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An INVITE Inititiated Dialog Event Package for the Session Initiation Protocol (SIP)
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Abstract

This document defines a dialog event package for the SIP Events architecture, along with a data format used in notifications for this package. The dialog package allows users to subscribe to another user, an receive notifications about the changes in state of INVITE initiated dialogs that the user is involved in.

Table of Contents

1. Introduction

The SIP Events framework [1] defines general mechanisms for subscription to, and notification of, events within SIP networks. It introduces the notion of a package, which is a specific "instantiation" of the events mechanism for a well-defined set of events. Packages have been defined for user presence [10], watcher information [11], and message waiting indicators [12], amongst others. Here, we define an event package for INVITE initiated dialogs. Dialogs refer to the SIP relationship established between two SIP peers [2]. Dialogs can be created by many methods, although RFC 3261 defines only one - the INVITE method. RFC 3265 defines the SUBSCRIBE and NOTIFY methods, which also create dialogs. However, the usage of this package to model transitions in the state of those dialogs is out of the scope of this specification.

There are a variety of applications enabled through the knowledge of INVITE dialog state. Some examples include:

Automatic Callback: In this basic Public Switched Telephone Network (PSTN) application, user A calls user B. User B is busy. User A would like to get a callback when user B hangs up. When B hangs up, user A's phone rings. When A picks it up, they here ringing, and are being connected to B. To implement this with SIP, a mechanism is required for B to receive a notification when the dialogs at A are complete.

Presence-Enabled Conferencing: In this application, a user A wishes to set up a conference call with users B and C. Rather than scheduling it, it is to be created automatically when A, B and C are all available. To do this, the server providing the application would like to know whether A, B and C are "online", not idle, and not in a phone call. Determining whether or not A, B and C are in calls can be done in two ways. In the first, the server acts as a call stateful proxy for users A, B and C, and therefore knows their call state. This won't always be possible, however, and it introduces scalability, reliability, and operational complexities. Rather, the server would subscriber to the dialog state of those users, and receive notifications as it changes. This enables the application to be provided in a distributed way; the server need not reside in the same domain as the users.

IM Conference Alerts: In this application, a user can get an IM sent to their phone whenever someone joins a conference that the phone is involved in. The IM alerts are generated by an application separate from the conference server.

In general, the dialog package allows for construction of distributed applications, where the application requires information on dialog state, but is not co-resident with the end user on which that state resides.

2. Terminology

In this document, the key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" are to be interpreted as described in RFC 2119 [9] and indicate requirement levels for compliant implementations.

3. Dialog Event Package

This section provides the details for defining a SIP Events package, as specified by [1].

3.1 Event Package Name

The name of this event package is "dialog". This package name is carried in the Event and Allow-Events header, as defined in [1].

3.2 Event Package Parameters

This package defines three Event Package parameters. They are call-id, to-tag and from-tag. If a subscription to a specific dialog is requested, all three of these parameters MUST be present. They identify the dialog that is being subscribed to. The to-tag is matched against the local tag, the from-tag is matched against the remote tag, and the call-id is matched against the Call-ID.

It is also possible to subscribe to the set of dialogs created as a result of a single INVITE sent by a UAC. In that case, the call-id and to-tag MUST be present. The to-tag is matched against the local tag, and the call-id is matched against the Call-ID.

The BNF for these parameters is:

```
call-id     =  "call-id" EQUAL SWS DQUOTE callid DQUOTE
                 ;;callid, EQUAL, SWS, DQUOTE from RFC3261
from-tag    =  "from-tag" EQUAL token
to-tag      =  "to-tag" EQUAL token
```

Note that the call-id parameter is a quoted string. This is because the BNF for word (which is used by callid) allows for characters not allowed within token.

3.3 SUBSCRIBE Bodies

A SUBSCRIBE for a dialog package MAY contain a body. This body defines a filter to apply to the subscription. Filter documents are not specified in this document, and at the time of writing, are expected to be the subject of future standardization activity.

A SUBSCRIBE for a dialog package MAY be sent without a body. This implies the default subscription filtering policy. The default policy is:

- If the Event header field contained dialog identifiers, notifications are generated every time there is a change in the

state of any matching dialogs for the user identified in the request URI of the SUBSCRIBE.

- If there were no dialog identifiers in the Event header field, notifications are generated every time there is any change in the state of any dialogs for the user identified in the request URI of the SUBSCRIBE.

- Notifications do not normally contain full state; rather, they only indicate the state of the dialog whose state has changed. The exception is a NOTIFY sent in response to a SUBSCRIBE. These NOTIFYs contain the complete view of dialog state.

- The notifications contain the identities of the participants in the dialog, and the dialog identifiers. Additional information, such as the route set, remote target URI, CSeq numbers, SDP information, and so on, are not included normally unless explicitly requested and/or explicitly authorized.

3.4 Subscription Duration

Dialog state changes fairly quickly; once established, a typical phone call lasts a few minutes (this is different for other session types, of course). However, the interval between new calls is typically infrequent. As such, we arbitrarily choose a default duration of one hour. Clients SHOULD specify an explicit duration.

There are two distinct use cases for dialog state. The first is when a subscriber is interested in the state of a specific dialog or dialogs (and they are authorized to find out about just the state of those dialogs). In that case, when the dialogs terminate, so too does the subscription. In these cases, the value of the subscription duration is largely irrelevant, and SHOULD be longer than the typical duration of a dialog, about two hours would cover most dialogs.

In another case, a subscriber is interested in the state of all dialogs for a specific user. In these cases, a shorter interval makes more sense. The default is one hour for these subscriptions.

3.5 NOTIFY Bodies

As described in RFC 3265 [1], the NOTIFY message will contain bodies that describe the state of the subscribed resource. This body is in a format listed in the Accept header field of the SUBSCRIBE, or a package-specific default if the Accept header field was omitted from the SUBSCRIBE.

In this event package, the body of the notification contains a dialog information document. This document describes the state of one or more dialogs associated with the subscribed resource. All subscribers and notifiers MUST support the "application/dialog-info+xml" data format described in Section 4. The subscribe request MAY contain an Accept header field. If no such header field is present, it has a default value of "application/dialog-info+xml". If the header field is present, it MUST include "application/dialog-info+xml", and MAY include any other types capable of representing dialog state.

Of course, the notifications generated by the server MUST be in one of the formats specified in the Accept header field in the SUBSCRIBE request.

3.6 Notifier Processing of SUBSCRIBE Requests

The dialog information for a user contains sensitive information. Therefore, all subscriptions SHOULD be authenticated and then authorized before approval. All implementors of this package MUST support the digest authentication mechanism as a baseline. Authorization policy is at the discretion of the administrator, as always. However, a few recommendations can be made.

It is RECOMMENDED that, if the policy of user B is that user A is allowed to call them, dialog subscriptions from user A be allowed. However, the information provided in the notifications does not contain any dialog identification information; merely an indication of whether the user is in one or more calls, or not. Specifically, they should not be able to find out any more information than if they sent an INVITE.

It is RECOMMENDED that if a user agent registers with the address-of-record X, that this user agent authorize subscriptions that come from any entity that can authenticate itself as X. Complete information on the dialog state SHOULD be sent in this case. This authorization behavior allows a group of devices representing a single user to all become aware of each other's state. This is useful for applications such as single-line-extension.

3.7 Notifier Generation of NOTIFY Requests

Notifications are generated for the dialog package when an INVITE request is sent, when a new dialog comes into existence at a UA, or when the state or characteristics of an existing dialog changes. Therefore, a model of dialog state is needed in order to determine precisely when to send notifications, and what their content should be. The SIP specification has a reasonably well defined lifecycle for dialogs. However, it is not explicitly modelled. This specification

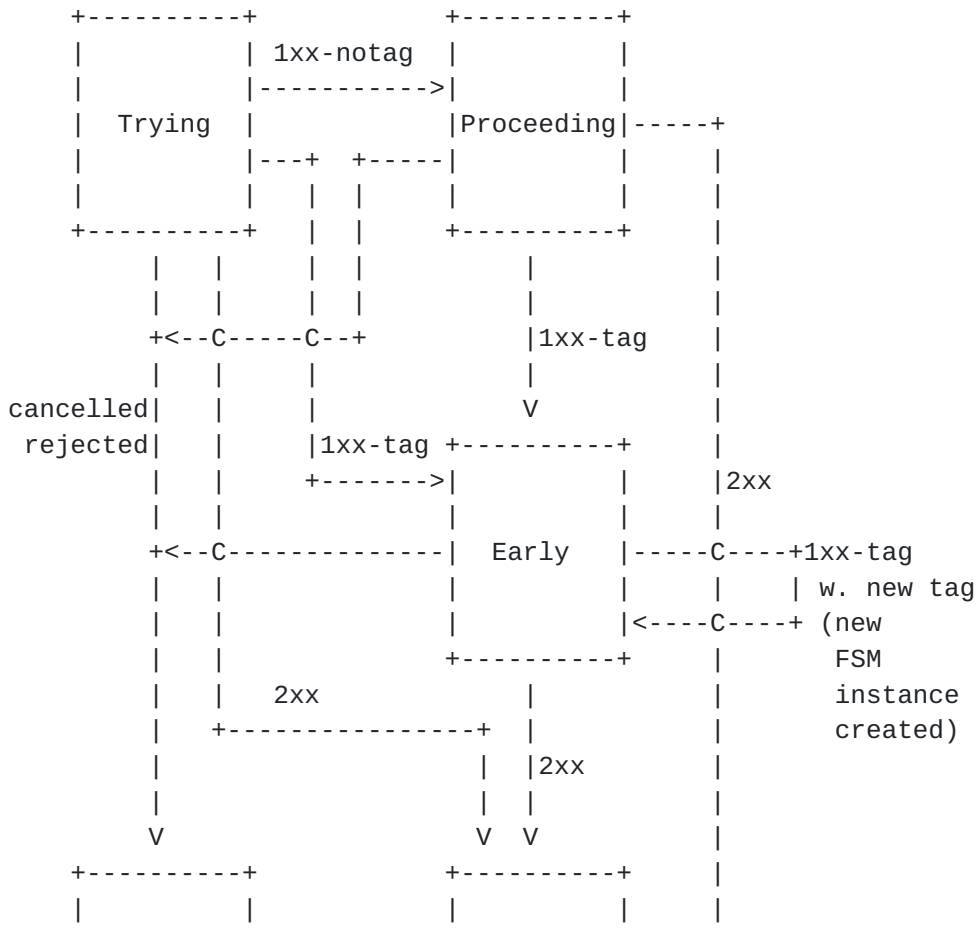
provides an explicit model of dialog state through a finite state machine.

It is RECOMMENDED that NOTIFY requests only contain information on the dialogs whose state has changed. However, if a notifier receives a SUBSCRIBE request, the triggered NOTIFY SHOULD contain the state of all dialogs that the subscriber is authorized to see.

3.7.1 The Dialog State Machine

Modelling of dialog state is complicated by two factors. The first is forking, which can cause a single INVITE to generate many dialogs at a UAC. The second is the differing views of state at the UAC and UAS. We have chosen to handle the first issue by extending the dialog FSM to include the states between transmission of the INVITE and the creation of actual dialogs through receipt of 1xx and 2xx responses. As a result, this specification supports the notion of dialog state for dialogs before they are fully instantiated.

We have also chosen to use a single FSM for both UAC and UAS.



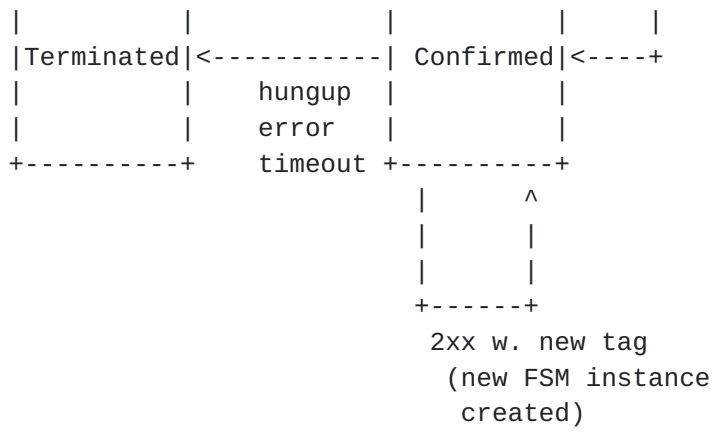


Figure 2

The FSM for dialog state is shown in Figure 2. The FSM is best understood by considering the UAC and UAS cases separately.

The FSM is created in the "trying" state when the UAC sends an INVITE request. Upon receipt of a 1xx without a tag (the "1xx-notag" event), the FSM transitions to the "proceeding" state. Note that there is no actual dialog yet, as defined by the SIP specification. However, there is a "half-dialog", in the sense that two of the three components of the dialog ID are known (the call identifier and local tag). If a 1xx with a tag is received, the FSM transitions to the early state. The full dialog identifier is now defined. Had a 2xx been received, the FSM would have transitioned to the "confirmed" state.

If, after transitioning to the "early" or ``confirmed'' states, the UAC receives another 1xx or 2xx respectively with a different tag, another instance of the FSM is created, initialized into the "early" or "confirmed" state respectively. The benefit of this approach is that there will be a single FSM representing the entire state of the invitation and resulting dialog when dealing with the common case of no forking.

If the UAC should send a CANCEL, and then subsequently receive a 487 to its INVITE transaction, all FSMs spawned from that INVITE transition to the "terminated" state with the event ``cancelled''. If the INVITE transaction terminates with a non-2xx response for any other reason, all FSMs spawned from that INVITE transition to the terminated state with the event "rejected".

Once in the confirmed state, the call is active. It can transition to the terminated state if the UAC sends a BYE or receives a BYE (corresponding to the "hungup" event), if a mid-dialog request generates a 481 or 408 response (corresponding to the "error" event),

or a mid-dialog request generates no response (corresponding to the "timeout" event).

From the perspective of the UAS, when an INVITE is received, the FSM is created in the "trying" state. If it sends a 1xx without a tag, the FSM transitions to the "proceeding" state. If a 1xx is sent with a tag, the FSM transitions to the "early" state, and if a 2xx is sent, it transitions to the "confirmed" state. If the UAS should receive a CANCEL request and then generate a 487 response to the INVITE (which can occur in the proceeding and early states), the FSM transitions to the terminated state with the event "cancelled". If the UAS should generate any other non-2xx final response to the INVITE request, the FSM transitions to the terminated state with the event "rejected". Once in the ``confirmed'' state, the transitions to the "terminated" state occur for the same reasons they do in the case of UAC.

> There should never be a transition from the "trying" state to the "terminated" state with the event ``cancelled'', since the SIP specification prohibits transmission of CANCEL until a provisional response is received. However, this transition is defined in the FSM just to unify the transitions from trying, proceeding, and early to the terminated state.

3.7.2 Applying the state machine

The notifier MAY generate a NOTIFY request on any event transition of the FSM. Whether it does or not is policy dependent. However, some general guidelines are provided.

When the subscriber is unauthenticated, or is authenticated, but represents a third party with no specific authorization policies, it is RECOMMENDED that subscriptions to an individual dialog, or to a specific set of dialogs, is forbidden. Only subscriptions to all dialogs (i.e., there are no dialog identifiers in the Event header field) are permitted. In that case, actual dialog states across all dialogs not be reported. Rather, a single "virtual" dialog FSM be used, and event transitions on that FSM be reported. If there is any dialog at the UA whose state is "confirmed", the virtual FSM is in the "confirmed" state. If there are no dialogs at the UA in the confirmed state, but there is at least one in the "early" state, the virtual FSM is in the "early" or "confirmed" state. If there are no dialogs in the confirmed or early states, but there is at least one in the "proceeding" state, the virtual FSM is in the "proceeding", "early" or "confirmed" state. If there are no dialogs in the confirmed, early, or proceeding states, but there is at least one in the "trying" state, the virtual FSM is in the "trying", "proceeding",

"early" or "confirmed" state. The choice about which state to use depends on whether the UA wishes to let unknown users that their phone is ringing, as opposed to in an active call. It is RECOMMENDED that, in the absence of any preference, "confirmed" is used in all cases. Furthermore, it is RECOMMENDED that the notifications of changes in the virtual FSM machine not convey any information except the state of the FSM and its event transitions - no dialog identifiers (which are ill-defined in this model in any case). The use of this virtual FSM allows for minimal information to be conveyed. A subscriber cannot know how many calls are in progress, or with whom, just that there exists a call. This is the same information they would receive if they simply sent an INVITE to the user instead; a 486 response would indicate that they are on a call.

When the subscriber is authenticated, and has authenticated itself with the same address-of-record that the UA itself uses, if no explicit authorization policy is defined, it is RECOMMENDED that all state transitions on dialogs that have been subscribed to (which is either all of them, if no dialog identifiers were present in the Event header field, or a specific set of them identified by the Event header field parameters) be reported, along with complete dialog IDs.

The notifier MAY generate a NOTIFY request on any change in the characteristics associated with the dialog. Since these include CSeq numbers and SDP, receipt of re-INVITEs and UPDATE requests [3] which modify this information MAY trigger notifications.

3.8 Subscriber Processing of NOTIFY Requests

The SIP Events framework expects packages to specify how a subscriber processes NOTIFY requests in any package specific ways, and in particular, how it uses the NOTIFY requests to contruct a coherent view of the state of the subscribed resource.

Typically, the NOTIFY for the dialog package will only contain information about those dialogs whose state has changed. To construct a coherent view of the total state of all dialogs, a subscriber to the dialog package will need to combine NOTIFYs received over time.

Notifications within this package can convey partial information; that is, they can indicate information about a subset of the state associated with the subscription. This means that an explicit algorithm needs to be defined in order to construct coherent and consistent state. The details of this mechanism are specific to the particular document type. See Section 4.2 for information on constructing coherent information from an application/dialog-info+xml document.

3.9 Handling of Forked Requests

Since dialog state is distributed across the UA for a particular user, it is reasonable and useful for a SUBSCRIBE request for dialog state to fork, and reach multiple UA.

As a result, a forked SUBSCRIBE request for dialog state can install multiple subscriptions. Subscribers to this package MUST be prepared to install subscription state for each NOTIFY generated as a result of a single SUBSCRIBE.

3.10 Rate of Notifications

For reasons of congestion control, it is important that the rate of notifications not become excessive. As a result, it is RECOMMENDED that the server not generate notifications for a single subscriber at a rate faster than once every 5 seconds.

3.11 State Agents

Dialog state is ideally maintained in the user agents in which the dialog resides. Therefore, the elements that maintain the dialog are the ones best suited to handle subscriptions to it. However, in some cases, a network agent may also know the state of the dialogs held by a user. As such, state agents MAY be used with this package.

4. Dialog Information Format

Dialog information is an XML document [4] that MUST be well-formed and SHOULD be valid. Dialog information documents MUST be based on XML 1.0 and MUST be encoded using UTF-8. This specification makes use of XML namespaces for identifying dialog information documents and document fragments. The namespace URI for elements defined by this specification is a URN [5], using the namespace identifier 'ietf' defined by [6] and extended by [7]. This URN is:

urn:ietf:params:xml:ns:dialog-info

A dialog information document begins with the root element tag "dialog-info".

4.1 Structure of Dialog Information

A dialog information document starts with a dialog-info element. This element has three mandatory attributes:

version: This attribute allows the recipient of dialog information documents to properly order them. Versions start at 0, and increment by one for each new document sent to a subscriber. Versions are scoped within a subscription. Versions MUST be representable using a 32 bit integer.

state: This attribute indicates whether the document contains the full dialog information, or whether it contains only information on those dialogs which have changed since the previous document (partial).

entity: This attribute contains a URI that identifies the user whose dialog information is reported in the remainder of the document. This user is referred to as the "observed user".

The dialog-info element has a series of dialog sub-elements. Each of those represents a specific dialog.

4.1.1 Dialog Element

The dialog element reports information on a specific dialog or "half-dialog". It has a single mandatory attribute, id. The id attribute provides a single string that can be used as an identifier for this dialog or "half-dialog". This is a different identifier than the dialog ID defined in RFC 3261 [2], but related to it.

For a caller, the id is created when an INVITE request is sent. When a 1xx with a tag, or a 2xx is received, the dialog is formally

created. The id remains unchanged. However, if an additional 1xx or 2xx is received, resulting in the creation of another dialog (and resulting FSM), that dialog is allocated a new id.

For a callee, the id is created when an INVITE outside of an existing dialog is received. When a 2xx or a 1xx with a tag is sent, creating the dialog, the id remains unchanged.

The id MUST be unique amongst all dialogs at a UA.

There are a number of optional attributes which provide identification information about the dialog:

call-id: This attribute is a string which represents the call-id component of the dialog identifier.

local-tag: This attribute is a string which represents the local-tag component of the dialog identifier.

remote-tag: This attribute is a string which represents the remote-tag component of the dialog identifier. The remote tag attribute won't be present if there is only a "half-dialog", resulting from the generation of an INVITE for which no final responses or provisional responses with tags has been received.

direction: This attribute is either initiator or recipient, and indicates whether the observed user was the initiator of the dialog, or the recipient of the INVITE that created it.

The sub-elements of the dialog element provide additional information about the dialog. The only mandatory one is state.

4.1.2 State

The state element indicates the state of the dialog. Its value is an enumerated type describing one of the states in the FSM above. It has an optional event attribute that can be used to indicate the event which caused the transition into the current state, and an optional code attribute that indicates the response code associated with the transition, assuming the event was caused by a response.

4.1.3 Local URI

The local-uri element indicates the local URI, as defined in [2]. It has an optional attribute, display-name, that contains the display name from the local URI.

4.1.4 Remote URI

The remote-uri element indicates the remote URI, as defined in [2]. It has an optional attribute, display-name, that contains the display name from the remote URI.

4.1.5 Local Session Description

The local-session-description element contains the session description used by the observed user for its end of the dialog. This element should generally NOT be included in the notifications, unless explicitly requested by the subscriber. It has a single attribute, type, which indicates the MIME media type of the session description.

4.1.6 Remote Session Description

The remote-session-description element contains the session description used by the peer of the observed user for its end of the dialog. This element should generally NOT be included in the notifications, unless explicitly requested by the subscriber. It has a single attribute, type, which indicates the MIME media type of the session description.

4.1.7 Remote Target

The remote-target contains the remote-target URI as constructed by the user agent for this dialog, as defined in RFC 3261 [2]. This element should generally not be included in notifications, unless explicitly requested by the subscriber.

4.1.8 Local CSeq

The local-cseq element contains the most recent value of the CSeq header used by the UA in an outgoing request on the dialog. This element should generally NOT be included in the notifications, unless explicitly requested by the subscriber. If no CSeq has yet been defined, the value of the element is -1.

4.1.9 Remote CSeq

The remote-cseq element contains the most recent value of the CSeq header seen by the UA in an incoming request on the dialog. This element should generally NOT be included in the notifications, unless explicitly requested by the subscriber. If no CSeq has yet been defined, the value of the element is -1.

4.1.10 Duration

The duration element contains the amount of time, in seconds, since the FSM was created.

4.2 Constructing Coherent State

The dialog information subscriber maintains a table for the list of dialogs. The table contains a row for each dialog. Each row is indexed by an ID, present in the "id" attribute of the "dialog" element. The contents of each row contain the state of that dialog as conveyed in the document. The table is also associated with a version number. The version number MUST be initialized with the value of the "version" attribute from the "dialog-info" element in the first document received. Each time a new document is received, the value of the local version number, and the "version" attribute in the new document, are compared. If the value in the new document is one higher than the local version number, the local version number is increased by one, and the document is processed. If the value in the document is more than one higher than the local version number, the local version number is set to the value in the new document, and the document is processed. If the document did not contain full state, the subscriber SHOULD generate a refresh request to trigger a full state notification. If the value in the document is less than the local version, the document is discarded without processing.

The processing of the dialog information document depends on whether it contains full or partial state. If it contains full state, indicated by the value of the "state" attribute in the "dialog-info" element, the contents of the table are flushed. They are repopulated from the document. A new row in the table is created for each "dialog" element. If the document contains partial state, as indicated by the value of the "state" attribute in the "dialog-info" element, the document is used to update the table. For each "dialog" element in the document, the subscriber checks to see whether a row exists for that dialog. This check is done by comparing the ID in the "id" attribute of the "dialog" element with the ID associated with the row. If the dialog doesn't exist in the table, a row is added, and its state is set to the information from that "dialog" element. If the dialog does exist, its state is updated to be the information from that "dialog" element. If a row is updated or created, such that its state is now terminated, that entry MAY be removed from the table at any time.

4.3 Schema

The following is the schema for the application/dialog-info+xml type:

```
<?xml version="1.0" encoding="UTF-8"?>
```

```
   <xs:schema
     targetNamespace="urn:ietf:params:xml:ns:dialog-info"
     xmlns:xs="http://www.w3.org/2001/XMLSchema"
     xmlns:tns="urn:ietf:params:xml:ns:dialog-info"
     elementFormDefault="qualified"
     attributeFormDefault="unqualified">
     <!-- This import brings in the XML language attribute xml:lang-->
     <xs:import namespace="http://www.w3.org/XML/1998/namespace"
        schemaLocation="http://www.w3.org/2001/03/xml.xsd"/>
     <xs:element name="dialog-info">
       <xs:complexType>
         <xs:sequence>
           <xs:element ref="tns:dialog" minOccurs="0" maxOccurs="unbounded"/>
           <xs:any namespace="##other" processContents="lax"
              minOccurs="0"  maxOccurs="unbounded"/>
         </xs:sequence>
         <xs:attribute name="version" type="xs:nonNegativeInteger"
              use="required"/>
         <xs:attribute name="state" use="required">
           <xs:simpleType>
             <xs:restriction base="xs:string">
               <xs:enumeration value="full"/>
               <xs:enumeration value="partial"/>
             </xs:restriction>
           </xs:simpleType>
         </xs:attribute>
         <xs:attribute name="entity" type="xs:anyURI" use="required"/>
       </xs:complexType>
     </xs:element>
     <xs:element name="dialog">
       <xs:complexType>
         <xs:sequence>
           <xs:element ref="tns:state"/>
           <xs:element name="duration" type="xs:nonNegativeInteger"
             minOccurs="0"/>
           <xs:element name="local-uri" type="tns:nameaddr"
             minOccurs="0"/>
           <xs:element name="remote-uri" type="tns:nameaddr"
             minOccurs="0"/>
           <xs:element name="local-session-description" type="tns:sessd"
             minOccurs="0"/>
           <xs:element name="remote-session-description" type="tns:sessd"
             minOccurs="0"/>
           <xs:element name="remote-target" type="tns:nameaddr"
             minOccurs="0"/>
           <xs:element name="local-cseq" type="xs:nonNegativeInteger"
             minOccurs="0"/>
           <xs:element name="remote-cseq" type="xs:nonNegativeInteger"
```

```
            minOccurs="0"/>
          <xs:any namespace="##other" processContents="lax"
            minOccurs="0" maxOccurs="unbounded"/>
        </xs:sequence>
        <xs:attribute name="id" type="xs:string" use="required"/>
        <xs:attribute name="call-id" type="xs:string" use="optional"/>
        <xs:attribute name="local-tag" type="xs:string" use="optional"/>
        <xs:attribute name="remote-tag" type="xs:string" use="optional"/>
        <xs:attribute name="direction" use="optional">
          <xs:simpleType>
            <xs:restriction base="xs:string">
              <xs:enumeration value="initiator"/>
              <xs:enumeration value="recipient"/>
            </xs:restriction>
          </xs:simpleType>
        </xs:attribute>
      </xs:complexType>
    </xs:element>
    <xs:complexType name="nameaddr">
      <xs:simpleContent>
        <xs:extension base="xs:anyURI">
          <xs:attribute name="display-name" type="xs:string"/>
        </xs:extension>
      </xs:simpleContent>
    </xs:complexType>
    <xs:complexType name="sessd">
      <xs:simpleContent>
        <xs:extension base="xs:string">
          <xs:attribute name="type" type="xs:string"/>
        </xs:extension>
      </xs:simpleContent>
    </xs:complexType>
    <xs:element name="state">
      <xs:complexType>
        <xs:simpleContent>
          <xs:extension base="xs:string">
            <xs:attribute name="event" use="optional">
              <xs:simpleType>
                <xs:restriction base="xs:string">
                  <xs:enumeration value="1xx-notag"/>
                  <xs:enumeration value="1xx-tag"/>
                  <xs:enumeration value="2xx"/>
                  <xs:enumeration value="cancelled"/>
                  <xs:enumeration value="rejected"/>
                  <xs:enumeration value="hungup"/>
                  <xs:enumeration value="error"/>
                  <xs:enumeration value="timeout"/>
                </xs:restriction>
```

```
              </xs:simpleType>
            </xs:attribute>
            <xs:attribute name="code" use="optional">
              <xs:simpleType>
                <xs:restriction base="xs:positiveInteger">
                  <xs:minInclusive value="100"/>
                  <xs:maxInclusive value="699"/>
                </xs:restriction>
              </xs:simpleType>
            </xs:attribute>
          </xs:extension>
        </xs:simpleContent>
      </xs:complexType>
    </xs:element>
  </xs:schema>
```

4.4 Example

For example, if a UAC sends an INVITE that looks like, in part:

```
INVITE sip:bob@example.com SIP/2.0
Via: SIP/2.0/UDP pc33.example.com;branch=z9hG4bKnashds8
Max-Forwards: 70
To: Bob <sip:bob@example.com>
From: Alice <sip:alice@example.com>;tag=1928301774
Call-ID: a84b4c76e66710
CSeq: 314159 INVITE
Contact: <sip:alice@pc33.example.com>
Content-Type: application/sdp
Content-Length: 142

[SDP not shown]
```

The XML document in a notification from Alice might look like:

```
<?xml version="1.0"?>
<dialog-info xmlns="urn:ietf:params:xml:ns:dialog-info"
             version="0"
             state="full"
             entity="sip:alice@example.com">
  <dialog id="as7d900as8" call-id="a84b4c76e66710"
          local-tag="1928301774" direction="initiator">
    <state>trying</state>
  </dialog>
```

```
</dialog-info>
```

If the following 180 response is received:

```
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP pc33.example.com;branch=z9hG4bKnashds8
To: Bob <sip:bob@example.com>;tag=456887766
From: Alice <sip:alice@example.com>;tag=1928301774
Call-ID: a84b4c76e66710
CSeq: 314159 INVITE
Contact: <sip:bob@host.example.com>
```

The XML document in a notification might look like:

```
<?xml version="1.0"?>
<dialog-info xmlns="urn:ietf:params:xml:ns:dialog-info"
             version="1"
             state="full"
             entity="sip:alice@example.com">
  <dialog id="as7d900as8" call-id="a84b4c76e66710"
          local-tag="1928301774" remote-tag="456887766"
          direction="initiator">
    <state>early</state>
  </dialog>
</dialog-info>
```

If it receives a second 180 with a different tag:

```
SIP/2.0 180 Ringing
Via: SIP/2.0/UDP pc33.example.com;branch=z9hG4bKnashds8
To: Bob <sip:bob@example.com>;tag=hh76a
From: Alice <sip:alice@example.com>;tag=1928301774
Call-ID: a84b4c76e66710
CSeq: 314159 INVITE
Contact: <sip:jack@host.example.com>
```

This results in the creation of a second dialog:

```
<?xml version="1.0"?>
<dialog-info xmlns="urn:ietf:params:xml:ns:dialog-info"
             version="2"
             state="full"
             entity="sip:alice@example.com">
  <dialog id="as7d900as8" call-id="a84b4c76e66710"
          local-tag="1928301774" remote-tag="456887766"
          direction="initiator">
    <state>early</state>
  </dialog>
  <dialog id="as7d900as8" call-id="a84b4c76e66710"
          local-tag="1928301774" remote-tag="hh76a"
          direction="initiator">
    <state>early</state>
  </dialog>
</dialog-info>
```

If a 200 OK is received on the second dialog, it moves to confirmed:

```
<?xml version="1.0"?>
<dialog-info xmlns="urn:ietf:params:xml:ns:dialog-info"
             version="3"
             state="partial"
             entity="sip:alice@example.com">
  <dialog id="as7d900as8" call-id="a84b4c76e66710"
          local-tag="1928301774" remote-tag="hh76a"
          direction="initiator">
    <state>confirmed</state>
  </dialog>
</dialog-info>
```

32 seconds later, the other early dialog terminates because no 2xx is received for it. This implies that it was successfully cancelled, and therefore the following notification is sent:

```
<?xml version="1.0"?>
<dialog-info xmlns="urn:ietf:params:xml:ns:dialog-info"
             version="4"
             state="partial"
             entity="sip:alice@example.com">
  <dialog id="as7d900as8" call-id="a84b4c76e66710"
          local-tag="1928301774" remote-tag="hh76a"
          direction="initiator">
    <state event="cancelled">terminated</state>
  </dialog>
</dialog-info>
```

5. Security Considerations

Subscriptions to dialog state can reveal sensitive information. For this reason, Section 3.6 discusses authentication and authorization of subscriptions, and provides guidelines on sensible authorization policies. All implementations of this package MUST support the digest authentication mechanism.

Since the data in notifications is sensitive as well, end-to-end SIP encryption mechanisms using S/MIME MAY be used to protect it.

6. IANA Considerations

This document registers a new MIME type, application/dialog-info+xml and registers a new XML namespace.

6.1 application/dialog-info+xml MIME Registration

MIME media type name: application

MIME subtype name: dialog-info+xml

Mandatory parameters: none

Optional parameters: Same as charset parameter application/xml as specified in RFC 3023 [8].

Encoding considerations: Same as encoding considerations of application/xml as specified in RFC 3023 [8].

Security considerations: See Section 10 of RFC 3023 [8] and Section 5 of this specification.

Interoperability considerations: none.

Published specification: This document.

Applications which use this media type: This document type has been used to support SIP applications such as call return and auto-conference.

Additional Information:

Magic Number: None

File Extension: .dif or .xml

Macintosh file type code: "TEXT"

Personal and email address for further information: Jonathan Rosenberg, <jdrosen@jdrosen.net>

Intended usage: COMMON

Author/Change controller: The IETF.

6.2 URN Sub-Namespace Registration for urn:ietf:params:xml:ns:dialog-info

This section registers a new XML namespace, as per the guidelines in [7].

URI: The URI for this namespace is
urn:ietf:params:xml:ns:dialog-info.

Registrant Contact: IETF, SIPPING working group, <sipping@ietf.org>,
Jonathan Rosenberg <jdrosen@jdrosen.net>.

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>Dialog Information Namespace</title>
</head
<body>
  <h1>Namespace for Dialog Information</h1>
  <h2>urn:ietf:params:xml:ns:dialog-info</h2>
  <p>See <a href="[[[URL of published RFC]]]">RFCXXXX</a>.</p>
</body>
</html>
END
```

6.3 Schema Registration

This specification registers a schema, as per the guidelines in in [7].

URI: please assign.

Registrant Contact: IETF, SIPPING Working Group
(sipping@ietf.org), Jonathan Rosenberg (jdrosen@jdrosen.net).

XML: The XML can be found as the sole content of Section 4.3.

7. Acknowledgements

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Normative References

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