <xs:enumeration value="neighbor"/>
                <xs:enumeration value="child"/>
                <xs:enumeration value="parent"/>
                <xs:enumeration value="sibling"/>
                <xs:enumeration value="spouse"/>
                <xs:enumeration value="kin"/>
                <xs:enumeration value="muse"/>
                <xs:enumeration value="crush"/>
                <xs:enumeration value="date"/>
                <xs:enumeration value="sweetheart"/>
                <xs:enumeration value="me"/>
                <xs:enumeration value="agent"/>
                <xs:enumeration value="emergency"/>
              </xs:restriction>
            </xs:simpleType>
          </xs:element>
        </xs:sequence>
      </xs:complexType>
    </xs:element>
    <xs:group ref="ns1:param-mediatype"/>
  </xs:sequence>
</xs:complexType>
</xs:element>
<xs:choice>
  <xs:element ref="ns1:uri"/>
  <xs:element ref="ns1:text"/>
</xs:choice>
</xs:sequence>
```

```
    </xs:complexType>
  </xs:element>
  <!-- 6.7.1 -->
  <xs:element name="categories">
    <xs:complexType>
      <xs:sequence>
        <xs:element minOccurs="0" name="parameters">
          <xs:complexType>
            <xs:sequence>
              <xs:group ref="ns1:param-altid"/>
              <xs:group ref="ns1:param-pid"/>
              <xs:group ref="ns1:param-pref"/>
              <xs:group ref="ns1:param-type"/>
            </xs:sequence>
          </xs:complexType>
        </xs:element>
        <xs:group ref="ns1:value-text-list"/>
      </xs:sequence>
    </xs:complexType>
  </xs:element>
  <!-- 6.7.2 -->
  <xs:element name="note">
    <xs:complexType>
      <xs:sequence>
        <xs:element minOccurs="0" name="parameters">
          <xs:complexType>
            <xs:sequence>
              <xs:group ref="ns1:param-language"/>
              <xs:group ref="ns1:param-altid"/>
              <xs:group ref="ns1:param-pid"/>
              <xs:group ref="ns1:param-pref"/>
              <xs:group ref="ns1:param-type"/>
            </xs:sequence>
          </xs:complexType>
        </xs:element>
        <xs:element ref="ns1:text"/>
      </xs:sequence>
    </xs:complexType>
  </xs:element>
  <!-- 6.7.3 -->
  <xs:element name="prodid">
    <xs:complexType>
      <xs:sequence>
        <xs:element ref="ns1:text"/>
      </xs:sequence>
    </xs:complexType>
  </xs:element>
  <!-- 6.7.4 -->
```

```
<xs:element name="rev" type="ns1:value-timestamp"/>
<!-- 6.7.5 -->
<xs:element name="sound">
  <xs:complexType>
    <xs:sequence>
      <xs:element minOccurs="0" name="parameters">
        <xs:complexType>
          <xs:sequence>
            <xs:group ref="ns1:param-language"/>
            <xs:group ref="ns1:param-altid"/>
            <xs:group ref="ns1:param-pid"/>
            <xs:group ref="ns1:param-pref"/>
            <xs:group ref="ns1:param-type"/>
            <xs:group ref="ns1:param-mediatype"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
      <xs:element ref="ns1:uri"/>
    </xs:sequence>
  </xs:complexType>
</xs:element>
<!-- 6.7.6 -->
<xs:element name="uid">
  <xs:complexType>
    <xs:sequence>
      <xs:element ref="ns1:uri"/>
    </xs:sequence>
  </xs:complexType>
</xs:element>
<!-- 6.7.7 -->
<xs:element name="clientpidmap">
  <xs:complexType>
    <xs:sequence>
      <xs:element ref="ns1:sourceid"/>
      <xs:element ref="ns1:uri"/>
    </xs:sequence>
  </xs:complexType>
</xs:element>
<xs:element name="sourceid" type="xs:positiveInteger"/>
<!-- 6.7.8 -->
<xs:element name="url">
  <xs:complexType>
    <xs:sequence>
      <xs:element minOccurs="0" name="parameters">
        <xs:complexType>
          <xs:sequence>
            <xs:group ref="ns1:param-altid"/>
            <xs:group ref="ns1:param-pid"/>
          </xs:sequence>
        </xs:complexType>
      </xs:element>
    </xs:sequence>
  </xs:complexType>
</xs:element>
```

```

        <xs:group ref="ns1:param-pref"/>
        <xs:group ref="ns1:param-type"/>
        <xs:group ref="ns1:param-mediatype"/>
    </xs:sequence>
</xs:complexType>
</xs:element>
    <xs:element ref="ns1:uri"/>
</xs:sequence>
</xs:complexType>
</xs:element>
<!-- 6.8.1 -->
<xs:element name="key">
    <xs:complexType>
        <xs:sequence>
            <xs:element minOccurs="0" name="parameters">
                <xs:complexType>
                    <xs:sequence>
                        <xs:group ref="ns1:param-altid"/>
                        <xs:group ref="ns1:param-pid"/>
                        <xs:group ref="ns1:param-pref"/>
                        <xs:group ref="ns1:param-type"/>
                        <xs:group ref="ns1:param-mediatype"/>
                    </xs:sequence>
                </xs:complexType>
            </xs:element>
            <xs:choice>
                <xs:element ref="ns1:uri"/>
                <xs:element ref="ns1:text"/>
            </xs:choice>
        </xs:sequence>
    </xs:complexType>
</xs:element>
<!-- 6.9.1 -->
<xs:element name="fburl">
    <xs:complexType>
        <xs:sequence>
            <xs:element minOccurs="0" name="parameters">
                <xs:complexType>
                    <xs:sequence>
                        <xs:group ref="ns1:param-altid"/>
                        <xs:group ref="ns1:param-pid"/>
                        <xs:group ref="ns1:param-pref"/>
                        <xs:group ref="ns1:param-type"/>
                        <xs:group ref="ns1:param-mediatype"/>
                    </xs:sequence>
                </xs:complexType>
            </xs:element>
            <xs:element ref="ns1:uri"/>
        </xs:sequence>
    </xs:complexType>
</xs:element>

```

```
        </xs:sequence>
      </xs:complexType>
    </xs:element>
    <!-- 6.9.2 -->
    <xs:element name="caladruri">
      <xs:complexType>
        <xs:sequence>
          <xs:element minOccurs="0" name="parameters">
            <xs:complexType>
              <xs:sequence>
                <xs:group ref="ns1:param-altid"/>
                <xs:group ref="ns1:param-pid"/>
                <xs:group ref="ns1:param-pref"/>
                <xs:group ref="ns1:param-type"/>
                <xs:group ref="ns1:param-mediatype"/>
              </xs:sequence>
            </xs:complexType>
          </xs:element>
          <xs:element ref="ns1:uri"/>
        </xs:sequence>
      </xs:complexType>
    </xs:element>
    <!-- 6.9.3 -->
    <xs:element name="caluri">
      <xs:complexType>
        <xs:sequence>
          <xs:element minOccurs="0" name="parameters">
            <xs:complexType>
              <xs:sequence>
                <xs:group ref="ns1:param-altid"/>
                <xs:group ref="ns1:param-pid"/>
                <xs:group ref="ns1:param-pref"/>
                <xs:group ref="ns1:param-type"/>
                <xs:group ref="ns1:param-mediatype"/>
              </xs:sequence>
            </xs:complexType>
          </xs:element>
          <xs:element ref="ns1:uri"/>
        </xs:sequence>
      </xs:complexType>
    </xs:element>
    <!-- Top-level grammar -->
    <xs:group name="property">
      <xs:choice>
        <xs:element ref="ns1:adr"/>
        <xs:element ref="ns1:anniversary"/>
        <xs:element ref="ns1:bday"/>
        <xs:element ref="ns1:caladruri"/>
      </xs:choice>
    </xs:group>
  </xs:schema>
```

```
<xs:element ref="nsl:caluri"/>
<xs:element ref="nsl:categories"/>
<xs:element ref="nsl:clientpidmap"/>
<xs:element ref="nsl:email"/>
<xs:element ref="nsl:fburl"/>
<xs:element ref="nsl:fn"/>
<xs:group ref="nsl:property-geo"/>
<xs:element ref="nsl:impp"/>
<xs:element ref="nsl:key"/>
<xs:element ref="nsl:kind"/>
<xs:element ref="nsl:lang"/>
<xs:element ref="nsl:logo"/>
<xs:element ref="nsl:member"/>
<xs:element ref="nsl:n"/>
<xs:element ref="nsl:nickname"/>
<xs:element ref="nsl:note"/>
<xs:element ref="nsl:org"/>
<xs:element ref="nsl:photo"/>
<xs:element ref="nsl:prodid"/>
<xs:element ref="nsl:related"/>
<xs:element ref="nsl:rev"/>
<xs:element ref="nsl:role"/>
<xs:element ref="nsl:gender"/>
<xs:element ref="nsl:sound"/>
<xs:element ref="nsl:source"/>
<xs:element ref="nsl:tel"/>
<xs:element ref="nsl:title"/>
<xs:group ref="nsl:property-tz"/>
<xs:element ref="nsl:uid"/>
<xs:element ref="nsl:url"/>
</xs:choice>
</xs:group>

<xs:element name="vcards">
  <xs:complexType>
    <xs:sequence>
      <xs:element maxOccurs="unbounded" ref="nsl:vcard"/>
    </xs:sequence>
  </xs:complexType>
</xs:element>

<xs:complexType name="vcardType">
  <xs:complexContent>
    <xs:restriction base="xs:anyType">
      <xs:choice maxOccurs="unbounded">
        <xs:group ref="nsl:property"/>
        <xs:element ref="nsl:group"/>
      </xs:choice>
    </xs:restriction>
  </xs:complexContent>
</xs:complexType>
```

```
        </xs:restriction>
      </xs:complexContent>
    </xs:complexType>

    <xs:element name="vcard" type="ns1:vcardType"/>

    <xs:element name="group">
      <xs:complexType>
        <xs:group minOccurs="0" maxOccurs="unbounded"
          ref="ns1:property"/>
        <xs:attribute name="name" use="required"/>
      </xs:complexType>
    </xs:element>
  </xs:schema>
```

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