                An Interactive Voice Response (IVR) Control Package
                    for the Media Control Channel Framework

Abstract

   This document defines a Media Control Channel Framework Package for
   Interactive Voice Response (IVR) dialog interaction on media
   connections and conferences. The package defines dialog management
   request elements for preparing, starting, and terminating dialog
   interactions, as well as associated responses and notifications.
   Dialog interactions are specified in a dialog language. This package
   defines a lightweight IVR dialog language (supporting prompt
   playback, runtime controls, Dual-Tone Multi-Frequency (DTMF)
   collection, and media recording) and allows other dialog languages to
   be used. The package also defines elements for auditing package
   capabilities and IVR dialogs.

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1. Introduction

   The Media Control Channel Framework [RFC6230] provides a generic
   approach for establishment and reporting capabilities of remotely
   initiated commands. The Channel Framework -- an equivalent term for
   the Media Control Channel Framework -- utilizes many functions
   provided by the Session Initiation Protocol (SIP) [RFC3261] for the
   rendezvous and establishment of a reliable channel for control
   interactions. The Control Framework also introduces the concept of a
   Control Package. A Control Package is an explicit usage of the
   Control Framework for a particular interaction set. This document
   defines a Control Package for Interactive Voice Response (IVR)
   dialogs on media connections and conferences. The term 'dialog' in
   this document refers to an IVR dialog and is completely unrelated to
   the notion of a SIP dialog. The term 'IVR' is used in its inclusive
   sense, allowing media other than voice for dialog interaction.

   The package defines dialog management request elements for preparing,
   starting, and terminating dialog interactions, as well as associated
   responses and notifications. Dialog interactions are specified using
   a dialog language where the language specifies a well-defined syntax
   and semantics for permitted operations (play a prompt, record input
   from the user, etc.). This package defines a lightweight IVR dialog
   language (supporting prompt playback, runtime controls, DTMF
   collection, and media recording) and allows other dialog languages to
   be used. These dialog languages are specified inside dialog
   management elements for preparing and starting dialog interactions.
   The package also defines elements for auditing package capabilities
   and IVR dialogs.

   This package has been designed to satisfy IVR requirements documented
   in "Media Server Control Protocol Requirements" [RFC5167] -- more
   specifically, REQ-MCP-28, REQ-MCP-29, and REQ-MCP-30. It achieves
   this by building upon two major approaches to IVR dialog design.
   These approaches address a wide range of IVR use cases and are used
   in many applications that are extensively deployed today.

   First, the package is designed to provide the major IVR functionality
   of SIP media server languages such as netann [RFC4240], Media Server
   Control Markup Language (MSCML) [RFC5022], and Media Server Markup
   Language (MSML) [RFC5707], which themselves build upon more
   traditional non-SIP languages ([H.248.9], [RFC2897]). A key
   differentiator is that this package provides IVR functionality using
   the Channel Framework.

   Second, its design is aligned with key concepts of the web model as
   defined in W3C Voice Browser languages. The key dialog management
   mechanism is closely aligned with Call Control XML (CCXML) [CCXML10].

The dialog functionality defined in this package can be largely seen
as a subset of VoiceXML ([VXML20], [VXML21]): where possible, basic
prompting, DTMF collection, and media recording features are
incorporated, but not any advanced VoiceXML constructs (such as
<form>, its interpretation algorithm, or a dynamic data model). As
W3C develops VoiceXML 3.0 [VXML30], we expect to see further
alignment, especially in providing a set of basic independent
primitive elements (such as prompt, collect, record, and runtime
controls) that can be reused in different dialog languages.

By reusing and building upon design patterns from these approaches to
IVR languages, this package is intended to provide a foundation that
is familiar to current IVR developers and sufficient for most IVR
applications, as well as a path to other languages that address more
advanced applications.

This Control Package defines a lightweight IVR dialog language. The
scope of this dialog language is the following IVR functionality:

o playing one or more media resources as a prompt to the user

o runtime controls (including VCR controls like speed and volume)

o collecting DTMF input from the user according to a grammar

o recording user media input

Out of scope for this dialog language are more advanced functions
including ASR (Automatic Speech Recognition), TTS (Text-to-Speech),
fax, automatic prompt recovery ('media fallback'), and media
transformation. Such functionality can be addressed by other dialog
languages (such as VoiceXML) used with this package, extensions to
this package (addition of foreign elements or attributes from another
namespace), or other Control Packages.

The functionality of this package is defined by messages, containing
XML [XML] elements, transported using the Media Control Channel
Framework. The XML elements can be divided into three types: dialog
management elements; a dialog element that defines a lightweight IVR
dialog language used with dialog management elements; and finally,
elements for auditing package capabilities as well as dialogs managed
by the package.

Dialog management elements are designed to manage the general
lifecycle of a dialog. Elements are provided for preparing a dialog,
starting the dialog on a conference or connection, and terminating
execution of a dialog. Each of these elements is contained in a
Media Control Channel Framework CONTROL message sent to the media

server. When the appropriate action has been executed, the media
server sends a REPORT message (or a 200 response to the CONTROL
message if it can execute in time) with a response element indicating
whether or not the operation was successful (e.g., if the dialog
cannot be started, then the error is reported in this response).
Once a dialog has been successfully started, the media server can
send further event notifications in a framework CONTROL message.
This package defines two event notifications: a DTMF event indicating
the DTMF activity, and a dialogexit event indicating that the dialog
has exited. If the dialog has executed successfully, the dialogexit
event includes information collected during the dialog. If an error
occurs during execution (e.g., a media resource failed to play, no
recording resource available, etc.), then error information is
reported in the dialogexit event. Once a dialogexit event is sent,
the dialog lifecycle is terminated.

The dialog management elements for preparing and starting a dialog
specify the dialog using a dialog language. A dialog language has
well-defined syntax and semantics for defined dialog operations.
Typically, dialog languages are written in XML where the root element
has a designated XML namespace and, when used as standalone
documents, have an associated MIME media type. For example, VoiceXML
is an XML dialog language with the root element <vxml> with the
designated namespace 'http://www.w3.org/2001/vxml' and standalone
documents are associated with the MIME media type 'application/
voicexml+xml' [RFC4267].

This Control Package defines its own lightweight IVR dialog language.
The language has a root element (<dialog>) with the same designated
namespace as used for other elements defined in this package (see
Section 8.2). The root element contains child elements for playing
prompts to the user, specifying runtime controls, collecting DTMF
input from the user, and recording media input from the user. The
child elements can co-occur so as to provide 'play announcement',
'prompt and collect', as well as 'prompt and record' functionality.

The dialog management elements for preparing and starting a dialog
can specify the dialog language either by including inline a fragment
with the root element or by referencing an external dialog document.
The dialog language defined in this package is specified inline.
Other dialog languages, such as VoiceXML, can be used by referencing
an external dialog document.

The document is organized as follows. Section 3 describes how this
Control Package fulfills the requirements for a Media Control Channel
Framework Control Package. Section 4 describes the syntax and
semantics of defined elements, including dialog management
(Section 4.2), the IVR dialog element (Section 4.3), and audit

elements (Section 4.4). Section 5 describes an XML schema for these
elements and provides extensibility by allowing attributes and
elements from other namespaces. Section 6 provides examples of
package usage. Section 7 describes important security considerations
for use of this Control Package. Section 8 provides information on
IANA registration of this Control Package, including its name, XML
namespace, and MIME media type. It also establishes a registry for
prompt variables. Finally, Section 9 provides additional information
on using VoiceXML when supported as an external dialog language.

2. Conventions and Terminology

   In this document, BCP 14 [RFC2119] defines the key words "MUST",
   "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT",
   "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL". In
   addition, BCP 15 indicates requirement levels for compliant
   implementations.

   The following additional terms are defined for use in this document:

   Dialog: A dialog performs media interaction with a user following
      the concept of an IVR (Interactive Voice Response) dialog (this
      sense of 'dialog' is completely unrelated to a SIP dialog). A
      dialog is specified as inline XML or via a URI reference to an
      external dialog document. Traditional IVR dialogs typically
      feature capabilities such as playing audio prompts, collecting
      DTMF input, and recording audio input from the user. More
      inclusive definitions include support for other media types,
      runtime controls, synthesized speech, recording and playback of
      video, recognition of spoken input, and mixed initiative
      conversations.

   Application Server: A SIP [RFC3261] application server (AS) hosts
      and executes services such as interactive media and conferencing
      in an operator's network. An AS influences and impacts the SIP
      session, in particular by terminating SIP sessions on a media
      server, which is under its control.

   Media Server: A media server (MS) processes media streams on behalf
      of an AS by offering functionality such as interactive media,
      conferencing, and transcoding to the end user. Interactive media
      functionality is realized by way of dialogs that are initiated by
      the application server.

3. Control Package Definition

   This section fulfills the mandatory requirement for information that
   MUST be specified during the definition of a Control Framework
   Package, as detailed in Section 7 of [RFC6230].

3.1. Control Package Name

   The Control Framework requires a Control Package to specify and
   register a unique name.

   The name of this Control Package is "msc-ivr/1.0" (Media Server
   Control - Interactive Voice Response - version 1.0). Its IANA
   registration is specified in Section 8.1.

   Since this is the initial ("1.0") version of the Control Package,
   there are no backwards-compatibility issues to address.

3.2. Framework Message Usage

   The Control Framework requires a Control Package to explicitly detail
   the CONTROL messages that can be used as well as provide an
   indication of directionality between entities. This will include
   which role type is allowed to initiate a request type.

   This package specifies Control and response messages in terms of XML
   elements defined in Section 4, where the message bodies have the MIME
   media type defined in Section 8.4. These elements describe requests,
   responses, and notifications and all are contained within a root
   <mscivr> element (Section 4.1).

   In this package, the MS operates as a Control Server in receiving
   requests from, and sending responses to, the AS (operating as Control
   Client). Dialog management requests and responses are defined in
   Section 4.2. Audit requests and responses are defined in
   Section 4.4. Dialog management and audit responses are carried in a
   framework 200 response or REPORT message bodies. This package's
   response codes are defined in Section 4.5.

   Note that package responses are different from framework response
   codes. Framework error response codes (see Section 7 of [RFC6230])
   are used when the request or event notification is invalid; for
   example, a request is invalid XML (400), or not understood (500).

   The MS also operates as a Control Client in sending event
   notification to the AS (Control Server). Event notifications
   (Section 4.2.5) are carried in CONTROL message bodies. The AS MUST
   respond with a Control Framework 200 response.

3.3. Common XML Support

   The Control Framework requires a Control Package definition to
   specify if the attributes for media dialog or conference references
   are required.

   This package requires that the XML schema in Section A.1 of [RFC6230]
   MUST be supported for media dialogs and conferences.

   The package uses "connectionid" and "conferenceid" attributes for
   various element definitions (Section 4). The XML schema (Section 5)
   imports the definitions of these attributes from the framework
   schema.

3.4. CONTROL Message Body

   The Control Framework requires a Control Package to define the
   control body that can be contained within a CONTROL command request
   and to indicate the location of detailed syntax definitions and
   semantics for the appropriate body types.

   When operating as Control Server, the MS receives Control message
   bodies with the MIME media type defined in Section 8.4 and containing
   an <mscivr> element (Section 4.1) with either a dialog management or
   audit request child element.

   The following dialog management request elements are carried in
   CONTROL message bodies to the MS: <dialogprepare> (Section 4.2.1),
   <dialogstart> (Section 4.2.2), and <dialogterminate> (Section 4.2.3)
   elements.

   The <audit> request element (Section 4.4.1) is also carried in
   CONTROL message bodies.

   When operating as Control Client, the MS sends CONTROL messages with
   the MIME media type defined in Section 8.4 and a body containing an
   <mscivr> element (Section 4.1) with a notification <event> child
   element (Section 4.2.5).

3.5. REPORT Message Body

   The Control Framework requires a Control Package definition to define
   the REPORT body that can be contained within a REPORT command
   request, or that no report package body is required. This section
   indicates the location of detailed syntax definitions and semantics
   for the appropriate body types.

When operating as Control Server, the MS sends REPORT bodies with the
MIME media type defined in Section 8.4 and containing a <mscivr>
element (Section 4.1) with a response child element. The response
element for dialog management requests is a <response> element
(Section 4.2.4). The response element for an audit request is an
<auditresponse> element (Section 4.4.2).

3.6. Audit

The Control Framework encourages Control Packages to specify whether
auditing is available, how it is triggered, as well as the query/
response formats.

This Control Package supports auditing of package capabilities and
dialogs on the MS. An audit request is carried in a CONTROL message
(see Section 3.4) and an audit response in a REPORT message (or a 200
response to the CONTROL if it can execute the audit in time) (see
Section 3.5).

The syntax and semantics of audit request and response elements are
defined in Section 4.4.

3.7. Examples

The Control Framework recommends Control Packages to provide a range
of message flows that represent common flows using the package and
this framework document.

This Control Package provides examples of such message flows in
Section 6.

4. Element Definitions

This section defines the XML elements for this package. The elements
are defined in the XML namespace specified in Section 8.2.

The root element is <mscivr> (Section 4.1). All other XML elements
(requests, responses, and notification elements) are contained within
it. Child elements describe dialog management (Section 4.2) and
audit (Section 4.4) functionality. The IVR dialog element (contained
within dialog management elements) is defined in Section 4.3.
Response status codes are defined in Section 4.5 and type definitions
in Section 4.6.

Implementation of this Control Package MUST address the Security
Considerations described in Section 7.

Implementation of this Control Package MUST adhere to the syntax and
semantics of XML elements defined in this section and the schema
(Section 5). Since XML schema is unable to support some types of
syntactic constraints (such as attribute and element co-occurrence),
some elements in this package specify additional syntactic
constraints in their textual definition. If there is a difference in
constraints between the XML schema and the textual description of
elements in this section, the textual definition takes priority.

The XML schema supports extensibility by allowing attributes and
elements from other namespaces. Implementations MAY support
additional capabilities by means of attributes and elements from
other (foreign) namespaces. Attributes and elements from foreign
namespaces are not described in this section.

Some elements in this Control Package contain attributes whose value
is a URI. These elements include: <dialogprepare> (Section 4.2.1),
<dialogstart> (Section 4.2.2), <media> (Section 4.3.1.5), <grammar>
(Section 4.3.1.3.1), and <record> (Section 4.3.1.4). The MS MUST
support both HTTP [RFC2616] and HTTPS [RFC2818] protocol schemes for
fetching and uploading resources, and the MS MAY support other
schemes. The implementation SHOULD support storage of authentication
information as part of its configuration, including security
certificates for use with HTTPS. If the implementation wants to
support user authentication, user certifications and passwords can
also be stored as part of its configuration or the implementation can
extend the schema (adding, for example, an http-password attribute in
its own namespace) and then map user authentication information onto
the appropriate headers following the HTTP authentication model
[RFC2616].

Some elements in this Control Package contain attributes whose value
is descriptive text primarily for diagnostic use. The implementation
can indicate the language used in the descriptive text by means of a
'desclang' attribute ([RFC2277], [RFC5646]). The desclang attribute
can appear on the root element as well as selected subordinate
elements (see Section 4.1). The desclang attribute value on the root
element applies to all desclang attributes in subordinate elements
unless the subordinate element has an explicit desclang attribute
that overrides it.

Usage examples are provided in Section 6.

4.1. <mscivr>

The <mscivr> element has the following attributes (in addition to
standard XML namespace attributes such as xmlns):

   version: a string specifying the mscivr package version. The value
      is fixed as '1.0' for this version of the package. The attribute
      is mandatory.

   desclang: specifies the language used in descriptive text attributes
      of subordinate elements (unless the subordinate element provides a
      desclang attribute that overrides the value for its descriptive
      text attributes). The descriptive text attributes on subordinate
      elements include: the reason attribute on <response>
      (Section 4.2.4), <dialogexit> (Section 4.2.5.1), and
      <auditresponse> (Section 4.4.2); desc attribute on <variabletype>
      and <format> (Section 4.4.2.2.5.1). A valid value is a language
      identifier (Section 4.6.11). The attribute is optional. The
      default value is i-default (BCP 47 [RFC5646]).

   The <mscivr> element has the following defined child elements, only
   one of which can occur:

   1. dialog management elements defined in Section 4.2:

       <dialogprepare> prepare a dialog. See Section 4.2.1.

       <dialogstart> start a dialog. See Section 4.2.2.

       <dialogterminate> terminate a dialog. See Section 4.2.3.

       <response> response to a dialog request. See Section 4.2.4.

       <event> dialog or subscription notification. See Section 4.2.5.

   2. audit elements defined in Section 4.4:

       <audit> audit package capabilities and managed dialogs. See
          Section 4.4.1.

       <auditresponse> response to an audit request. See
          Section 4.4.2.

   For example, a request to the MS to start an IVR dialog playing a
   prompt:

```
<mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr">
 <dialogstart connectionid="ssd3r3:sds345b">
  <dialog>
   <prompt>
    <media loc="http://www.example.com/welcome.wav"/>
   </prompt>
  </dialog>
 </dialogstart>
</mscivr>
```

and a response from the MS that the dialog started successfully:

```
<mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr">
 <response status="200" dialogid="d1"/>
</mscivr>
```

and finally a notification from the MS indicating that the dialog
exited upon completion of playing the prompt:

```
<mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr"
       desclang="en">
 <event dialogid="d1">
  <dialogexit status="1" reason="successful completion of the dialog">
   <promptinfo termmode="completed"/>
  </dialogexit>
 </event>
</mscivr>
```

The language of the descriptive text in the reason attribute of
<dialogexit> is explicitly indicated by the desclang attribute of the
<mscivr> root element.

4.2. Dialog Management Elements

   This section defines the dialog management XML elements for this
   Control Package. These elements are divided into requests,
   responses, and notifications.

   Request elements are sent to the MS to request a specific dialog
   operation to be executed. The following request elements are
   defined:

   <dialogprepare>: prepare a dialog for later execution

   <dialogstart>: start a (prepared) dialog on a connection or
      conference

   <dialogterminate>: terminate a dialog

Responses from the MS describe the status of the requested operation.
Responses are specified in a <response> element (Section 4.2.4) that
includes a mandatory attribute describing the status in terms of a
numeric code. Response status codes are defined in Section 4.5. The
MS MUST respond to a request message with a response message. If the
MS is not able to process the request and carry out the dialog
operation, the request has failed and the MS MUST indicate the class
of failure using an appropriate 4xx response code. Unless an error
response code is specified for a class of error within this section,
implementations follow Section 4.5 in determining the appropriate
status code for the response.

Notifications are sent from the MS to provide updates on the status
of a dialog or operations defined within the dialog. Notifications
are specified in an <event> element (Section 4.2.5).

```
                            +---------+
                            |  IDLE   |
                            +---------+
                              |     |
                              |     |
              <dialogprepare>/|     |<dialogstart>/
                              |     |
             +---------+      |     |             +---------+
      +-----<--|         |<--------+   +----------->|         |+------>-+
      | +-<----|PREPARING|          +----------->|STARTING |        | |
      | |      |         |           ---------->|         |---->--+ |
      | |      +---------+          /             +---------+       | |
      | |         |                /                   |           | |
      | |         |/200 response  /        /200 response|          | |
      | |         |              /                      |          | |
      | |         |             /                       |          | |
      | |         |            /                        |          | |
      V V         v           /<dialogstart>/           v          | |
      | |      +---------+   /                      +---------+     | |
      | |      |         |--------+            +----|         |     | |
      | |      | PREPARED|---------+           |    | STARTED |     | |
      | |      |         |         |           +--->|         |     | |
      | |      |         |--------+| <dialogterminate>/|      |     | |
      | |      +---------+        || 200 response  +---------+     | |
      | |                         ||                   |           | |
      | |   /dialogexit notification||                  |           | |
      | |        (timeout)        ||                   |           | |
      | |                         ||                   |           | |
      | |                         ||                   |           | |
      | |                         ||                   |           | |
      | |                         ||<dialogterminate>/ |           | |
      | |                         || 200 response      |           | |
      | |                         ||      +            |/dialogexit|  |
      | |                         || /dialogexit       | notification| |
      | |                         || notification      |           | |
      | |                         ||                   |           | |
      | |                         vv                   |           | |
      | |   /ERROR response  +-----------+             |           | |
      | +---------------------->|           |<----------+ /ERROR response| |
      +----------------------->|TERMINATED |<--------------------------+ |
           <dialogterminate>/  |           |<----------------------------+
              410 response     +-----------+ <dialogterminate>/410 response
```
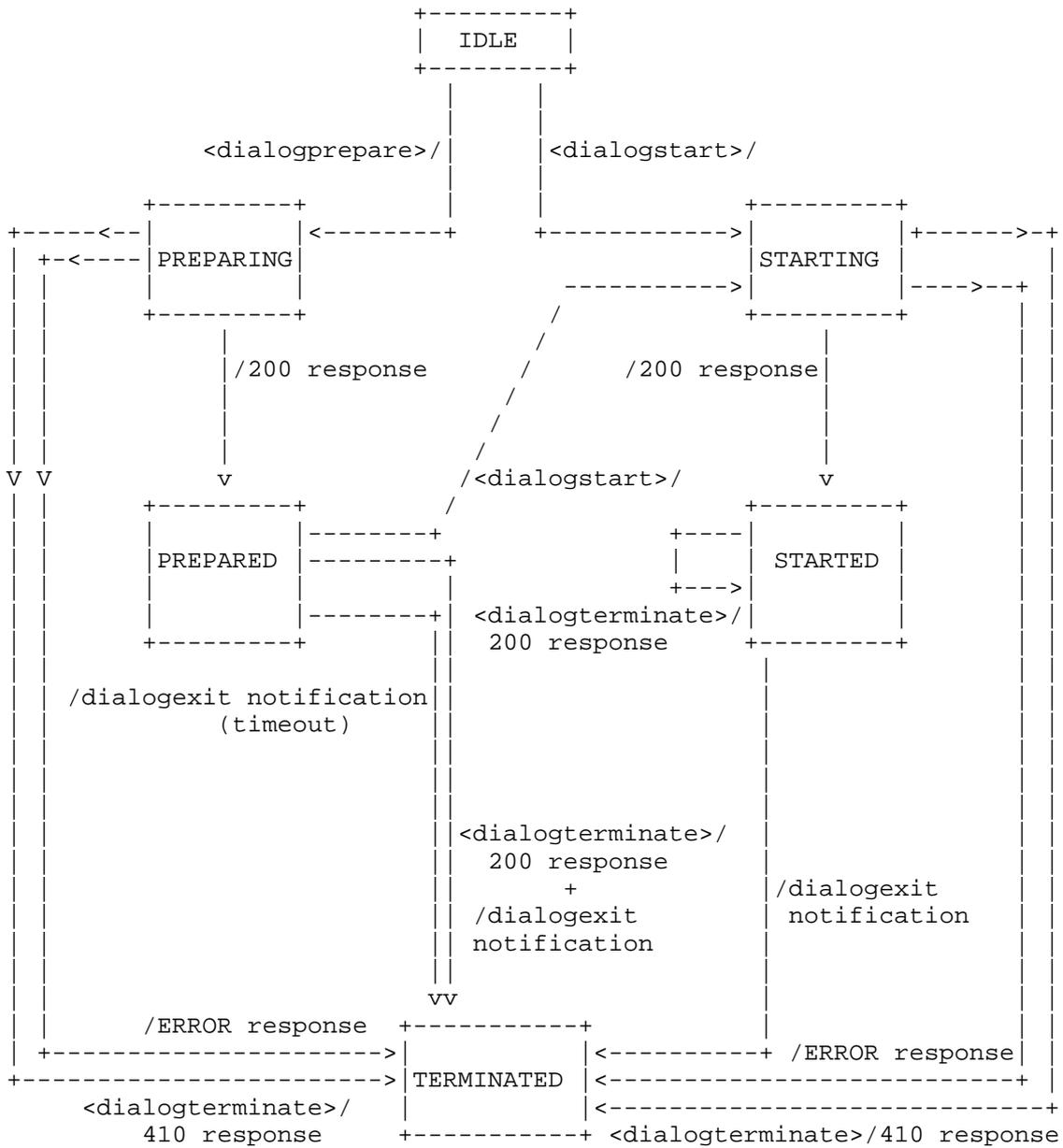
                        Figure 1: Dialog Lifecycle

   The MS implementation MUST adhere to the dialog lifecycle shown in
   Figure 1, where each dialog has the following states:

IDLE: the dialog is uninitialized.

PREPARING: the dialog is being prepared. The dialog is assigned a
   valid dialog identifier (see below). If an error occurs, the
   dialog transitions to the TERMINATED state and the MS MUST send a
   response indicating the error. If the dialog is terminated before
   preparation is complete, the dialog transitions to the TERMINATED
   state and the MS MUST send a 410 response (Section 4.5) for the
   prepare request.

PREPARED: the dialog has been successfully prepared and the MS MUST
   send a 200 response indicating the prepare operation was
   successful. If the dialog is terminated, then the MS MUST send a
   200 response, the dialog transitions to the TERMINATED state and
   the MS MUST send a dialogexit notification event (see
   Section 4.2.5.1). If the duration the dialog remains in the
   PREPARED state exceeds the maximum preparation duration, the
   dialog transitions to the TERMINATED state and the MS MUST send a
   dialogexit notification with the appropriate error status code
   (see Section 4.2.5.1). A maximum preparation duration of 300s is
   RECOMMENDED.

STARTING: the dialog is being started. If the dialog has not
   already been prepared, it is first prepared and assigned a valid
   dialog identifier (see below). If an error occurs the dialog
   transitions to the TERMINATED state and the MS MUST send a
   response indicating the error. If the dialog is terminated, the
   dialog transitions to the TERMINATED state and the MS MUST send a
   410 response (Section 4.5) for the start request.

STARTED: the dialog has been successfully started and is now active.
   The MS MUST send a 200 response indicating the start operation was
   successful. If any dialog events occur that were subscribed to,
   the MS MUST send a notifications when the dialog event occurs.
   When the dialog exits (due to normal termination, an error, or a
   terminate request), the MS MUST send a dialogexit notification
   event (see Section 4.2.5.1) and the dialog transitions to the
   TERMINATED state.

TERMINATED: the dialog is terminated and its dialog identifier is no
   longer valid. Dialog notifications MUST NOT be sent for this
   dialog.

Each dialog has a valid identifier until it transitions to a
TERMINATED state. The dialog identifier is assigned by the MS unless
the <dialogprepare> or <dialogstart> request already specifies a

identifier (dialogid) that is not associated with any other dialog on
the MS. Once a dialog is in a TERMINATED state, its dialog
identifier is no longer valid and can be reused for another dialog.

The identifier is used to reference the dialog in subsequent
requests, responses, and notifications. In a <dialogstart> request,
the dialog identifier can be specified in the prepareddialogid
attribute indicating the prepared dialog to start. In
<dialogterminate> and <audit> requests, the dialog identifier is
specified in the dialogid attribute, indicating which dialog is to be
terminated or audited, respectively. If these requests specify a
dialog identifier already associated with another dialog on the MS,
the MS sends a response with a 405 status code (see Section 4.5) and
the same dialogid as in the request. The MS MUST specify a dialog
identifier in notifications associated with the dialog. The MS MUST
specify a dialog identifier in responses unless it is a response to a
syntactically invalid request.

For a given dialog, the <dialogprepare> or <dialogstart> request
elements specify the dialog content to execute either by including
inline a <dialog> element (the dialog language defined in this
package; see Section 4.3) or by referencing an external dialog
document (a dialog language defined outside this package). When
referencing an external dialog document, the request element contains
a URI reference to the remote document (specifying the dialog
definition) and, optionally, a type attribute indicating the MIME
media type associated with the dialog document. Consequently, the
dialog language associated with a dialog on the MS is identified
either inline by a <dialog> child element or by a src attribute
referencing a document containing the dialog language. The MS MUST
support inline the IVR dialog language defined in Section 4.3. The
MS MAY support other dialog languages by reference.

4.2.1. <dialogprepare>

   The <dialogprepare> request is sent to the MS to request preparation
   of a dialog. Dialog preparation consists of (a) retrieving an
   external dialog document and/or external resources referenced within
   an inline <dialog> element and (b) validating the dialog document
   syntactically and semantically.

   A prepared dialog is executed when the MS receives a <dialogstart>
   request referencing the prepared dialog identifier (see
   Section 4.2.2).

   The <dialogprepare> element has the following attributes:

src: specifies the location of an external dialog document to
   prepare. A valid value is a URI (see Section 4.6.9). The MS MUST
   support both HTTP [RFC2616] and HTTPS [RFC2818] schemes and the MS
   MAY support other schemes. If the URI scheme is unsupported, the
   MS sends a <response> with a 420 status code (Section 4.5). If
   the document cannot be retrieved within the timeout interval, the
   MS sends a <response> with a 409 status code. If the document
   contains a type of dialog language that the MS does not support,
   the MS sends a <response> with a 421 status code. The attribute
   is optional. There is no default value.

type: specifies the type of the external dialog document indicated
   in the 'src' attribute. A valid value is a MIME media type (see
   Section 4.6.10). If the URI scheme used in the src attribute
   defines a mechanism for establishing the authoritative MIME media
   type of the media resource, the value returned by that mechanism
   takes precedence over this attribute. The attribute is optional.
   There is no default value.

maxage: Used to set the max-age value of the 'Cache-Control' header
   in conjunction with an external dialog document fetched using
   HTTP, as per [RFC2616]. A valid value is a non-negative integer
   (see Section 4.6.4). The attribute is optional. There is no
   default value.

maxstale: Used to set the max-stale value of the 'Cache-Control'
   header in conjunction with an external dialog document fetched
   using HTTP, as per [RFC2616]. A valid value is a non-negative
   integer (see Section 4.6.4). The attribute is optional. There is
   no default value.

fetchtimeout: the maximum timeout interval to wait when fetching an
   external dialog document. A valid value is a Time Designation
   (see Section 4.6.7). The attribute is optional. The default
   value is 30s.

dialogid: string indicating a unique name for the dialog. If a
   dialog with the same name already exists on the MS, the MS sends a
   <response> with a 405 status code (Section 4.5). If this
   attribute is not specified, the MS MUST create a unique name for
   the dialog (see Section 4.2 for dialog identifier assignment).
   The attribute is optional. There is no default value.

The <dialogprepare> element has the following sequence of child
elements:

<dialog> an IVR dialog (Section 4.3) to prepare. The element is
   optional.

   <params>: specifies input parameters (Section 4.2.6) for dialog
      languages defined outside this specification. The element is
      optional. If a parameter is not supported by the MS for the
      external dialog language, the MS sends a <response> with a 427
      status code (Section 4.5).

   The dialog to prepare can be specified either inline with a <dialog>
   child element or externally (for dialog languages defined outside
   this specification) using the src attribute. It is a syntax error if
   both an inline <dialog> element and a src attribute are specified and
   the MS sends a <response> with a 400 status code (see Section 4.5).
   The type, maxage, maxstale, and fetchtimeout attributes are only
   relevant when a dialog is specified as an external document.

   For example, a <dialogprepare> request to prepare an inline IVR
   dialog with a single prompt:

```
<mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr">
 <dialogprepare>
  <dialog>
   <prompt>
    <media loc="http://www.example.com/welcome.wav"/>
   </prompt>
  </dialog>
 </dialogprepare>
</mscivr>
```

   In this example, a request with a specified dialogid to prepare a
   VoiceXML dialog document located externally:

```
<mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr">
 <dialogprepare dialogid="d2" type="application/voicexml+xml"
                src="http://www.example.com/mydialog.vxml"
                fetchtimeout="15s"/>
</mscivr>
```

   Since MS support for dialog languages other than the IVR dialog
   language defined in this package is optional, if the MS does not
   support the dialog language, it would send a response with the status
   code 421 (Section 4.5). Further information on using VoiceXML can be
   found in Section 9.

4.2.2. <dialogstart>

   The <dialogstart> element is sent to the MS to start a dialog. If
   the dialog has not been prepared, the dialog is prepared (retrieving
   external document and/or external resources referenced within
   <dialog> element and the dialog document validated syntactically and

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semantically). Media processors (e.g., DTMF and prompt queue) are
activated and associated with the specified connection or conference.

The <dialogstart> element has the following attributes:

src: specifies the location of an external dialog document to start.
   A valid value is a URI (see Section 4.6.9). The MS MUST support
   both HTTP [RFC2616] and HTTPS [RFC2818] schemes and the MS MAY
   support other schemes. If the URI scheme is unsupported, the MS
   sends a <response> with a 420 status code (Section 4.5). If the
   document cannot be retrieved with the timeout interval, the MS
   sends a <response> with a 409 status code. If the document
   contains a type of dialog language that the MS does not support,
   the MS sends a <response> with a 421 status code. The attribute
   is optional. There is no default value.

type: specifies the type of the external dialog document indicated
   in the 'src' attribute. A valid value is a MIME media type (see
   Section 4.6.10). If the URI scheme used in the src attribute
   defines a mechanism for establishing the authoritative MIME media
   type of the media resource, the value returned by that mechanism
   takes precedence over this attribute. The attribute is optional.
   There is no default value.

maxage: Used to set the max-age value of the 'Cache-Control' header
   in conjunction with an external dialog document fetched using
   HTTP, as per [RFC2616]. A valid value is a non-negative integer
   (see Section 4.6.4). The attribute is optional. There is no
   default value.

maxstale: Used to set the max-stale value of the 'Cache-Control'
   header in conjunction with an external dialog document fetched
   using HTTP, as per [RFC2616]. A valid value is a non-negative
   integer (see Section 4.6.4). The attribute is optional. There is
   no default value.

fetchtimeout: the maximum timeout interval to wait when fetching an
   external dialog document. A valid value is a Time Designation
   (see Section 4.6.7). The attribute is optional. The default
   value is 30s.

dialogid: string indicating a unique name for the dialog. If a
   dialog with the same name already exists on the MS, the MS sends a
   <response> with a 405 status code (Section 4.5). If neither the
   dialogid attribute nor the prepareddialogid attribute is
   specified, the MS MUST create a unique name for the dialog (see
   Section 4.2 for dialog identifier assignment). The attribute is
   optional. There is no default value.

preparedialogid: string identifying a dialog previously prepared
   using a dialogprepare (Section 4.2.1) request. If neither the
   dialogid attribute nor the preparedialogid attribute is
   specified, the MS MUST create a unique name for the dialog (see
   Section 4.2 for dialog identifier assignment). The attribute is
   optional. There is no default value.

connectionid: string identifying the SIP dialog connection on which
   this dialog is to be started (see Appendix A.1 of [RFC6230]). The
   attribute is optional. There is no default value.

conferenceid: string identifying the conference on which this dialog
   is to be started (see Appendix A.1 of [RFC6230]). The attribute
   is optional. There is no default value.

Exactly one of the connectionid or conferenceid attributes MUST be
specified. If both the connectionid and conferenceid attributes are
specified or neither is specified, it is a syntax error and the MS
sends a <response> with a 400 status code (Section 4.5).

It is an error if the connection or conference referenced by a
specific connectionid or conferenceid attribute is not available on
the MS at the time the <dialogstart> request is executed. If an
invalid connectionid is specified, the MS sends a <response> with a
407 status code (Section 4.5). If an invalid conferenceid is
specified, the MS sends a <response> with a 408 status code.

The <dialogstart> element has the following sequence of child
elements:

<dialog>: specifies an IVR dialog (Section 4.3) to execute. The
   element is optional.

<subscribe>: specifies subscriptions to dialog events
   (Section 4.2.2.1). The element is optional.

<params>: specifies input parameters (Section 4.2.6) for dialog
   languages defined outside this specification. The element is
   optional. If a parameter is not supported by the MS for the
   external dialog language, the MS sends a <response> with a 427
   status code (Section 4.5).

<stream>: determines the media stream(s) associated with the
   connection or conference on which the dialog is executed
   (Section 4.2.2.2). The <stream> element is optional. Multiple
   <stream> elements can be specified.

The dialog to start can be specified either (a) inline with a
<dialog> child element, (b) externally using the src attribute (for
dialog languages defined outside this specification), or (c) by
referencing a previously prepared dialog using the prepareddialogid
attribute. If exactly one of the src attribute, the
prepareddialogid, or a <dialog> child element is not specified, it is
a syntax error and the MS sends a <response> with a 400 status code
(Section 4.5). If the prepareddialogid and dialogid attributes are
specified, it is also a syntax error and the MS sends a <response>
with a 400 status code. The type, maxage, maxstale, and fetchtimeout
attributes are only relevant when a dialog is specified as an
external document.

The <stream> element provides explicit control over which media
streams on the connection or conference are used during dialog
execution. For example, if a connection supports both audio and
video streams, a <stream> element could be used to indicate that only
the audio stream is used in receive mode. In cases where there are
multiple media streams of the same type for a dialog, the AS MUST use
<stream> elements to explicitly specify the configuration. If no
<stream> elements are specified, then the default media configuration
is that defined for the connection or conference.

If a <stream> element is in conflict (a) with another <stream>
element, (b) with specified connection or conference media
capabilities, or (c) with a Session Description Protocol (SDP) label
value as part of the connectionid (see Appendix A.1 of [RFC6230]),
then the MS sends a <response> with a 411 status code (Section 4.5).
If the media stream configuration is not supported by the MS, then
the MS sends a <response> with a 428 status code (Section 4.5).

The MS MAY support multiple, simultaneous dialogs being started on
the same connection or conference. For example, the same connection
can receive different media streams (e.g., audio and video) from
different dialogs, or receive (and implicitly mix where appropriate)
the same type of media streams from different dialogs. If the MS
does not support starting another dialog on the same connection or
conference, it sends a <response> with a 432 status code
(Section 4.5) when it receives the second (or subsequent) dialog
request.

For example, a request to start an ivr dialog on a connection
subscribing to DTMF notifications:

```
<mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr">
 <dialogstart connectionid="connection1">
  <dialog>
   <prompt>
    <media loc="http://www.example.com/getpin.wav"/>
   </prompt>
   <collect maxdigits="2"/>
  </dialog>
  <subscribe>
   <dtmfsub matchmode="all"/>
  </subscribe>
 </dialogstart>
</mscivr>
```

In this example, the dialog is started on a conference where the
conference only receives an audio media stream from the dialog:

```
<mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr">
 <dialogstart conferenceid="conference1">
  <dialog>
   <record maxtime="384000s"/>
  </dialog>
  <stream media="audio" direction="recvonly"/>
 </dialogstart>
</mscivr>
```

4.2.2.1. <subscribe>

   The <subscribe> element allows the AS to subscribe to, and be
   notified of, specific events that occur during execution of the
   dialog. Notifications of dialog events are delivered using the
   <event> element (see Section 4.2.5).

   The <subscribe> element has no attributes.

   The <subscribe> element has the following sequence of child elements
   (0 or more occurrences):

   <dtmfsub>: Subscription to DTMF input during the dialog
      (Section 4.2.2.1.1). The element is optional.

   If a request has a <subscribe> with no child elements, the MS treats
   the request as if no <subscribe> element were specified.

   The MS MUST support <dtmfsub> subscription for the IVR dialog
   language defined in this specification (Section 4.3). It MAY support
   other dialog subscriptions (specified using attributes and child
   elements from a foreign namespace). If the MS does not support a

subscription specified in a foreign namespace, the MS sends a
response with a 431 status code (see Section 4.5).

4.2.2.1.1. <dtmfsub>

The <dtmfsub> element has the following attributes:

matchmode: controls which DTMF input is subscribed to. Valid values
    are "all" - notify all DTMF key presses received during the
    dialog; "collect" - notify only DTMF input matched by the collect
    operation (Section 4.3.1.3); and "control" - notify only DTMF
    input matched by the runtime control operation (Section 4.3.1.2).
    The attribute is optional. The default value is "all".

The <dtmfsub> element has no child elements.

DTMF notifications are delivered in the <dtmfnotify> element
(Section 4.2.5.2).

For example, the AS wishes to subscribe to DTMF key press matching a
runtime control:

```
<mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr">
 <dialogstart dialogid="d3" connectionid="connection1">
  <dialog>
   <prompt>
    <media loc="http://www.example.com/getpin.wav"/>
   </prompt>
   <control ffkey="2" rwkey="3"/>
  </dialog>
  <subscribe>
   <dtmfsub matchmode="control"/>
  </subscribe>
 </dialogstart>
</mscivr>
```

Each time a '2' or '3' DTMF input is received, the MS sends a
notification event:

```
<mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr">
 <event dialogid="d3">
   <dtmfnotify matchmode="collect" dtmf="2"
      timestamp="2008-05-12T12:13:14Z"/>
 </event>
</mscivr>
```

4.2.2.2. <stream>

   The <stream> element has the following attributes:

   media: a string indicating the type of media associated with the
      stream. A valid value is a MIME type-name as defined in Section
      4.2 of [RFC4288]. The following values MUST be used for common
      types of media: "audio" for audio media, and "video" for video
      media. See [IANA] for registered MIME type names. The attribute
      is mandatory.

   label: a string indicating the SDP label associated with a media
      stream [RFC4574]. The attribute is optional.

   direction: a string indicating the direction of the media flow
      relative to the endpoint conference or connection. Defined values
      are "sendrecv" (the endpoint can send media to, and receive media
      from, the dialog), "sendonly" (the endpoint can only send media to
      the dialog), "recvonly" (the endpoint can only receive media from
      the dialog), and "inactive" (stream is not to be used). The
      default value is "sendrecv". The attribute is optional.

   The <stream> element has the following sequence of child elements:

   <region>: an element to specify the area within a mixer video layout
      where a media stream is displayed (Section 4.2.2.2.1). The
      element is optional.

   <priority>: an element to configure priority associated with the
      stream in the conference mix (Section 4.2.2.2.2). The element is
      optional.

   If conferenceid is not specified or if the "media" attribute does not
   have the value of "video", then the MS ignores the <region> and
   <priority> elements.

   For example, assume a User Agent connection with multiple audio and
   video streams associated with the user and a separate web camera. In
   this case, the dialog could be started to record only the audio and
   video streams associated with the user:

```
<mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr">
 <dialogstart connectionid="connection1">
  <dialog>
   <record maxtime="384000s"/>
  </dialog>
  <stream media="audio" label="camaudio" direction="inactive"/>
  <stream media="video" label="camvideo" direction="inactive"/>
  <stream media="audio" label="useraudio" direction="sendonly"/>
  <stream media="video" label="uservideo" direction="sendonly"/>
 </dialogstart>
</mscivr>
```

   Using the <region> element, the dialog can be started on a conference
   mixer so that the video output from the dialog is directed to a
   specific area within a video layout. For example:

```
<mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr">
 <dialogstart conferenceid="conference1">
  <dialog>
   <prompt>
     <media loc="http://www.example.com/presentation.3gp"/>
   </prompt>
  </dialog>
  <stream media="video" direction="recvonly">
    <region>1</region>
  </stream>
 </dialogstart>
</mscivr>
```

4.2.2.2.1. <region>

   The <region> element is used to specify a named area within a
   presentation layout where a video media stream is displayed. The MS
   could, for example, play video media into an area of a video layout
   where the layout and its named regions are specified using the Mixer
   Control Package [MIXER-CP].

   The <region> element has no attributes and its content model
   specifies the name of the region.

   If the region name is invalid, then the MS reports a 416 status code
   (Section 4.5) in the response to the request element containing the
   <region> element.

4.2.2.2.2. <priority>

   The <priority> element is used to explicitly specify the priority of
   the dialog for presentation in a conference mix.

The <priority> element has no attributes and its content model
specifies a positive integer (see Section 4.6.5). The lower the
value, the higher the priority.

4.2.3. <dialogterminate>

A dialog can be terminated by sending a <dialogterminate> request
element to the MS.

The <dialogterminate> element has the following attributes:

dialogid: string identifying the dialog to terminate. If the
   specified dialog identifier is invalid, the MS sends a response
   with a 405 status code (Section 4.5). The attribute is mandatory.

immediate: indicates whether or not a dialog in the STARTED state is
   to be terminated immediately (in other states, termination is
   always immediate). A valid value is a boolean (see
   Section 4.6.1). A value of true indicates that the dialog is
   terminated immediately and the MS MUST send a dialogexit
   notification (Section 4.2.5.1) without report information. A
   value of false indicates that the dialog terminates after the
   current iteration and the MS MUST send a dialogexit notification
   with report information. The attribute is optional. The default
   value is false.

The MS MUST reply to the <dialogterminate> request with a <response>
element (Section 4.2.4), reporting whether or not the dialog was
terminated successfully.

For example, immediately terminating a STARTED dialog with dialogid
"d4":

```
<mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr">
 <dialogterminate dialogid="d4" immediate="true"/>
</mscivr>
```

If the dialog is terminated successfully, then the response to the
dialogterminate request would be:

```
<mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr">
 <response status="200" dialogid="d4"/>
</mscivr>
```

4.2.4. <response>

Responses to dialog management requests are specified with a
<response> element.

The <response> element has following attributes:

status: numeric code indicating the response status. Valid values
   are defined in Section 4.5. The attribute is mandatory.

reason: string specifying a reason for the response status. The
   attribute is optional. There is no default value.

desclang: specifies the language used in the value of the reason
   attribute. A valid value is a language identifier
   (Section 4.6.11). The attribute is optional. If not specified,
   the value of the desclang attribute on <mscivr> (Section 4.1)
   applies.

dialogid: string identifying the dialog. If the request specifies a
   dialogid, then that value is used. Otherwise, with
   <dialogprepare> and <dialogstart> requests, the dialogid generated
   by the MS is used. If there is no available dialogid because the
   request is syntactically invalid (e.g., a <dialogterminate>
   request with no dialogid attribute specified), then the value is
   the empty string. The attribute is mandatory.

connectionid: string identifying the SIP dialog connection
   associated with the dialog (see Appendix A.1 of [RFC6230]). The
   attribute is optional. There is no default value.

conferenceid: string identifying the conference associated with the
   dialog (see Appendix A.1 of [RFC6230]). The attribute is
   optional. There is no default value.

For example, a response when a dialog was prepared successfully:

```
<mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr">
 <response status="200" dialogid="d5"/>
</mscivr>
```

The response if dialog preparation failed due to an unsupported
dialog language:

```
<mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr">
 <response status="421" dialogid="d5"
    reason="Unsupported dialog language: application/voicexml+xml"/>
</mscivr>
```

In this example, a <dialogterminate> request does not specify a
dialogid:

```
<mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr">
 <dialogterminate/>
</mscivr>
```

The response status indicates a 400 (Syntax error) status code and
the dialogid attribute has an empty string value:

```
<mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr">
 <response status="400" dialogid=" "
    reason="Attribute required: dialogid"/>
</mscivr>
```

4.2.5. <event>

   When a dialog generates a notification event, the MS sends the event
   using an <event> element.

   The <event> element has the following attributes:

   dialogid: string identifying the dialog that generated the event.
      The attribute is mandatory.

   The <event> element has the following child elements, only one of
   which can occur:

   <dialogexit>: indicates that the dialog has exited
      (Section 4.2.5.1).

   <dtmfnotify>: indicates that a DTMF key press occurred
      (Section 4.2.5.2).

4.2.5.1. <dialogexit>

   The <dialogexit> event indicates that a prepared or active dialog has
   exited because it is complete, it has been terminated, or an error
   occurred during execution (for example, a media resource cannot be
   played). This event MUST be sent by the MS when the dialog exits.

   The <dialogexit> element has the following attributes:

   status: a status code indicating the status of the dialog when it
      exits. A valid value is a non-negative integer (see
      Section 4.6.4). The MS MUST support the following values:

      0 indicates the dialog has been terminated by a <dialogterminate>
         request.

      1 indicates successful completion of the dialog.

> 2 indicates the dialog terminated because the connection or
>   conference associated with the dialog has terminated.
>
> 3 indicates the dialog terminated due to exceeding its maximum
>   duration.
>
> 4 indicates the dialog terminated due to an execution error.

All other valid but undefined values are reserved for future use,
where new status codes are assigned using the Standards Action
process defined in [RFC5226]. The AS MUST treat any status code
it does not recognize as being equivalent to 4 (dialog execution
error). The attribute is mandatory.

reason: a textual description that the MS SHOULD use to provide a
   reason for the status code, e.g., details about an error. A valid
   value is a string (see Section 4.6.6). The attribute is optional.
   There is no default value.

desclang: specifies the language used in the value of the reason
   attribute. A valid value is a language identifier
   (Section 4.6.11). The attribute is optional. If not specified,
   the value of the desclang attribute on <mscivr> (Section 4.1)
   applies.

The <dialogexit> element has the following sequence of child
elements:

<promptinfo>: report information (Section 4.3.2.1) about the prompt
   execution in an IVR <dialog>. The element is optional.

<controlinfo>: reports information (Section 4.3.2.2) about the
   control execution in an IVR <dialog>. The element is optional.

<collectinfo>: reports information (Section 4.3.2.3) about the
   collect execution in an IVR <dialog>. The element is optional.

<recordinfo>: reports information (Section 4.3.2.4) about the record
   execution in an IVR <dialog>. The element is optional.

<params>: reports exit parameters (Section 4.2.6) for a dialog
   language defined outside this specification. The element is
   optional.

For example, when an active <dialog> exits normally, the MS sends a
dialogexit <event> reporting information:

```
<mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr">
 <event dialogid="d6">
  <dialogexit status="1">
   <collectinfo dtmf="1234"  termmode="match"/>
  </dialogexit>
 </event>
</mscivr>
```

4.2.5.2. <dtmfnotify>

   The <dtmfnotify> element provides a notification of DTMF input
   received during the active dialog as requested by a <dtmfsub>
   subscription (Section 4.2.2.1).

   The <dtmfnotify> element has the following attributes:

   matchmode: indicates the matching mode specified in the subscription
      request. Valid values are as follows:

         "all" - all DTMF key presses notified individually;

         "collect" - only DTMF input matched by the collect operation
         notified; and

         "control" - only DTMF input matched by the control operation
         notified.

      The attribute is optional. The default value is "all".

   dtmf: DTMF key presses received according to the matchmode. A valid
      value is a DTMF string (see Section 4.6.3) with no space between
      characters. The attribute is mandatory.

   timestamp: indicates the time (on the MS) at which the last key
      press occurred according to the matchmode. A valid value is a
      dateTime expression (Section 4.6.12). The attribute is mandatory.

   For example, a notification of DTMF input matched during the collect
   operation:

```
<mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr">
 <event dialogid="d3">
   <dtmfnotify matchmode="collect" dtmf="3123"
     timestamp="2008-05-12T12:13:14Z"/>
 </event>
</mscivr>
```

4.2.6. <params>

   The <params> element is a container for <param> elements
   (Section 4.2.6.1).

   The <params> element has no attributes, but the following child
   elements are defined (0 or more):

   <param>: specifies a parameter name and value (Section 4.2.6.1).

   For example, usage with a dialog language defined outside this
   specification to send additional parameters into the dialog:

   <mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr">
   <dialogstart type="application/x-dialog"
                src="nfs://nas01/dialog4" connectionid="c1">
     <params>
      <param name="mode">playannouncement</param>
      <param name="prompt1">nfs://nas01/media1.3gp</param>
      <param name="prompt2">nfs://nas01/media2.3gp</param>
     </params>
    </dialogstart>
   </mscivr>

4.2.6.1. <param>

   The <param> element describes a parameter name and value.

   The <param> element has the following attributes:

   name: a string indicating the name of the parameter. The attribute
      is mandatory.

   type: specifies a type indicating how the inline value of the
      parameter is to be interpreted. A valid value is a MIME media
      type (see Section 4.6.10). The attribute is optional. The
      default value is "text/plain".

   encoding: specifies a content-transfer-encoding schema applied to
      the inline value of the parameter on top of the MIME media type
      specified with the type attribute. A valid value is a content-
      transfer-encoding schema as defined by the "mechanism" token in
      Section 6.1 of [RFC2045]. The attribute is optional. There is no
      default value.

   The <param> element content model is the value of the parameter.
   Note that a value that contains XML characters (e.g., "<") needs to
   be escaped following standard XML conventions.

For example, usage with a dialog language defined outside this
specification to receive parameters from the dialog when it exits:

```
<mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr">
 <event dialogid="d6">
  <dialogexit status="1">
  <params>
   <param name="mode">recording</param>
   <param name="recording1" type="audio/x-wav" encoding="base64">
    <![CDATA[
     R0lGODlhZABqALMAAFrMYr/BvlKOVJKOg2xZUKmenMfDw8tgWJpV
    ]]>
   </param>
  </params>
  </dialogexit>
 </event>
</mscivr>
```

4.3. IVR Dialog Elements

   This section describes the IVR dialog language defined as part of
   this specification. The MS MUST support this dialog language.

   The <dialog> element is an execution container for operations of
   playing prompts (Section 4.3.1.1), runtime controls
   (Section 4.3.1.2), collecting DTMF (Section 4.3.1.3), and recording
   user input (Section 4.3.1.4). Results of the dialog execution
   (Section 4.3.2) are reported in a dialogexit notification event.

   Using these elements, three common dialog models are supported:

   playannouncements: only a <prompt> element is specified in the
      container. The prompt media resources are played in sequence.

   promptandcollect: a <collect> element is specified and, optionally,
      a <prompt> element. If a <prompt> element is specified and
      bargein is enabled, playing of the prompt is terminated when
      bargein occurs, and DTMF collection is initiated; otherwise, the
      prompt is played to completion before DTMF collection is
      initiated. If no prompt element is specified, DTMF collection is
      initiated immediately.

   promptandrecord: a <record> element is specified and, optionally, a
      <prompt> element. If a <prompt> element is specified and bargein
      is enabled, playing of the prompt is terminated when bargein
      occurs, and recording is initiated; otherwise, the prompt is
      played to completion before recording is initiated. If no prompt
      element is specified, recording is initiated immediately.

In addition, this dialog language supports runtime ('VCR') controls
enabling a user to control prompt playback using DTMF.

Each of the core elements -- <prompt>, <control>, <collect>, and
<record> -- are specified so that their execution and reporting is
largely self-contained. This facilitates their reuse in other dialog
container elements. Note that DTMF and bargein behavior affects
multiple elements and is addressed in the relevant element
definitions.

Execution results are reported in the <dialogexit> notification event
with child elements defined in Section 4.3.2. If the dialog
terminated normally (i.e., not due to an error or to a
<dialogterminate> request), then the MS MUST report the results for
the operations specified in the dialog:

<prompt>: <promptinfo> (see Section 4.3.2.1) with at least the
   termmode attribute specified.

<control>: <controlinfo> (see Section 4.3.2.2) if any runtime
   controls are matched.

<collect>: <collectinfo> (see Section 4.3.2.3) with the dtmf and
   termmode attributes specified.

<record>: <recordinfo> (see Section 4.3.2.4) with at least the
   termmode attribute and one <mediainfo> element specified.

The media format requirements for IVR dialogs are undefined. This
package is agnostic to the media types and codecs for media resources
and recording that need to be supported by an implementation. For
example, an MS implementation might only support audio and in
particular the 'audio/basic' codec for media playback and recording.
However, when executing a dialog, if an MS encounters a media type or
codec that it cannot process, the MS MUST stop further processing and
report the error using the dialogexit notification.

4.3.1. <dialog>

An IVR dialog to play prompts to the user, allow runtime controls,
collect DTMF, or record input. The dialog is specified using a
<dialog> element.

A <dialog> element has the following attributes:

repeatCount: number of times the dialog is to be executed. A valid
   value is a non-negative integer (see Section 4.6.4). A value of 0
   indicates that the dialog is repeated until halted by other means.
   The attribute is optional. The default value is 1.

repeatDur: maximum duration for dialog execution. A valid value is
   a time designation (see Section 4.6.7). If no value is specified,
   then there is no limit on the duration of the dialog. The
   attribute is optional. There is no default value.

repeatUntilComplete: indicates whether the MS terminates dialog
   execution when an input operation is completed successfully. A
   valid value is a boolean (see Section 4.6.1). A value of true
   indicates that dialog execution is terminated when an input
   operation associated with its child elements is completed
   successfully (see execution model below for precise conditions).
   A value of false indicates that dialog execution is terminated by
   other means. The attribute is optional. The default value is
   false.

The repeatDur attribute takes priority over the repeatCount attribute
in determining maximum duration of the dialog. See 'repeatCount' and
'repeatDur' in the Synchronized Multimedia Integration Language
(SMIL) [W3C.REC-SMIL2-20051213] for further information. In the
situation where a dialog is repeated more than once, only the results
of operations in the last dialog iteration are reported.

The <dialog> element has the following sequence of child elements (at
least one, any order):

<prompt>: defines media resources to play in sequence (see
   Section 4.3.1.1). The element is optional.

<control>: defines how DTMF is used for runtime controls (see
   Section 4.3.1.2). The element is optional.

<collect>: defines how DTMF is collected (see Section 4.3.1.3). The
   element is optional.

<record>: defines how recording takes place (see Section 4.3.1.4).
   The element is optional.

Although the behavior when both <collect> and <record> elements are
specified in a request is not defined in this Control Package, the MS
MAY support this configuration. If the MS does not support this
configuration, the MS sends a <response> with a 433 status code.

The MS has the following execution model for the IVR dialog after
initialization (initialization errors are reported by the MS in the
response):

1. If an error occurs during execution, then the MS terminates the
    dialog and reports the error in the <dialogexit> event by setting
    the status attribute (see Section 4.3.2). Details about the
    error are specified in the reason attribute.

2. The MS initializes a counter to 0.

3. The MS starts a duration timer for the value of the repeatDur
    attribute. If the timer expires before the dialog is complete,
    then the MS terminates the dialog and sends a dialogexit whose
    status attribute is set to 3 (see Section 4.2.5.1). The MS MAY
    report information in the dialogexit gathered in the last
    execution cycle (if any).

4. The MS initiates a dialog execution cycle. Each cycle executes
    the operations associated with the child elements of the dialog.
    If a <prompt> element is specified, then execute the element's
    prompt playing operation and activate any controls (if the
    <control> element is specified). If no <prompt> is specified or
    when a specified <prompt> terminates, then start the collect
    operation or the record operation if the <collect> or <record>
    elements, respectively, are specified. If subscriptions are
    specified for the dialog, then the MS sends a notification event
    when the specified event occurs. If execution of a child element
    results in an error, the MS terminates dialog execution (and
    stops other child element operations) and the MS sends a
    dialogexit status event, reporting any information gathered.

5. If the dialog execution cycle completes successfully, then the MS
    increments the counter by one. The MS terminates dialog
    execution if either of the following conditions is true:

    * the value of the repeatCount attribute is greater than zero,
       and the counter is equal to the value of the repeatCount
       attribute.

    * the value of the repeatUntilComplete attribute is true and one
       of the following conditions is true:

       + <collect> reports termination status of 'match' or
          'stopped'.

       + <record> reports termination status of 'stopped', 'dtmf',
          'maxtime', or 'finalsilence'.

When the MS terminates dialog execution, it sends a dialogexit
(with a status of 1) reporting operation information collected in
the last dialog execution cycle only. Otherwise, another dialog
execution cycle is initiated.

4.3.1.1. <prompt>

The <prompt> element specifies a sequence of media resources to play
back in document order.

A <prompt> element has the following attributes:

xml:base: A string declaring the base URI from which relative URIs
   in child elements are resolved prior to fetching. A valid value
   is a URI (see Section 4.6.9). The attribute is optional. There
   is no default value.

bargein: Indicates whether user input stops prompt playback unless
   the input is associated with a specified runtime <control>
   operation (input matching control operations never interrupts
   prompt playback). A valid value is a boolean (see Section 4.6.1).
   A value of true indicates that bargein is permitted and prompt
   playback is stopped. A value of false indicates that bargein is
   not permitted: user input does not terminate prompt playback. The
   attribute is optional. The default value is true.

The <prompt> element has the following child elements (at least one,
any order, multiple occurrences of elements permitted):

<media>: specifies a media resource (see Section 4.3.1.5) to play.
   The element is optional.

<variable>: specifies a variable media announcement (see
   Section 4.3.1.1.1) to play. The element is optional.

<dtmf>: generates one or more DTMF tones (see Section 4.3.1.1.2) to
   play. The element is optional.

<par>: specifies media resources to play in parallel (see
   Section 4.3.1.1.3). The element is optional.

If the MS does not support the configuration required for prompt
playback to the output media streams and a more specific error code
is not defined for its child elements, the MS sends a <response> with
a 429 status code (Section 4.5). The MS MAY support transcoding
between the media resource format and the output stream format.

The MS has the following execution model for prompt playing after
initialization:

1. The MS initiates prompt playback playing its child elements
    (<media>, <variable>, <dtmf>, and <par>) one after another in
    document order.

2. If any error (including fetching and rendering errors) occurs
    during prompt execution, then the MS terminates playback and
    reports its error status to the dialog container (see
    Section 4.3) with a <promptinfo> (see Section 4.3.2.1) where the
    termmode attribute is set to stopped and any additional
    information is set.

3. If DTMF input is received and the value of the bargein attribute
    is true, then the MS terminates prompt playback and reports its
    execution status to the dialog container (see Section 4.3) with a
    <promptinfo> (see Section 4.3.2.1) where the termmode attribute
    is set to bargein and any additional information is set.

4. If prompt playback is stopped by the dialog container, then the
    MS reports its execution status to the dialog container (see
    Section 4.3) with a <promptinfo> (see Section 4.3.2.1) where the
    termmode attribute is set to stopped and any additional
    information is set.

5. If prompt playback completes successfully, then the MS reports
    its execution status to the dialog container (see Section 4.3)
    with a <promptinfo> (see Section 4.3.2.1) where the termmode
    attribute is set to completed and any additional information is
    set.

4.3.1.1.1. <variable>

   The <variable> element specifies variable announcements using
   predefined media resources. Each variable has at least a type (e.g.,
   date) and a value (e.g., 2008-02-25). The value is rendered
   according to the prompt variable type (e.g., 2008-02-25 is rendered
   as the date 25th February 2008). The precise mechanism for
   generating variable announcements (including the location of
   associated media resources) is implementation specific.

   A <variable> element has the following attributes:

   type: specifies the type of prompt variable to render. This
      specification defines three values -- date (Section 4.3.1.1.1.1),
      time (Section 4.3.1.1.1.2), and digits (Section 4.3.1.1.1.3). All
      other valid but undefined values are reserved for future use,

where new values are assigned as described in Section 8.5. A
valid value is a string (see Section 4.6.6). The attribute is
mandatory.

value: specifies a string to be rendered according to the prompt
variable type. A valid value is a string (see Section 4.6.6).
The attribute is mandatory.

format: specifies format information that the prompt variable type
uses to render the value attribute. A valid value is a string
(see Section 4.6.6). The attribute is optional. There is no
default value.

gender: specifies the gender that the prompt variable type uses to
render the value attribute. Valid values are "male" or "female".
The attribute is optional. There is no default value.

xml:lang: specifies the language that the prompt variable type uses
to render the value attribute. A valid value is a language
identifier (see Section 4.6.11). The attribute is optional.
There is no default value.

The <variable> element has no children.

This specification is agnostic to the type and codec of media
resources into which variables are rendered as well as the rendering
mechanism itself. For example, an MS implementation supporting audio
rendering could map the <variable> into one or more audio media
resources.

This package is agnostic to which <variable> types are supported by
an implementation. If a <variable> element configuration specified
in a request is not supported by the MS, the MS sends a <response>
with a 425 status code (Section 4.5).

4.3.1.1.1.1. Date Type

The date variable type provides a mechanism for dynamically rendering
a date prompt.

The <variable> type attribute MUST have the value "date".

The <variable> format attribute MUST be one of the following values
and comply with its rendering of the value attribute:

mdy indicating that the <variable> value attribute is to be rendered
as sequence composed of month, then day, then year.

   ymd   indicating that the <variable> value attribute is to be rendered
         as sequence composed of year, then month, then day.

   dym   indicating that the <variable> value attribute is to be rendered
         as sequence composed of day, then year, then month.

   dm   indicating that the <variable> value attribute is to be rendered
         as sequence composed of day then month.

   The <variable> value attribute MUST comply with a lexical
   representation of date where

   yyyy '-' mm '-' dd

   as defined in Section 3.2.9 of [XMLSchema:Part2].

   For example,

     <variable type="date" format="dmy" value="2010-11-25"
     xml:lang="en" gender="male"/>

   describes a variable date prompt where the date can be rendered in
   audio as "twenty-fifth of November two thousand and ten" using a list
   of <media> resources:

   <media loc="nfs://voicebase/en/male/25th.wav"/>
   <media loc="nfs://voicebase/en/male/of.wav"/>
   <media loc="nfs://voicebase/en/male/november.wav"/>
   <media loc="nfs://voicebase/en/male/2000.wav"/>
   <media loc="nfs://voicebase/en/male/and.wav"/>
   <media loc="nfs://voicebase/en/male/10.wav"/>

4.3.1.1.1.2. Time Type

   The time variable type provides a mechanism for dynamically rendering
   a time prompt.

   The <variable> type attribute MUST have the value "time".

   The <variable> format attribute MUST be one of the following values
   and comply with its rendering of the value attribute:

   t12   indicating that the <variable> value attribute is to be rendered
         as a time in traditional 12-hour format using am or pm (for
         example, "twenty-five minutes past 2 pm" for "14:25").

   t24 indicating that the <variable> value attribute is to be rendered
        as a time in 24-hour format (for example, "fourteen twenty-five"
        for "14:25").

   The <variable> value attribute MUST comply with a lexical
   representation of time where

   hh ':' mm (':' ss)?

   as defined in Section 3.2.8 of [XMLSchema:Part2].

4.3.1.1.1.3. Digits Type

   The digits variable type provides a mechanism for dynamically
   rendering a digit sequence.

   The <variable> type attribute MUST have the value "digits".

   The <variable> format attribute MUST be one of the following values
   and comply with its rendering of the value attribute:

   gen indicating that the <variable> value attribute is to be rendered
        as a general digit string (for example, "one two three" for
        "123").

   crn indicating that the <variable> value attribute is to be rendered
        as a cardinal number (for example, "one hundred and twenty-
        three" for "123").

   ord indicating that the <variable> value attribute is to be rendered
        as an ordinal number (for example, "one hundred and twenty-
        third" for "123").

   The <variable> value attribute MUST comply with the lexical
   representation

       d+

   i.e., one or more digits.

4.3.1.1.2. <dtmf>

   The <dtmf> element specifies a sequence of DTMF tones for output.

   DTMF tones could be generated using <media> resources where the
   output is transported as RTP audio packets. However, <media>
   resources are not sufficient for cases where DTMF tones are to be
   transported as DTMF RTP [RFC4733] or in event packages.

A <dtmf> element has the following attributes:

digits: specifies the DTMF sequence to output. A valid value is a
   DTMF string (see Section 4.6.3). The attribute is mandatory.

level: used to define the power level for which the DTMF tones will
   be generated. Values are expressed in dBm0. A valid value is an
   integer in the range of 0 to -96 (dBm0). Larger negative values
   express lower power levels. Note that values lower than -55 dBm0
   will be rejected by most receivers (TR-TSY-000181, ITU-T Q.24A).
   The attribute is optional. The default value is -6 (dBm0).

duration: specifies the duration for which each DTMF tone is
   generated. A valid value is a time designation (see
   Section 4.6.7). The MS MAY round the value if it only supports
   discrete durations. The attribute is optional. The default value
   is 100 ms.

interval: specifies the duration of a silence interval following
   each generated DTMF tone. A valid value is a time designation
   (see Section 4.6.7). The MS MAY round the value if it only
   supports discrete durations. The attribute is optional. The
   default value is 100 ms.

The <dtmf> element has no children.

If a <dtmf> element configuration is not supported, the MS sends a
<response> with a 426 status code (Section 4.5).

4.3.1.1.3. <par>

The <par> element allows media resources to be played in parallel.
Each of its child elements specifies a media resource (or a sequence
of media resources using the <seq> element). When playback of the
<par> element is initiated, the MS begins playback of all its child
elements at the same time. This element is modeled after the <par>
element in SMIL [W3C.REC-SMIL2-20051213].

The <par> element has the following attributes:

endsync: indicates when playback of the element is complete. Valid
   values are "first" (indicates that the element is complete when
   any child element reports that it is complete) and "last"
   (indicates it is complete when every child elements are complete).
   The attribute is optional. The default value is "last".

If the value is "first", then playback of other child elements is
stopped when one child element reports it is complete.

   The <par> element has the following child elements (at least one, any
   order, multiple occurrences of each element permitted):

   <seq>: specifies a sequence of media resources to play in parallel
      with other <par> child elements (see Section 4.3.1.1.3.1). The
      element is optional.

   <media>: specifies a media resource (see Section 4.3.1.5) to play.
      The MS is responsible for assigning the appropriate media
      stream(s) when more than one is available. The element is
      optional.

   <variable>: specifies a variable media announcement (see
      Section 4.3.1.1.1) to play. The element is optional.

   <dtmf>: generates one or more DTMF tones (see Section 4.3.1.1.2) to
      play. The element is optional.

   It is RECOMMENDED that a <par> element contains only one <media>
   element of the same media type (i.e., same type-name as defined in
   Section 4.6.10). If a <par> element configuration is not supported,
   the MS sends a <response> with a 435 status code (Section 4.5).

   Runtime <control>s (Section 4.3.1.2) apply to each child element
   playing in parallel. For example, pause and resume controls cause
   all child elements to be paused and resumed, respectively.

   If the <par> element is stopped by the prompt container (e.g.,
   bargein or dialog termination), then playback of all child elements
   is stopped. The playback duration (Section 4.3.2.1) reported for the
   <par> element is the duration of parallel playback, not the
   cumulative duration of each child element played in parallel.

   For example, a request to playback audio and video media in parallel:

```
<mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr">
 <dialogstart connectionid="c1">
   <dialog>
    <prompt>
     <par>
      <media type="audio/x-wav"
             loc="http://www.example.com/media/comments.wav"/>
      <media type="video/3gpp;codecs='s263'"
             loc="http://www.example.com/media/camera.3gp"/>
     </par>
    </prompt>
   </dialog>
  </dialogstart>
</mscivr>
```

When the <prompt> element is executed, it begins playback of its
child element in document-order sequence. In this case, there is
only one child element, a <par> element itself containing audio and
video <media> child elements. Consequently, playback of both audio
and video media resources is initiated at the same time. Since the
endsync attribute is not specified, the default value "last" applies.
The <par> element playback is complete when the media resource with
the longest duration is complete.

4.3.1.1.3.1. <seq>

   The <seq> element specifies media resources to be played back in
   sequence. This allows a sequence of media resources to be played at
   the same time as other children of a <par> element are played in
   parallel, for example, a sequence of audio resources while a video
   resource is played in parallel. This element is modeled after the
   <seq> element in SMIL [W3C.REC-SMIL2-20051213].

   The <seq> element has no attributes.

   The <seq> element has the following child elements (at least one, any
   order, multiple occurrences of each element permitted):

   <media>: specifies a media resource (see Section 4.3.1.5) to play.
      The element is optional.

   <variable>: specifies a variable media announcement (see
      Section 4.3.1.1.1) to play. The element is optional.

   <dtmf>: generates one or more DTMF tones (see Section 4.3.1.1.2) to
      play. The element is optional.

Playback of a <seq> element is complete when all child elements in
the sequence are complete. If the <seq> element is stopped by the
<par> container, then playback of the current child element is
stopped (remaining child elements in the sequence are not played).

For example, a request to play a sequence of audio resources in
parallel with a video media:

```
<mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr">
<dialogstart connectionid="c1">
  <dialog>
   <prompt>
    <par endsync="first">
     <seq>
       <media type="audio/x-wav"
            loc="http://www.example.com/media/date.wav"/>
       <media type="audio/x-wav"
            loc="http://www.example.com/media/intro.wav"/>
       <media type="audio/x-wav"
            loc="http://www.example.com/media/main.wav"/>
       <media type="audio/x-wav"
            loc="http://www.example.com/media/end.wav"/>
     </seq>
     <media type="video/3gpp;codecs='s263'"
            loc="rtsp://www.example.com/media/camera.3gp"/>
    </par>
   </prompt>
  </dialog>
 </dialogstart>
</mscivr>
```

When the <prompt> element is executed, it begins playback of the
<par> element containing a <seq> element and a video <media> element.
The <seq> element itself contains a sequence of audio <media>
elements. Consequently, playback of the video media resource is
initiated at the same time as playback of the sequence of the audio
media resources is initiated. Each audio resource is played back
after the previous one completes. Since the endsync attribute is set
to "first", the <par> element playback is complete when either all
the audio resources in <seq> have been played to completion or the
video <media> is complete, whichever occurs first.

4.3.1.2. <control>

The <control> element defines how DTMF input is mapped to runtime
controls, including prompt playback controls.

DTMF input matching these controls MUST NOT cause prompt playback to
be interrupted (i.e., no prompt bargein), but causes the appropriate
operation to be applied, for example, speeding up prompt playback.

DTMF input matching these controls has priority over <collect> input
for the duration of prompt playback. If an incoming DTMF character
matches a specified runtime control, then the DTMF character is
consumed: it is not added to the digit buffer and so is not available
to the <collect> operation. Once prompt playback is complete,
runtime controls are no longer active.

The <control> element has the following attributes:

gotostartkey: maps a DTMF key to skip directly to the start of the
   prompt. A valid value is a DTMF character (see Section 4.6.2).
   The attribute is optional. There is no default value.

gotoendkey: maps a DTMF key to skip directly to the end of the
   prompt. A valid value is a DTMF character (see Section 4.6.2).
   The attribute is optional. There is no default value.

skipinterval: indicates how far an MS skips backwards or forwards
   through prompt playback when the rewind (rwkey) of fast forward
   key (ffkey) is pressed. A valid value is a Time Designation (see
   Section 4.6.7). The attribute is optional. The default value is
   6s.

ffkey: maps a DTMF key to a fast forward operation equal to the
   value of 'skipinterval'. A valid value is a DTMF character (see
   Section 4.6.2). The attribute is optional. There is no default
   value.

rwkey: maps a DTMF key to a rewind operation equal to the value of
   'skipinterval'. A valid value is a DTMF character (see
   Section 4.6.2). The attribute is optional. There is no default
   value.

pauseinterval: indicates how long an MS pauses prompt playback when
   the pausekey is pressed. A valid value is a Time Designation (see
   Section 4.6.7). The attribute is optional. The default value is
   10s.

pausekey: maps a DTMF key to a pause operation equal to the value of
   'pauseinterval'. A valid value is a DTMF character (see
   Section 4.6.2). The attribute is optional. There is no default
   value.

resumekey: maps a DTMF key to a resume operation. A valid value is
   a DTMF character (see Section 4.6.2). The attribute is optional.
   There is no default value.

volumeinterval: indicates the increase or decrease in playback
   volume (relative to the current volume) when the volupkey or
   voldnkey is pressed. A valid value is a percentage (see
   Section 4.6.8). The attribute is optional. The default value is
   10%.

volupkey: maps a DTMF key to a volume increase operation equal to
   the value of 'volumeinterval'. A valid value is a DTMF character
   (see Section 4.6.2). The attribute is optional. There is no
   default value.

voldnkey: maps a DTMF key to a volume decrease operation equal to
   the value of 'volumeinterval'. A valid value is a DTMF character
   (see Section 4.6.2). The attribute is optional. There is no
   default value.

speedinterval: indicates the increase or decrease in playback speed
   (relative to the current speed) when the speedupkey or speeddnkey
   is pressed. A valid value is a percentage (see Section 4.6.8).
   The attribute is optional. The default value is 10%.

speedupkey: maps a DTMF key to a speed increase operation equal to
   the value of the speedinterval attribute. A valid value is a DTMF
   character (see Section 4.6.2). The attribute is optional. There
   is no default value.

speeddnkey: maps a DTMF key to a speed decrease operation equal to
   the value of the speedinterval attribute. A valid value is a DTMF
   character (see Section 4.6.2). The attribute is optional. There
   is no default value.

external: allows one or more DTMF keys to be declared as external
   controls (for example, video camera controls); the MS can send
   notifications when a matching key is activated using <dtmfnotify>
   (Section 4.2.5.2). A valid value is a DTMF string (see
   Section 4.6.3). The attribute is optional. There is no default
   value.

If the same DTMF is specified in more than one DTMF key control
attribute -- except the pausekey and resumekey attributes -- the MS
sends a <response> with a 413 status code (Section 4.5).

The MS has the following execution model for runtime control after
initialization:

   1. If an error occurs during execution, then the MS terminates
       runtime control and the error is reported to the dialog
       container. The MS MAY report controls executed successfully
       before the error in <controlinfo> (see Section 4.3.2.2).

   2. Runtime controls are active only during prompt playback (if no
       <prompt> element is specified, then runtime controls are
       ignored). If DTMF input matches any specified keys (for example,
       the ffkey), then the MS applies the appropriate operation
       immediately. If a seek operation (ffkey, rwkey) attempts to go
       beyond the beginning or end of the prompt queue, then the MS
       automatically truncates it to the prompt queue beginning or end,
       respectively. If a volume operation (voldnkey, volupkey)
       attempts to go beyond the minimum or maximum volume supported by
       the platform, then the MS automatically limits the operation to
       minimum or maximum supported volume, respectively. If a speed
       operation (speeddnkey, speedupkey) attempts to go beyond the
       minimum or maximum playback speed supported by the platform, then
       the MS automatically limits the operation to minimum or maximum
       supported speed, respectively. If the pause operation attempts
       to pause output when it is already paused, then the operation is
       ignored. If the resume operation attempts to resume when the
       prompts are not paused, then the operation is ignored. If a
       seek, volume, or speed operation is applied when output is
       paused, then the MS also resumes output automatically.

   3. If DTMF control subscription has been specified for the dialog,
       then each DTMF match of a control operation is reported in a
       <dtmfnotify> notification event (Section 4.2.5.2).

   4. When the dialog exits, all control matches are reported in a
       <controlinfo> element (Section 4.3.2.2).

4.3.1.3. <collect>

   The <collect> element defines how DTMF input is collected.

   The <collect> element has the following attributes:

   cleardigitbuffer: indicates whether the digit buffer is to be
      cleared. A valid value is a boolean (see Section 4.6.1). A value
      of true indicates that the digit buffer is to be cleared. A value
      of false indicates that the digit buffer is not to be cleared.
      The attribute is optional. The default value is true.

   timeout: indicates the maximum time to wait for user input to begin.
      A valid value is a Time Designation (see Section 4.6.7). The
      attribute is optional. The default value is 5s.

interdigittimeout: indicates the maximum time to wait for another
   DTMF when the collected input is incomplete with respect to the
   grammar. A valid value is a Time Designation (see Section 4.6.7).
   The attribute is optional. The default value is 2s.

termtimeout: indicates the maximum time to wait for the termchar
   character when the collected input is complete with respect to the
   grammar. A valid value is a Time Designation (see Section 4.6.7).
   The attribute is optional. The default value is 0s (no delay).

escapekey: specifies a DTMF key that indicates collected grammar
   matches are discarded and the DTMF collection is to be re-
   initiated. A valid value is a DTMF character (see Section 4.6.2).
   The attribute is optional. There is no default value.

termchar: specifies a DTMF character for terminating DTMF input
   collection using the internal grammar. It is ignored when a
   custom grammar is specified. A valid value is a DTMF character
   (see Section 4.6.2). To disable termination by a conventional
   DTMF character, set the parameter to an unconventional character
   like 'A'. The attribute is optional. The default value is '#'.

maxdigits: The maximum number of digits to collect using an internal
   digits (0-9 only) grammar. It is ignored when a custom grammar is
   specified. A valid value is a positive integer (see
   Section 4.6.5). The attribute is optional. The default value is
   5.

The following matching priority is defined for incoming DTMF:
termchar attribute, escapekey attribute, and then as part of a
grammar. For example, if "1" is defined as the escapekey attribute
and as part of a grammar, then its interpretation as an escapekey
takes priority.

The <collect> element has the following child element:

<grammar>: indicates a custom grammar format (see
   Section 4.3.1.3.1). The element is optional.

The custom grammar takes priority over the internal grammar. If a
<grammar> element is specified, the MS MUST use it for DTMF
collection.

The MS has the following execution model for DTMF collection after
initialization:

1. The DTMF collection buffer MUST NOT receive DTMF input matching
    <control> operations (see Section 4.3.1.2).

   2. If an error occurs during execution, then the MS terminates
       collection and reports the error to the dialog container (see
       Section 4.3). The MS MAY report DTMF collected before the error
       in <collectinfo> (see Section 4.3.2.3).

   3. The MS clears the digit buffer if the value of the
       cleardigitbuffer attribute is true.

   4. The MS activates an initial timer with the duration of the value
       of the timeout attribute. If the initial timer expires before
       any DTMF input is received, then collection execution terminates,
       the <collectinfo> (see Section 4.3.2.3) has the termmode
       attribute set to noinput and the execution status is reported to
       the dialog container.

   5. When the first DTMF collect input is received, the initial timer
       is canceled and DTMF collection begins. Each DTMF input is
       collected unless it matches the value of the escapekey attribute
       or the termchar attribute when the internal grammar is used.
       Collected input is matched against the grammar to determine if it
       is valid and, if valid, whether collection is complete. Valid
       DTMF patterns are either a simple digit string where the maximum
       length is determined by the maxdigits attribute and that can be
       optionally terminated by the character in the termchar attribute,
       or a custom DTMF grammar specified with the <grammar> element.

   6. After escapekey input, or a valid input that does not complete
       the grammar, the MS activates a timer for the value of the
       interdigittimeout attribute or the termtimeout attribute. The MS
       only uses the termtimeout value when the grammar does not allow
       any additional input; otherwise, the MS uses the
       interdigittimeout.

   7. If DTMF collect input matches the value of the escapekey
       attribute, then the MS re-initializes DTMF collection: i.e., the
       MS discards collected DTMFs already matched against the grammar,
       and the MS attempts to match incoming DTMF (including any pending
       in the digit buffer) as described in Step 5 above.

   8. If the collect input is not valid with respect to the grammar or
       an interdigittimeout timer expires, the MS terminates collection
       execution and reports execution status to the dialog container
       with a <collectinfo> (see Section 4.3.2.3) where the termmode
       attribute is set to nomatch.

   9. If the collect input completes the grammar or if a termtimeout
       timer expires, then the MS terminates collection execution and
       reports execution status to the dialog container with

      <collectinfo> (see Section 4.3.2.3) where the termmode attribute
      is set to match.

4.3.1.3.1. <grammar>

   The <grammar> element allows a custom grammar, inline or external, to
   be specified. Custom grammars permit the full range of DTMF
   characters including '*' and '#' to be specified for DTMF pattern
   matching.

   The <grammar> element has the following attributes:

   src: specifies the location of an external grammar document. A
      valid value is a URI (see Section 4.6.9). The MS MUST support
      both HTTP [RFC2616] and HTTPS [RFC2818] schemes and the MS MAY
      support other schemes. If the URI scheme is unsupported, the MS
      sends a <response> with a 420 status code (Section 4.5). If the
      resource cannot be retrieved within the timeout interval, the MS
      sends a <response> with a 409 status code. If the grammar format
      is not supported, the MS sends a <response> with a 424 status
      code. The attribute is optional. There is no default value.

   type: identifies the preferred type of the grammar document
      identified by the src attribute. A valid value is a MIME media
      type (see Section 4.6.10). If the URI scheme used in the src
      attribute defines a mechanism for establishing the authoritative
      MIME media type of the media resource, the value returned by that
      mechanism takes precedence over this attribute. The attribute is
      optional. There is no default value.

   fetchtimeout: the maximum interval to wait when fetching a grammar
      resource. A valid value is a Time Designation (see
      Section 4.6.7). The attribute is optional. The default value is
      30s.

   The <grammar> element allows inline grammars to be specified. XML
   grammar formats MUST use a namespace other than the one used in this
   specification. Non-XML grammar formats MAY use a CDATA section.

   The MS MUST support the Speech Recognition Grammar Specification
   [SRGS] XML grammar format ("application/srgs+xml") and MS MAY support
   the Key Press Markup Language (KPML) [RFC4730] or other grammar
   formats. If the grammar format is not supported by the MS, then the
   MS sends a <response> with a 424 status code (Section 4.5).

   For example, the following fragment shows DTMF collection with an
   inline SRGS grammar:

```
   <collect cleardigitbuffer="false" timeout="20s"
           interdigittimeout="1s">
           <grammar>
                   <grammar xmlns="http://www.w3.org/2001/06/grammar"
                               version="1.0" mode="dtmf">
                     <rule id="digit">
                      <one-of>
                             <item>0</item>
                             <item>1</item>
                             <item>2</item>
                             <item>3</item>
                             <item>4</item>
                             <item>5</item>
                             <item>6</item>
                             <item>7</item>
                             <item>8</item>
                             <item>9</item>
                      </one-of>
                   </rule>

                   <rule id="pin" scope="public">
                    <one-of>
                           <item>
                            <item repeat="4">
                             <ruleref uri="#digit"/>
                                   </item>#</item>
                                   <item>* 9</item>
                     </one-of>
                   </rule>

         </grammar>
           </grammar>
          </collect>
```

   The same grammar could also be referenced externally (and take
   advantage of HTTP caching):

```
   <collect cleardigitbuffer="false" timeout="20s">
       <grammar type="application/srgs+xml"
               src="http://example.org/pin.grxml"/>
   </collect>
```

4.3.1.4. <record>

   The <record> element specifies how media input is recorded.

   The <record> element has the following attributes:

   timeout: indicates the time to wait for user input to begin. A
      valid value is a Time Designation (see Section 4.6.7). The
      attribute is optional. The default value is 5s.

   vadinitial: controls whether Voice Activity Detection (VAD) is used
      to initiate the recording operation. A valid value is a boolean
      (see Section 4.6.1). A value of true indicates the MS MUST
      initiate recording if the VAD detects voice on the configured
      inbound audio streams. A value of false indicates that the MS
      MUST NOT initiate recording using VAD. The attribute is optional.
      The default value is false.

   vadfinal: controls whether VAD is used to terminate the recording
      operation. A valid value is a boolean (see Section 4.6.1). A
      value of true indicates the MS MUST terminate recording if the VAD
      detects a period of silence (whose duration is specified by the
      finalsilence attribute) on configured inbound audio streams. A
      value of false indicates that the MS MUST NOT terminate recording
      using VAD. The attribute is optional. The default value is
      false.

   dtmfterm: indicates whether the recording operation is terminated by
      DTMF input. A valid value is a boolean (see Section 4.6.1). A
      value of true indicates that recording is terminated by DTMF
      input. A value of false indicates that recording is not
      terminated by DTMF input. The attribute is optional. The default
      value is true.

   maxtime: indicates the maximum duration of the recording. A valid
      value is a Time Designation (see Section 4.6.7). The attribute is
      optional. The default value is 15s.

   beep: indicates whether a 'beep' is to be played immediately prior
      to initiation of the recording operation. A valid value is a
      boolean (see Section 4.6.1). The attribute is optional. The
      default value is false.

   finalsilence: indicates the interval of silence that indicates the
      end of voice input. This interval is not part of the recording
      itself. This parameter is ignored if the vadfinal attribute has
      the value false. A valid value is a Time Designation (see
      Section 4.6.7). The attribute is optional. The default value is
      5s.

   append: indicates whether recorded data is appended or not to a
      recording location if a resource already exists. A valid value is
      a boolean (see Section 4.6.1). A value of true indicates that
      recorded data is appended to the existing resource at a recording

location. A value of false indicates that recorded data is to
overwrite the existing resource. The attribute is optional. The
default value is false.

When a recording location is specified using the HTTP or HTTPS
protocol, the recording operation SHOULD be performed using the
HTTP GET and PUT methods, unless the HTTP server provides a
special interface for recording uploads and appends (e.g., using
POST). When the append attribute has the value false, the
recording data is uploaded to the specified location using HTTP
PUT and replaces any data at that location on the HTTP origin
server. When append has the value true, the existing data (if
any) is first downloaded from the specified location using HTTP
GET, then the recording data is appended to the existing recording
(note that this might require codec conversion and modification to
the existing data), then the combined recording is uploaded to the
specified location using HTTP PUT. HTTP errors are handled as
described in [RFC2616].

When the recording location is specified using protocols other
than HTTP or HTTPS, the mapping of the append operation onto the
upload protocol scheme is implementation specific.

If either the vadinitial or vadfinal attribute is set to true and the
MS does not support VAD, the MS sends a <response> with a 434 status
code (Section 4.5).

The <record> element has the following child element (0 or more
occurrences):

<media>: specifies the location and type of the media resource for
   uploading recorded data (see Section 4.3.1.5). The MS MUST
   support both HTTP [RFC2616] and HTTPS [RFC2818] schemes for
   uploading recorded data and the MS MAY support other schemes. The
   MS uploads recorded data to this resource as soon as possible
   after recording is complete. The element is optional.

If multiple <media> elements are specified, then media input is to be
recorded in parallel to multiple resource locations.

If no <media> child element is specified, the MS MUST record media
input but the recording location and the recording format are
implementation specific (e.g., the MS records audio in the WAV format
to a local disk accessible by HTTP). The recording location and
format are reported in <recordinfo> (Section 4.3.2.4) when the dialog
terminates. The recording MUST be available from this location until
the connection or conference associated with the dialog on the MS
terminates.

If the MS does not support the configuration required for recording
from the input media streams to one or more <media> elements and a
more specific error code is not defined for its child elements, the
MS sends a <response> with a 423 status code (Section 4.5).

Note that an MS MAY support uploading recorded data to recording
locations at the same time the recording operation takes place. Such
implementations need to be aware of the requirements of certain
recording formats (e.g., WAV) for metadata at the beginning of the
uploaded file, that the finalsilence interval is not part of the
recording and how these requirements interact with the URI scheme.

The MS has the following execution model for recording after
initialization:

1. If an error occurs during execution (e.g., authentication or
    communication error when trying to upload to a recording
    location), then the MS terminates record execution and reports
    the error to the dialog container (see Section 4.3). The MS MAY
    report data recorded before the error in <recordinfo> (see
    Section 4.3.2.4).

2. If DTMF input (not matching a <control> operation) is received
    during prompt playback and the prompt bargein attribute is set to
    true, then the MS activates the record execution. Otherwise, the
    MS activates it after the completion of prompt playback.

3. If a beep attribute with the value of true is specified, then the
    MS plays a beep tone.

4. The MS activates a timer with the duration of the value of the
    timeout attribute. If the timer expires before the recording
    operation begins, then the MS terminates the recording execution
    and reports the status to dialog container with <recordinfo> (see
    Section 4.3.2.4) where the termmode attribute is set to noinput.

5. Initiation of the recording operation depends on the value of the
    vadinitial attribute. If vadinitial has the value false, then
    the recording operation is initiated immediately. Otherwise, the
    recording operation is initiated when voice activity is detected.

6. When the recording operation is initiated, a timer is started for
    the value of the maxtime attribute (maximum duration of the
    recording). If the timer expires before the recording operation
    is complete, then the MS terminates recording execution and
    reports the execution status to the dialog container with
    <recordinfo> (see Section 4.3.2.4) where the termmode attribute
    set to maxtime.

   7. During the record operation input, media streams are recording to
       a location and format specified in one or more <media> child
       elements. If no <media> child element is specified, the MS
       records input to an implementation-specific location and format.

   8. If the dtmfterm attribute has the value true and DTMF input is
       detected during the record operation, then the MS terminates
       recording and its status is reported to the dialog container with
       a <recordinfo> (see Section 4.3.2.4) where the termmode attribute
       is set to dtmf.

   9. If vadfinal attribute has the value true, then the MS terminates
       the recording operation when a period of silence, with the
       duration specified by the value of the finalsilence attribute, is
       detected. This period of silence is not part of the final
       recording. The status is reported to the dialog container with a
       <recordinfo> (see Section 4.3.2.4) where the termmode attribute
       is set to finalsilence.

   For example, a request to record audio and video input to separate
   locations:

```
<mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr">
<dialogstart connectionid="c1">
  <dialog>
   <record maxtime="30s" vadinitial="false" vadfinal="false">
    <media type="audio/x-wav"
        loc="http://www.example.com/upload/audio.wav"/>
    <media type="video/3gpp;codecs='s263'"
        loc="http://www.example.com/upload/video.3gp"/>
   </record>
  </dialog>
 </dialogstart>
</mscivr>
```

   When the <record> element is executed, it immediately begins
   recording of the audio and video (since vadinitial is false) where
   the destination locations are specified in the <media> child
   elements. Recording is completed when the duration reaches 30s or
   the connection is terminated.

4.3.1.5. <media>

   The <media> element specifies a media resource to playback from (see
   Section 4.3.1.1) or record to (see Section 4.3.1.4). In the playback
   case, the resource is retrieved and in the recording case, recording
   data is uploaded to the resource location.

A <media> element has the following attributes:

loc: specifies the location of the media resource. A valid value is
   a URI (see Section 4.6.9). The MS MUST support both HTTP
   [RFC2616] and HTTPS [RFC2818] schemes and the MS MAY support other
   schemes. If the URI scheme is not supported by the MS, the MS
   sends a <response> with a 420 status code (Section 4.5). If the
   resource is to be retrieved but the MS cannot retrieve it within
   the timeout interval, the MS sends a <response> with a 409 status
   code. If the format of the media resource is not supported, the
   MS sends a <response> with a 429 status code. The attribute is
   mandatory.

type: specifies the type of the media resource indicated in the loc
   attribute. A valid value is a MIME media type (see
   Section 4.6.10) that, depending on its definition, can include
   additional parameters (e.g., [RFC4281]). If the URI scheme used
   in the loc attribute defines a mechanism for establishing the
   authoritative MIME media type of the media resource, the value
   returned by that mechanism takes precedence over this attribute.
   If additional media parameters are specified, the MS MUST use them
   to determine media processing. For example, [RFC4281] defines a
   'codec' parameter for media types like video/3gpp that would
   determine which media streams are played or recorded. The
   attribute is optional. There is no default value.

fetchtimeout: the maximum interval to wait when fetching a media
   resource. A valid value is a Time Designation (see
   Section 4.6.7). The attribute is optional. The default value is
   30s.

soundLevel: playback soundLevel (volume) for the media resource. A
   valid value is a percentage (see Section 4.6.8). The value
   indicates increase or decrease relative to the original recorded
   volume of the media. A value of 100% (the default) plays the
   media at its recorded volume, a value of 200% will play the media
   twice recorded volume, 50% at half its recorded volume, a value of
   0% will play the media silently, and so on. See 'soundLevel' in
   SMIL [W3C.REC-SMIL2-20051213] for further information. The
   attribute is optional. The default value is 100%.

clipBegin: offset from start of media resource to begin playback. A
   valid value is a Time Designation (see Section 4.6.7). The offset
   is measured in normal media playback time from the beginning of
   the media resource. If the clipBegin offset is after the end of
   media (or the clipEnd offset), no media is played. See
   'clipBegin' in SMIL [W3C.REC-SMIL2-20051213] for further
   information. The attribute is optional. The default value is 0s.

   clipEnd: offset from start of media resource to end playback. A
      valid value is a Time Designation (see Section 4.6.7). The offset
      is measured in normal media playback time from the beginning of
      the media resource. If the clipEnd offset is after the end of
      media, then the media is played to the end. If clipBegin is after
      clipEnd, then no media is played. See 'clipEnd' in SMIL
      [W3C.REC-SMIL2-20051213] for further information. The attribute
      is optional. There is no default value.

   The fetchtimeout, soundLevel, clipBegin, and clipEnd attributes are
   only relevant in the playback use case. The MS ignores these
   attributes when using the <media> for recording.

   The <media> element has no children.

4.3.2. Exit Information

   When the dialog exits, information about the specified operations is
   reported in a <dialogexit> notification event (Section 4.2.5.1).

4.3.2.1. <promptinfo>

   The <promptinfo> element reports the information about prompt
   execution. It has the following attributes:

   duration: indicates the duration of prompt playback in milliseconds.
      A valid value is a non-negative integer (see Section 4.6.4). The
      attribute is optional. There is no default value.

   termmode: indicates how playback was terminated. Valid values are
      'stopped', 'completed', or 'bargein'. The attribute is mandatory.

   The <promptinfo> element has no child elements.

4.3.2.2. <controlinfo>

   The <controlinfo> element reports information about control
   execution.

   The <controlinfo> element has no attributes and has 0 or more
   <controlmatch> child elements each describing an individual runtime
   control match.

4.3.2.2.1. <controlmatch>

   The <controlmatch> element has the following attributes:

   dtmf: DTMF input triggering the runtime control. A valid value is a
      DTMF string (see Section 4.6.3) with no space between characters.
      The attribute is mandatory.

   timestamp: indicates the time (on the MS) at which the control was
      triggered. A valid value is a dateTime expression
      (Section 4.6.12). The attribute is mandatory.

   The <controlmatch> element has no child elements.

4.3.2.3. <collectinfo>

   The <collectinfo> element reports the information about collect
   execution.

   The <collectinfo> element has the following attributes:

   dtmf: DTMF input collected from the user. A valid value is a DTMF
      string (see Section 4.6.3) with no space between characters. The
      attribute is optional. There is no default value.

   termmode: indicates how collection was terminated. Valid values are
      'stopped', 'match', 'noinput', or 'nomatch'. The attribute is
      mandatory.

   The <collectinfo> element has no child elements.

4.3.2.4. <recordinfo>

   The <recordinfo> element reports information about record execution
   (Section 4.3.1.4).

   The <recordinfo> element has the following attributes:

   termmode: indicates how recording was terminated. Valid values are
      'stopped', 'noinput', 'dtmf', 'maxtime', and 'finalsilence'. The
      attribute is mandatory.

   duration: indicates the duration of the recording in milliseconds.
      A valid value is a non-negative integer (see Section 4.6.4). The
      attribute is optional. There is no default value.

   The <recordinfo> element has the following child element (0 or more
   occurrences):

   <mediainfo>: indicates information about a recorded media resource
      (see Section 4.3.2.4.1). The element is optional.

When the record operation is successful, the MS MUST specify a
<mediainfo> element for each recording location. For example, if the
<record> element contained three <media> child elements, then the
<recordinfo> would contain three <mediainfo> child elements.

4.3.2.4.1. <mediainfo>

The <mediainfo> element reports information about a recorded media
resource.

The <mediainfo> element has the following attributes:

loc: indicates the location of the media resource. A valid value is
   a URI (see Section 4.6.9). The attribute is mandatory.

type: indicates the format of the media resource. A valid value is
   a MIME media type (see Section 4.6.10). The attribute is
   mandatory.

size: indicates the size of the media resource in bytes. A valid
   value is a non-negative integer (see Section 4.6.4). The
   attribute is optional. There is no default value.

4.4. Audit Elements

The audit elements defined in this section allow the MS to be audited
for package capabilities as well as dialogs managed by the package.
Auditing is particularly important for two use cases. First, it
enables discovery of package capabilities supported on an MS before
an AS starts a dialog on connection or conference. The AS can then
use this information to create request elements using supported
capabilities and, in the case of codecs, to negotiate an appropriate
SDP for a User Agent's connection. Second, auditing enables
discovery of the existence and status of dialogs currently managed by
the package on the MS. This could be used when one AS takes over
management of the dialogs if the AS that initiated the dialogs fails
or is no longer available (see Security Considerations described in
Section 7).

4.4.1. <audit>

The <audit> request element is sent to the MS to request information
about the capabilities of, and dialogs currently managed with, this
Control Package. Capabilities include supported dialog languages,
grammar formats, record and media types, as well as codecs. Dialog
information includes the status of managed dialogs as well as codecs.

The <audit> element has the following attributes:

   capabilities: indicates whether package capabilities are to be
      audited. A valid value is a boolean (see Section 4.6.1). A value
      of true indicates that capability information is to be reported.
      A value of false indicates that capability information is not to
      be reported. The attribute is optional. The default value is
      true.

   dialogs: indicates whether dialogs currently managed by the package
      are to be audited. A valid value is a boolean (see
      Section 4.6.1). A value of true indicates that dialog information
      is to be reported. A value of false indicates that dialog
      information is not to be reported. The attribute is optional.
      The default value is true.

   dialogid: string identifying a specific dialog to audit. The MS
      sends a response with a 406 status code (Section 4.5) if the
      specified dialog identifier is invalid. The attribute is
      optional. There is no default value.

   If the dialogs attribute has the value true and dialogid attribute is
   specified, then only audit information about the specified dialog is
   reported. If the dialogs attribute has the value false, then no
   dialog audit information is reported even if a dialogid attribute is
   specified.

   The <audit> element has no child elements.

   When the MS receives an <audit> request, it MUST reply with an
   <auditresponse> element (Section 4.4.2), which includes a mandatory
   attribute describing the status in terms of a numeric code. Response
   status codes are defined in Section 4.5. If the request is
   successful, the <auditresponse> contains (depending on attribute
   values) a <capabilities> element (Section 4.4.2.2) reporting package
   capabilities and a <dialogs> element (Section 4.4.2.3) reporting
   managed dialog information. If the MS is not able to process the
   request and carry out the audit operation, the audit request has
   failed and the MS MUST indicate the class of failure using an
   appropriate 4xx response code. Unless an error response code is
   specified for a class of error within this section, implementations
   follow Section 4.5 in determining the appropriate status code for the
   response.

   For example, a request to audit capabilities and dialogs managed by
   the package:

   <mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr">
     <audit/>
   </mscivr>

In this example, only capabilities are to be audited:

```
<mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr">
  <audit dialogs="false"/>
</mscivr>
```

With this example, only a specific dialog is to be audited:

```
<mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr">
  <audit capabilities="false" dialogid="d4"/>
</mscivr>
```

4.4.2. <auditresponse>

   The <auditresponse> element describes a response to an <audit>
   request.

   The <auditresponse> element has the following attributes:

   status: numeric code indicating the audit response status. The
      attribute is mandatory. Valid values are defined in Section 4.5.

   reason: string specifying a reason for the status. The attribute is
      optional.

   desclang: specifies the language used in the value of the reason
      attribute. A valid value is a language identifier
      (Section 4.6.11). The attribute is optional. If not specified,
      the value of the desclang attribute on <mscivr> (Section 4.1)
      applies.

   The <auditresponse> element has the following sequence of child
   elements:

   <capabilities> element (Section 4.4.2.2) describing capabilities of
      the package. The element is optional.

   <dialogs> element (Section 4.4.2.3) describing information about
      managed dialogs. The element is optional.

   For example, a successful response to an <audit> request requesting
   capabilities and dialogs information:

```
   <mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr">
    <auditresponse status="200">
     <capabilities>
      <dialoglanguages>
       <mimetype>application/voicexml+xml</mimetype>
      </dialoglanguages>
      <grammartypes/>
      <recordtypes>
       <mimetype>audio/x-wav</mimetype>
       <mimetype>video/3gpp</mimetype>
      </recordtypes>
      <prompttypes>
       <mimetype>audio/x-wav</mimetype>
       <mimetype>video/3gpp</mimetype>
      </prompttypes>
      <variables>
       <variabletype type="date" desc="value formatted as YYYYMMDD">
        <format desc="month year day">mdy</format>
        <format desc="year month day">ymd</format>
        <format desc="day month year">dmy</format>
        <format desc="day month">dm</format>
       </variabletype>
      </variables>
      <maxpreparedduration>600s</maxpreparedduration>
      <maxrecordduration>1800s</maxrecordduration>
      <codecs>
       <codec name="video">
        <subtype>H263</subtype>
       </codec>
       <codec name="video">
        <subtype>H264</subtype>
       </codec>
       <codec name="audio">
        <subtype>PCMU</subtype>
       </codec>
       <codec name="audio">
        <subtype>PCMA</subtype>
       </codec>
       <codec name="audio">
        <subtype>telephone-event</subtype>
       </codec>
      </codecs>
     </capabilities>
     <dialogs>
      <dialogaudit dialogid="4532" state="preparing"/>
      <dialogaudit dialogid="4599" state="prepared"/>
      <dialogaudit dialogid="1234" state="started" conferenceid="conf1">
       <codecs>
```

```
         <codec name="audio">
          <subtype>PCMA</subtype>
         </codec>
         <codec name="audio">
          <subtype>telephone-event</subtype>
         </codec>
        </codecs>
      </dialogaudit>
     </dialogs>
   </auditresponse>
  </mscivr>
```

4.4.2.1. <codecs>

The <codecs> provides audit information about codecs.

The <codecs> element has no attributes.

The <codecs> element has the following sequence of child elements (0 or more occurrences):

<codec>: audit information for a codec (Section 4.4.2.1.1). The element is optional.

For example, a fragment describing two codecs:

```
<codecs>
  <codec name="audio">
   <subtype>PCMA</subtype>
  </codec>
  <codec name="audio">
   <subtype>telephone-event</subtype>
  </codec>
</codecs>
```

4.4.2.1.1. <codec>

The <codec> element describes a codec on the MS. The element is modeled on the <codec> element in the XCON conference information data model [XCON-DATA-MODEL] but allows addition information (e.g., rate, speed, etc.) to be specified.

The <codec> element has the following attributes:

name: indicates the type name of the codec's media format as defined in [IANA]. A valid value is a "type-name" as defined in Section 4.2 of [RFC4288]. The attribute is mandatory.

The <codec> element has the following sequence of child elements:

<subtype>: element whose content model describes the subtype of the
   codec's media format as defined in [IANA]. A valid value is a
   "subtype-name" as defined in Section 4.2 of [RFC4288]. The
   element is mandatory.

<params>: element (Section 4.2.6) describing additional information
   about the codec. This package is agnostic to the names and values
   of the codec parameters supported by an implementation. The
   element is optional.

For example, a fragment with a <codec> element describing the H263
video codec:

```
<codec name="video">
 <subtype>H263</subtype>
</codec>
```

4.4.2.2. <capabilities>

The <capabilities> element provides audit information about package
capabilities.

The <capabilities> element has no attributes.

The <capabilities> element has the following sequence of child
elements:

<dialoglanguages>: element (Section 4.4.2.2.1) describing additional
   dialog languages supported by the MS. The element is mandatory.

<grammartypes>: element (Section 4.4.2.2.2) describing supported
   <grammar> (Section 4.3.1.3.1) format types. The element is
   mandatory.

<recordtypes>: element (Section 4.4.2.2.3) describing <media>
   (Section 4.3.1.5) format types supported for <record>
   (Section 4.3.1.4). The element is mandatory.

<prompttypes>: element (Section 4.4.2.2.4) describing supported
   <media> (Section 4.3.1.5) format types for playback within a
   <prompt> (Section 4.3.1.1). The element is mandatory.

<variables>: element (Section 4.4.2.2.5) describing supported types
   and formats for the <variable> element (Section 4.3.1.1.1). The
   element is mandatory.

   <maxpreparedduration>: element (Section 4.4.2.2.6) describing the
      supported maximum duration for a prepared dialog following a
      <dialogprepare> (Section 4.2.1) request. The element is
      mandatory.

   <maxrecordduration>: element (Section 4.4.2.2.7) describing the
      supported maximum duration for a recording <record>
      (Section 4.3.1.4) request. The element is mandatory.

   <codecs>: element (Section 4.4.2.1) describing codecs available to
      the package. The element is mandatory.

   For example, a fragment describing capabilities:

```
     <capabilities>
      <dialoglanguages>
       <mimetype>application/voicexml+xml</mimetype>
      </dialoglanguages>
      <grammartypes/>
      <recordtypes>
       <mimetype>audio/x-wav</mimetype>
       <mimetype>video/3gpp</mimetype>
      </recordtypes>
      <prompttypes>
       <mimetype>audio/x-wav</mimetype>
       <mimetype>video/3gpp</mimetype>
      </prompttypes>
      <variables/>
      <maxpreparedduration>30s</maxpreparedduration>
      <maxrecordduration>60s</maxrecordduration>
      <codecs>
       <codec name="video">
        <subtype>H263</subtype>
       </codec>
       <codec name="video">
        <subtype>H264</subtype>
       </codec>
       <codec name="audio">
        <subtype>PCMU</subtype>
       </codec>
       <codec name="audio">
        <subtype>PCMA</subtype>
       </codec>
       <codec name="audio">
        <subtype>telephone-event</subtype>
       </codec>
      </codecs>
     </capabilities>
```

4.4.2.2.1. <dialoglanguages>

   The <dialoglanguages> element provides information about additional
   dialog languages supported by the package. Dialog languages are
   identified by their associated MIME media types. The MS MUST NOT
   include the mandatory dialog language for this package (Section 4.3).

   The <dialoglanguages> element has no attributes.

   The <dialoglanguages> element has the following sequence of child
   elements (0 or more occurrences):

   <mimetype>: element whose content model describes a MIME media type
      (Section 4.6.10) associated with a supported dialog language. The
      element is optional.

4.4.2.2.2. <grammartypes>

   The <grammartypes> element provides information about <grammar>
   format types supported by the package. The MS MUST NOT include the
   mandatory SRGS format type, "application/srgs+xml"
   (Section 4.3.1.3.1).

   The <grammartypes> element has no attributes.

   The <grammartypes> element has the following sequence of child
   elements (0 or more occurrences):

   <mimetype>: element whose content model describes a mime type
      (Section 4.6.10). The element is optional.

4.4.2.2.3. <recordtypes>

   The <recordtypes> element provides information about media resource
   format types of <record> supported by the package (Section 4.3.1.4).

   The <recordtypes> element has no attributes.

   The <recordtypes> element has the following sequence of child
   elements (0 or more occurrences):

   <mimetype>: element whose content model describes a mime type
      (Section 4.6.10). The element is optional.

4.4.2.2.4. <prompttypes>

   The <prompttypes> element provides information about media resource
   format types of <prompt> supported by the package (Section 4.3.1.1).

   The <prompttypes> element has no attributes.

   The <prompttypes> element has the following sequence of child
   elements (0 or more occurrences):

   <mimetype>: element whose content model describes a mime type
      (Section 4.6.10). The element is optional.

4.4.2.2.5. <variables>

   The <variables> element provides information about types and formats
   for the <variable> element (Section 4.3.1.1.1) supported by the
   package.

   The <variables> element has no attributes.

   The <variables> element has the following sequence of child elements
   (0 or more occurrences):

   <variabletype>: element describing the formats support for a given
      type (Section 4.4.2.2.5.1). The element is optional.

   For example, a fragment describing support for <variable> with a
   "date" type according to the formats specified in
   Section 4.3.1.1.1.1.

   ```
   <variables>
    <variabletype type="date" desc="value formatted as YYYYMMDD">
      <format desc="month year day">mdy</format>
      <format desc="year month day">ymd</format>
      <format desc="day month year">dmy</format>
      <format desc="day month">dm</format>
    </variabletype>
   </variables>
   ```

4.4.2.2.5.1. <variabletype>

   The <variabletype> element describes the formats supported for
   <variable> supported type.

   The <variabletype> element has the following attributes:

   type: indicates a supported value associated with the type attribute
      of the <variable> element. The attribute is mandatory.

   desc: a string providing some textual description of the type and
      format. The attribute is optional.

   desclang: specifies the language used in the value of the desc
      attribute. A valid value is a language identifier
      (Section 4.6.11). The attribute is optional. If not specified,
      the value of the desclang attribute on <mscivr> (Section 4.1)
      applies.

   The <variabletype> element has the following sequence of child
   elements (0 or more occurrences):

   <format>: element with a desc attribute (optional description),
      desclang (optional language identifier for the description), and a
      content model describing a supported format in the <variable>
      format attribute. The element is optional.

4.4.2.2.6. <maxpreparedduration>

   The <maxpreparedduration> element describes the maximum duration for
   a dialog to remain in the prepared state (Section 4.2) following a
   <dialogprepare> (Section 4.2.1) request.

   The <maxpreparedduration> element has no attributes.

   The <maxpreparedduration> element has a content model describing the
   maximum prepared dialog duration as a time designation
   (Section 4.6.7).

4.4.2.2.7. <maxrecordduration>

   The <maxrecordduration> element describes the maximum recording
   duration for <record> Section 4.3.1.4) request supported by the MS.

   The <maxrecordduration> element has no attributes.

   The <maxrecordduration> element has a content model describing the
   maximum duration of recording as a time designation (Section 4.6.7).

4.4.2.3. <dialogs>

   The <dialogs> element provides audit information about dialogs.

   The <dialogs> element has no attributes.

   The <dialogs> element has the following sequence of child elements (0
   or more occurrences):

   <dialogaudit>: audit information for a dialog (Section 4.4.2.3.1).
      The element is optional.

4.4.2.3.1. <dialogaudit>

   The <dialogaudit> element has the following attributes:

   dialogid: string identifying the dialog. The attribute is
      mandatory.

   state: string indicating the state of the dialog. Valid values are
      preparing, prepared, starting, and started. The attribute is
      mandatory.

   connectionid: string identifying the SIP dialog connection
      associated with the dialog (see Appendix A.1 of [RFC6230]). The
      attribute is optional. There is no default value.

   conferenceid: string identifying the conference associated with the
      dialog (see Appendix A.1 of [RFC6230]). The attribute is
      optional. There is no default value.

   The <dialogaudit> element has the following child element:

   <codecs> element describing codecs used in the dialog. See
      Section 4.4.2.1. The element is optional.

   For example, a fragment describing a started dialog that is using
   PCMU and telephony-event audio codecs:

   <dialogaudit dialogid="1234" state="started" conferenceid="conf1">
    <codecs>
     <codec name="audio">
      <subtype>PCMU</subtype>
     </codec>
     <codec name="audio">
      <subtype>telephone-event</subtype>
     </codec>
    </codecs>
   </dialogaudit>

4.5. Response Status Codes

   This section describes the response codes in Table 1 for the status
   attribute of dialog management <response> (Section 4.2.4) and audit
   <auditresponse> (Section 4.4.2) responses. The MS MUST support the
   status response codes defined here. All other valid but undefined
   values are reserved for future use, where new status codes are
   assigned using the Standards Action process defined in [RFC5226].
   The AS MUST treat any responses it does not recognize as being
   equivalent to the x00 response code for all classes. For example, if

an AS receives an unrecognized response code of 499, it can safely
assume that there was something wrong with its request and treat the
response as if it had received a 400 (Syntax error) response code.

4xx responses are definite failure responses from a particular MS.
The reason attribute in the response SHOULD identify the failure in
more detail, for example, "Mandatory attribute missing: src in media
element" for a 400 (Syntax error) response code.

The AS SHOULD NOT retry the same request without modification (for
example, correcting a syntax error or changing the connectionid to
use one available on the MS). However, the same request to a
different MS might be successful, for example, if another MS supports
a capability required in the request.

4xx failure responses can be grouped into three classes: failure due
to a syntax error in the request (400); failure due to an error
executing the request on the MS (405-419); and failure due to the
request requiring a capability not supported by the MS (420-439).

In cases where more than one request code could be reported for a
failure, the MS SHOULD use the most specific error code of the
failure class for the detected error. For example, if the MS detects
that the dialogid in the request is invalid, then it uses a 406
status code. However, if the MS merely detects that an execution
error occurred, then 419 is used.

Code	Summary	Description	Informational: AS Possible Recovery Action
200	OK	request has succeeded.	
400	Syntax error	request is syntactically invalid: it is not valid with respect to the XML schema specified in Section 5 or it violates a co-occurrence constraint for a request element defined in Section 4.	Change the request so that it is syntactically valid.
405	dialogid already exists	request uses a dialogid identifier for a new dialog that is already used by another dialog on the MS (see Section 4.2).	Send a request for a new dialog without specifying the dialogid and let the MS generate a unique dialogid in the response.
406	dialogid does not exist	request uses a dialogid identifier for an dialog that does not exist on the MS (see Section 4.2).	Send an <audit> request (Section 4.4.1) requesting the list of dialog identifiers already used by the MS and then use one of the listed dialog identifiers.
407	connectionid does not exist	request uses a connectionid identifier for a connection that does not exist on the MS.	Use another method to determine which connections are available on the MS.
408	conferenceid does not exist	request uses a conferenceid identifier for a conference that does not exist on the MS.	Use another method to determine which conferences are available on the MS.

409	Resource cannot be retrieved	request uses a URI to reference an external resource (e.g., dialog, media, or grammar) that cannot be retrieved within the timeout interval.	Check that the resource URI is valid, can be reached from the MS, and that the appropriate authentication is used.
410	Dialog execution canceled	request to prepare or start a dialog that has been terminated by a <dialogterminate/> request (see Section 4.2).	
411	Incompatible stream configuration	request specifies a media stream configuration that is in conflict with itself, or the connection or conference capabilities (see Section 4.2.2).	Change the media stream configuration to match the capabilities of the connection or conference.
412	Media stream not available	request specifies an operation for which a media stream is not available. For example, playing a video media resource on an connection or conference without video streams.	Check the media stream capability of the connection or conference and use an operation that only uses these capabilities.
413	Control keys with same value	request contains a <control> element (Section 4.3.1.2) where some keys have the same value.	Use different keys for the different control operations.
419	Other execution error	requested operation cannot be executed by the MS.	
420	Unsupported URI scheme	request specifies a URI whose scheme is not supported by the MS.	Use a URI scheme that is supported.

421	Unsupported dialog language	request references an external dialog language not supported by the MS.	Send an <audit> request (Section 4.4.1) requesting the MS capabilities and then use one of the listed dialog languages.
422	Unsupported playback format	request references a media resource for playback whose format is not supported by the MS.	Send an <audit> request (Section 4.4.1) requesting the MS capabilities and then use one of the listed playback media formats.
423	Unsupported record format	request references a media resource for recording whose format is not supported by the MS.	Send an <audit> request (Section 4.4.1) requesting the MS capabilities and then use one of the listed record media formats.
424	Unsupported grammar format	request references a grammar whose format is not supported by the MS.	Send an <audit> request (Section 4.4.1) requesting the MS capabilities and then use one of the listed grammar types.
425	Unsupported variable configuration	request contains a prompt <variable> element (Section 4.3.1.1.1) not supported by the MS.	Send an <audit> request (Section 4.4.1) requesting the MS capabilities and then use one of the listed variable types.
426	Unsupported DTMF configuration	request contains a prompt <dtmf> element (Section 4.3.1.1.2) not supported by the MS.		

427	Unsupported parameter	request contains a <param> element (Section 4.2.6.1) not supported by the MS.		
428	Unsupported media stream configuration	request contains a <stream> element (Section 4.2.2.2) whose configuration is not supported by the MS.		
429	Unsupported playback configuration	request contains a <prompt> element (Section 4.3.1.1) that the MS is unable to play on the available output media streams.		
430	Unsupported record configuration	request contains a <record> element (Section 4.3.1.4) that the MS is unable to record with on the available input media streams.		
431	Unsupported foreign namespace attribute or element	request contains attributes or elements from another namespace that the MS does not support.		
432	Unsupported multiple dialog capability	request tries to start another dialog on the same conference or connection where a dialog is already running.		
433	Unsupported collect and record capability	request contains <collect> and <record> elements and the MS does support these operations simultaneously.		
434	Unsupported VAD capability	request contains a <record> element where Voice Activity Detection (VAD) is required, but the MS does not support VAD.		

```
  |  435  | Unsupported  | request contains a   |                  |
  |       | parallel     | prompt <par> element |                  |
  |       | playback     | whose configuration  |                  |
  |       |              | is not supported by  |                  |
  |       |              | the MS.              |                  |
  |  439  | Other        | request requires     |                  |
  |       | unsupported  | another capability   |                  |
  |       | capability   | not supported by the |                  |
  |       |              | MS.                  |                  |
  +------+--------------+----------------------+------------------+
```

                         Table 1: Status Codes

4.6. Type Definitions

   This section defines types referenced in attribute and element
   definitions.

4.6.1. Boolean

   The value space of boolean is the set {true, false, 1, 0} as defined
   in Section 3.2.2 of [XMLSchema:Part2]. In accordance with this
   definition, the concept of false can be lexically represented by the
   strings "0" and "false" and the concept of true by the strings "1"
   and "true"; implementations MUST support both styles of lexical
   representation.

4.6.2. DTMFChar

   A DTMF character. The value space is the set {0, 1, 2, 3, 4, 5, 6,
   7, 8, 9, #, *, A, B, C, D}.

4.6.3. DTMFString

   A string composed of one or more DTMFChars.

4.6.4. Non-Negative Integer

   The value space of non-negative integer is the infinite set
   {0,1,2,...} as defined in Section 3.3.20 of [XMLSchema:Part2].

   Implementation Note: It is RECOMMENDED that implementations at least
   support a maximum value of a 32-bit integer (2,147,483,647).

4.6.5. Positive Integer

   The value space of positive integer is the infinite set {1,2,...} as
   defined in Section 3.3.25 of [XMLSchema:Part2].

   Implementation Note: It is RECOMMENDED that implementations at least
   support a maximum value of a 32-bit integer (2,147,483,647).

4.6.6. String

   A string in the character encoding associated with the XML element as
   defined in Section 3.2.1 of [XMLSchema:Part2].

4.6.7. Time Designation

   A time designation consists of a non-negative real number followed by
   a time unit identifier.

   The time unit identifiers are "ms" (milliseconds) and "s" (seconds).

   Examples include: "3s", "850ms", "0.7s", ".5s", and "+1.5s".

4.6.8. Percentage

   A percentage consists of a positive integer followed by "%".

   Examples include: "100%", "500%", and "10%".

4.6.9. URI

   Uniform Resource Indicator as defined in [RFC3986].

4.6.10. MIME Media Type

   A string formatted as an IANA MIME media type [MIME.mediatypes]. The
   ABNF [RFC5234] production for the string is:

   type = type-name "/" subtype-name *(";" parameter)

   parameter = parameter-name "=" value

   where "type-name" and "subtype-name" are defined in Section 4.2 of
   [RFC4288], "parameter-name" is defined in Section 4.3 of [RFC4288],
   and "value" is defined in Section 5.1 of [RFC2045].

4.6.11. Language Identifier

   A language identifier labels information content as being of a
   particular human language variant. Following the XML specification
   for language identification [XML], a legal language identifier is
   identified by a [RFC5646] code and matched according to [RFC4647].

4.6.12. DateTime

   A string formatted according to the XML schema definition of a
   dateTime type [XMLSchema:Part2].

5. Formal Syntax

   This section defines the XML schema for IVR Control Package. The
   schema is normative.

   The schema defines datatypes, attributes, dialog management, and IVR
   dialog elements in the urn:ietf:params:xml:ns:msc-ivr namespace. In
   most elements the order of child elements is significant. The schema
   is extensible: elements allow attributes and child elements from
   other namespaces. Elements from outside this package's namespace can
   occur after elements defined in this package.

   The schema is dependent upon the schema (framework.xsd) defined in
   Appendix A.1 of the Control Framework [RFC6230]. It is also
   dependent upon the W3C (xml.xsd) schema for definitions of XML
   attributes (e.g., xml:base).

```
<?xml version="1.0" encoding="UTF-8"?>
<xsd:schema targetNamespace="urn:ietf:params:xml:ns:msc-ivr"
 elementFormDefault="qualified" blockDefault="#all"
 xmlns="urn:ietf:params:xml:ns:msc-ivr"
 xmlns:fw="urn:ietf:params:xml:ns:control:framework-attributes"
 xmlns:xsd="http://www.w3.org/2001/XMLSchema">

 <xsd:annotation>
  <xsd:documentation>
    IETF MediaCtrl IVR 1.0 (20110104)

    This is the schema of the IETF MediaCtrl IVR Control
    Package.

    The schema namespace is urn:ietf:params:xml:ns:msc-ivr

  </xsd:documentation>
 </xsd:annotation>

 <!--
    ###########################################################

    SCHEMA IMPORTS

    ###########################################################
 -->
```

```
 <xsd:import namespace="http://www.w3.org/XML/1998/namespace"
  schemaLocation="http://www.w3.org/2001/xml.xsd">
  <xsd:annotation>
   <xsd:documentation>
    This import brings in the XML attributes for
    xml:base, xml:lang, etc

    See http://www.w3.org/2001/xml.xsd for latest version
   </xsd:documentation>
  </xsd:annotation>
 </xsd:import>

 <xsd:import
  namespace="urn:ietf:params:xml:ns:control:framework-attributes"
  schemaLocation="framework.xsd">
  <xsd:annotation>
   <xsd:documentation>
    This import brings in the framework attributes for
    conferenceid and connectionid.
   </xsd:documentation>
  </xsd:annotation>
 </xsd:import>


 <!--
   ####################################################

   Extensible core type

   ####################################################
 -->


 <xsd:complexType name="Tcore">
  <xsd:annotation>
   <xsd:documentation>
    This type is extended by other (non-mixed) component types to
    allow attributes from other namespaces.
   </xsd:documentation>
  </xsd:annotation>
  <xsd:sequence/>
  <xsd:anyAttribute namespace="##other" processContents="lax" />
 </xsd:complexType>


 <!--
   ####################################################
```

```
  TOP LEVEL ELEMENT: mscivr

  ##################################################
 -->

 <xsd:complexType name="mscivrType">
  <xsd:complexContent>
   <xsd:extension base="Tcore">
    <xsd:sequence>
     <xsd:choice>
      <xsd:element ref="dialogprepare" />
      <xsd:element ref="dialogstart" />
      <xsd:element ref="dialogterminate" />
      <xsd:element ref="response" />
      <xsd:element ref="event" />
      <xsd:element ref="audit" />
      <xsd:element ref="auditresponse" />
      <xsd:any namespace="##other" minOccurs="0"
       maxOccurs="unbounded" processContents="lax" />
     </xsd:choice>
    </xsd:sequence>
    <xsd:attribute name="version" type="version.datatype"
     use="required" />
    <xsd:attribute name="desclang" type="xsd:language"
     default="i-default" />
   </xsd:extension>
  </xsd:complexContent>
 </xsd:complexType>

 <xsd:element name="mscivr" type="mscivrType" />


 <!--
  ##################################################

  DIALOG MANAGEMENT TYPES

  ##################################################
 -->

 <!-- dialogprepare -->

 <xsd:complexType name="dialogprepareType">
  <xsd:complexContent>
   <xsd:extension base="Tcore">
    <xsd:sequence>
     <xsd:element ref="dialog" minOccurs="0"
      maxOccurs="1" />
```

```
    <xsd:element ref="params" minOccurs="0"
     maxOccurs="1" />
    <xsd:any namespace="##other" minOccurs="0"
     maxOccurs="unbounded" processContents="lax" />
   </xsd:sequence>
   <xsd:attribute name="src" type="xsd:anyURI" />
   <xsd:attribute name="type" type="mime.datatype"/>
   <xsd:attribute name="maxage" type="xsd:nonNegativeInteger"/>
   <xsd:attribute name="maxstale" type="xsd:nonNegativeInteger"/>
   <xsd:attribute name="fetchtimeout"
    type="timedesignation.datatype" default="30s" />
   <xsd:attribute name="dialogid"
    type="dialogid.datatype" />
  </xsd:extension>
 </xsd:complexContent>
</xsd:complexType>

<xsd:element name="dialogprepare" type="dialogprepareType" />

<!--  dialogstart -->

<xsd:complexType name="dialogstartType">
 <xsd:complexContent>
  <xsd:extension base="Tcore">
   <xsd:sequence>
    <xsd:element ref="dialog" minOccurs="0"
     maxOccurs="1" />
    <xsd:element ref="subscribe" minOccurs="0"
     maxOccurs="1" />
    <xsd:element ref="params" minOccurs="0"
     maxOccurs="1" />
    <xsd:element ref="stream" minOccurs="0"
     maxOccurs="unbounded" />
    <xsd:any namespace="##other" minOccurs="0"
     maxOccurs="unbounded" processContents="lax" />
   </xsd:sequence>
   <xsd:attribute name="src" type="xsd:anyURI" />
   <xsd:attribute name="type" type="mime.datatype"/>
   <xsd:attribute name="maxage" type="xsd:nonNegativeInteger"/>
   <xsd:attribute name="maxstale" type="xsd:nonNegativeInteger"/>
   <xsd:attribute name="fetchtimeout"
    type="timedesignation.datatype" default="30s" />
   <xsd:attribute name="dialogid"
    type="dialogid.datatype" />
   <xsd:attribute name="prepareddialogid"
    type="dialogid.datatype" />
   <xsd:attributeGroup ref="fw:framework-attributes" />
  </xsd:extension>
```

```
   </xsd:complexContent>
  </xsd:complexType>

  <xsd:element name="dialogstart" type="dialogstartType" />

  <!--  dialogterminate -->

  <xsd:complexType name="dialogterminateType">
   <xsd:complexContent>
    <xsd:extension base="Tcore">
    <xsd:sequence>
     <xsd:any namespace="##other" minOccurs="0"
       maxOccurs="unbounded" processContents="lax" />
     </xsd:sequence>
     <xsd:attribute name="dialogid"
      type="dialogid.datatype" use="required" />
     <xsd:attribute name="immediate"
      type="xsd:boolean" default="false" />
    </xsd:extension>
   </xsd:complexContent>
  </xsd:complexType>

  <xsd:element name="dialogterminate" type="dialogterminateType" />

  <!--  response -->

  <xsd:complexType name="responseType">
   <xsd:complexContent>
    <xsd:extension base="Tcore">
     <xsd:sequence>
     <xsd:any namespace="##other" minOccurs="0"
       maxOccurs="unbounded" processContents="lax" />
     </xsd:sequence>
     <xsd:attribute name="status" type="status.datatype"
      use="required" />
     <xsd:attribute name="reason" type="xsd:string" />
     <xsd:attribute name="desclang" type="xsd:language"/>
     <xsd:attribute name="dialogid"
      type="dialogid.datatype" use="required" />
     <xsd:attributeGroup ref="fw:framework-attributes" />
    </xsd:extension>
   </xsd:complexContent>
  </xsd:complexType>

  <xsd:element name="response" type="responseType" />

  <!--  event -->
```

```
  <xsd:complexType name="eventType">
   <xsd:complexContent>
    <xsd:extension base="Tcore">
     <xsd:sequence>
      <xsd:choice>
       <xsd:element ref="dialogexit" minOccurs="0"
        maxOccurs="1" />
       <xsd:element ref="dtmfnotify" minOccurs="0"
        maxOccurs="1" />
       <xsd:any namespace="##other" minOccurs="0"
        maxOccurs="unbounded" processContents="lax" />
      </xsd:choice>
     </xsd:sequence>
     <xsd:attribute name="dialogid"
      type="dialogid.datatype" use="required" />
    </xsd:extension>
   </xsd:complexContent>
  </xsd:complexType>

  <xsd:element name="event" type="eventType" />

  <!-- dialogexit-->

  <xsd:complexType name="dialogexitType">
   <xsd:complexContent>
    <xsd:extension base="Tcore">
     <xsd:sequence>
      <xsd:element ref="promptinfo" minOccurs="0"
       maxOccurs="1" />
      <xsd:element ref="controlinfo" minOccurs="0"
       maxOccurs="1" />
      <xsd:element ref="collectinfo" minOccurs="0"
       maxOccurs="1" />
      <xsd:element ref="recordinfo" minOccurs="0"
       maxOccurs="1" />
      <xsd:element ref="params" minOccurs="0"
       maxOccurs="1" />
      <xsd:any namespace="##other" minOccurs="0"
       maxOccurs="unbounded" processContents="lax" />
     </xsd:sequence>
     <xsd:attribute name="status"
      type="xsd:nonNegativeInteger" use="required" />
     <xsd:attribute name="reason" type="xsd:string" />
     <xsd:attribute name="desclang" type="xsd:language"/>
    </xsd:extension>
   </xsd:complexContent>
  </xsd:complexType>
```

```
  <xsd:element name="dialogexit" type="dialogexitType" />


  <!--  dtmfnotify-->

  <xsd:complexType name="dtmfnotifyType">
   <xsd:complexContent>
    <xsd:extension base="Tcore">
    <xsd:sequence>
     <xsd:any namespace="##other" minOccurs="0"
      maxOccurs="unbounded" processContents="lax" />
     </xsd:sequence>
     <xsd:attribute name="matchmode"
      type="matchmode.datatype" default="all" />
     <xsd:attribute name="dtmf" type="dtmfstring.datatype"
      use="required" />
     <xsd:attribute name="timestamp" type="xsd:dateTime"
      use="required" />
    </xsd:extension>
   </xsd:complexContent>
  </xsd:complexType>

  <xsd:element name="dtmfnotify" type="dtmfnotifyType" />


  <!-- promptinfo -->

  <xsd:complexType name="promptinfoType">
   <xsd:complexContent>
    <xsd:extension base="Tcore">
  <xsd:sequence>
     <xsd:any namespace="##other" minOccurs="0"
      maxOccurs="unbounded" processContents="lax" />
     </xsd:sequence>
     <xsd:attribute name="duration"
      type="xsd:nonNegativeInteger" />
     <xsd:attribute name="termmode"
      type="prompt_termmode.datatype" use="required" />
    </xsd:extension>
   </xsd:complexContent>
  </xsd:complexType>

  <xsd:element name="promptinfo" type="promptinfoType" />


  <!-- controlinfo -->

  <xsd:complexType name="controlinfoType">
```

```
  <xsd:complexContent>
   <xsd:extension base="Tcore">
    <xsd:sequence>
     <xsd:element ref="controlmatch" minOccurs="0"
      maxOccurs="unbounded" />
     <xsd:any namespace="##other" minOccurs="0"
      maxOccurs="unbounded" processContents="lax" />
    </xsd:sequence>
   </xsd:extension>
  </xsd:complexContent>
 </xsd:complexType>

 <xsd:element name="controlinfo" type="controlinfoType" />


 <!-- controlmatch -->

 <xsd:complexType name="controlmatchType">
  <xsd:complexContent>
   <xsd:extension base="Tcore">
<xsd:sequence>
    <xsd:any namespace="##other" minOccurs="0"
      maxOccurs="unbounded" processContents="lax" />
    </xsd:sequence>
    <xsd:attribute name="dtmf"
     type="dtmfstring.datatype" />
    <xsd:attribute name="timestamp" type="xsd:dateTime" />
   </xsd:extension>
  </xsd:complexContent>
 </xsd:complexType>

 <xsd:element name="controlmatch" type="controlmatchType" />


 <!--  collectinfo -->

 <xsd:complexType name="collectinfoType">
  <xsd:complexContent>
   <xsd:extension base="Tcore">
<xsd:sequence>
    <xsd:any namespace="##other" minOccurs="0"
      maxOccurs="unbounded" processContents="lax" />
    </xsd:sequence>
    <xsd:attribute name="dtmf"
     type="dtmfstring.datatype" />
    <xsd:attribute name="termmode"
     type="collect_termmode.datatype" use="required" />
   </xsd:extension>
```

```
    </xsd:complexContent>
   </xsd:complexType>

   <xsd:element name="collectinfo" type="collectinfoType" />


   <!-- recordinfo -->

   <xsd:complexType name="recordinfoType">
    <xsd:complexContent>
     <xsd:extension base="Tcore">
     <xsd:sequence>
       <xsd:element ref="mediainfo" minOccurs="0"
        maxOccurs="unbounded" />
       <xsd:any namespace="##other" minOccurs="0"
        maxOccurs="unbounded" processContents="lax" />
      </xsd:sequence>
      <xsd:attribute name="duration"
       type="xsd:nonNegativeInteger" />
      <xsd:attribute name="termmode"
       type="record_termmode.datatype" use="required" />
     </xsd:extension>
    </xsd:complexContent>
   </xsd:complexType>

   <xsd:element name="recordinfo" type="recordinfoType" />

   <!--  mediainfo -->

   <xsd:complexType name="mediainfoType">
    <xsd:complexContent>
     <xsd:extension base="Tcore">
   <xsd:sequence>
       <xsd:any namespace="##other" minOccurs="0"
         maxOccurs="unbounded" processContents="lax" />
      </xsd:sequence>
      <xsd:attribute name="loc" type="xsd:anyURI"
       use="required" />
      <xsd:attribute name="type" type="mime.datatype"
      use="required"/>
      <xsd:attribute name="size"
       type="xsd:nonNegativeInteger" />
     </xsd:extension>
    </xsd:complexContent>
   </xsd:complexType>
   <xsd:element name="mediainfo" type="mediainfoType" />
```

```
 <!--   subscribe -->

 <xsd:complexType name="subscribeType">
  <xsd:complexContent>
   <xsd:extension base="Tcore">
    <xsd:sequence>
     <xsd:element ref="dtmfsub" minOccurs="0"
      maxOccurs="unbounded" />
     <xsd:any namespace="##other" minOccurs="0"
      maxOccurs="unbounded" processContents="lax" />
    </xsd:sequence>
   </xsd:extension>
  </xsd:complexContent>
 </xsd:complexType>

 <xsd:element name="subscribe" type="subscribeType" />


 <!--   dtmfsub -->

 <xsd:complexType name="dtmfsubType">
  <xsd:complexContent>
   <xsd:extension base="Tcore">
 <xsd:sequence>
    <xsd:any namespace="##other" minOccurs="0"
      maxOccurs="unbounded" processContents="lax" />
    </xsd:sequence>
    <xsd:attribute name="matchmode"
     type="matchmode.datatype" default="all" />
   </xsd:extension>
  </xsd:complexContent>
 </xsd:complexType>

 <xsd:element name="dtmfsub" type="dtmfsubType" />


 <!-- params -->
 <xsd:complexType name="paramsType">
  <xsd:complexContent>
   <xsd:extension base="Tcore">
    <xsd:sequence>
     <xsd:element ref="param" minOccurs="0"
      maxOccurs="unbounded" />
     <xsd:any namespace="##other" minOccurs="0"
      maxOccurs="unbounded" processContents="lax" />
    </xsd:sequence>
   </xsd:extension>
  </xsd:complexContent>
```

```
   </xsd:complexType>

  <xsd:element name="params" type="paramsType" />


  <!--  param -->
  <!--  doesn't extend tCore since its content model is mixed -->
  <xsd:complexType name="paramType" mixed="true">
   <xsd:sequence/>
   <xsd:attribute name="name" type="xsd:string" use="required" />
   <xsd:attribute name="type" type="mime.datatype" default="text/plain"/>
      <xsd:attribute name="encoding" type="xsd:string"/>
   <xsd:anyAttribute namespace="##other" processContents="lax" />
  </xsd:complexType>

  <xsd:element name="param" type="paramType" />


  <!--  stream -->

  <xsd:complexType name="streamType">
   <xsd:complexContent>
    <xsd:extension base="Tcore">
    <xsd:sequence>
      <xsd:element ref="region" minOccurs="0"
       maxOccurs="1" />
     <xsd:element ref="priority" minOccurs="0"
       maxOccurs="1" />
      <xsd:any namespace="##other" minOccurs="0"
       maxOccurs="unbounded" processContents="lax" />
     </xsd:sequence>
     <xsd:attribute name="media" type="media.datatype"
      use="required" />
     <xsd:attribute name="label" type="label.datatype" />
     <xsd:attribute name="direction"
      type="direction.datatype" default="sendrecv" />
    </xsd:extension>
   </xsd:complexContent>
  </xsd:complexType>

  <xsd:element name="stream" type="streamType" />

<!--  region  -->
<xsd:simpleType name="regionType">
 <xsd:restriction base="xsd:NMTOKEN"/>
</xsd:simpleType>
  <xsd:element name="region" type="regionType" />
```

```
 <!--  priority  -->
 <xsd:simpleType name="priorityType">
  <xsd:restriction base="xsd:positiveInteger" />
 </xsd:simpleType>

 <xsd:element name="priority" type="priorityType" />


<!-- dialog -->

 <xsd:complexType name="dialogType">
  <xsd:complexContent>
   <xsd:extension base="Tcore">
    <xsd:sequence>
     <xsd:element ref="prompt" minOccurs="0"
      maxOccurs="1" />
     <xsd:element ref="control" minOccurs="0"
      maxOccurs="1" />
     <xsd:element ref="collect" minOccurs="0"
      maxOccurs="1" />
     <xsd:element ref="record" minOccurs="0"
      maxOccurs="1" />
     <xsd:any namespace="##other" minOccurs="0"
      maxOccurs="unbounded" processContents="lax" />
    </xsd:sequence>
    <xsd:attribute name="repeatCount"
     type="xsd:nonNegativeInteger" default="1" />
    <xsd:attribute name="repeatDur"
     type="timedesignation.datatype" />
    <xsd:attribute name="repeatUntilComplete"
     type="xsd:boolean" default="false"/>
   </xsd:extension>
  </xsd:complexContent>
 </xsd:complexType>

 <xsd:element name="dialog" type="dialogType" />


 <!--  prompt  -->

 <xsd:complexType name="promptType">
  <xsd:complexContent>
   <xsd:extension base="Tcore">
    <xsd:choice minOccurs="1" maxOccurs="unbounded">
     <xsd:element ref="media" />
     <xsd:element ref="variable" />
     <xsd:element ref="dtmf" />
     <xsd:element ref="par" />
```

```
      <xsd:any namespace="##other"
       processContents="lax" />
    </xsd:choice>
    <xsd:attribute ref="xml:base" />
    <xsd:attribute name="bargein" type="xsd:boolean"
     default="true" />
   </xsd:extension>
  </xsd:complexContent>
 </xsd:complexType>

 <xsd:element name="prompt" type="promptType" />


 <!--  media -->

 <xsd:complexType name="mediaType">
  <xsd:complexContent>
   <xsd:extension base="Tcore">
 <xsd:sequence>
    <xsd:any namespace="##other" minOccurs="0"
      maxOccurs="unbounded" processContents="lax" />
    </xsd:sequence>
    <xsd:attribute name="loc" type="xsd:anyURI"
     use="required" />
    <xsd:attribute name="type" type="mime.datatype" />
    <xsd:attribute name="fetchtimeout"
     type="timedesignation.datatype" default="30s" />
    <xsd:attribute name="soundLevel"
     type="percentage.datatype" default="100%" />
    <xsd:attribute name="clipBegin"
     type="timedesignation.datatype" default="0s" />
     <xsd:attribute name="clipEnd"
     type="timedesignation.datatype"/>
   </xsd:extension>
  </xsd:complexContent>
 </xsd:complexType>

 <xsd:element name="media" type="mediaType" />

 <!--  variable -->

 <xsd:complexType name="variableT">
  <xsd:complexContent>
   <xsd:extension base="Tcore">
 <xsd:sequence>
    <xsd:any namespace="##other" minOccurs="0"
      maxOccurs="unbounded" processContents="lax" />
    </xsd:sequence>
```

```
      <xsd:attribute name="value" type="xsd:string"
       use="required" />
      <xsd:attribute name="type" type="xsd:string"
       use="required" />
      <xsd:attribute name="format" type="xsd:string" />
      <xsd:attribute name="gender" type="gender.datatype" />
      <xsd:attribute ref="xml:lang" />
     </xsd:extension>
    </xsd:complexContent>
  </xsd:complexType>

  <xsd:element name="variable" type="variableT" />

  <!-- dtmf -->

  <xsd:complexType name="dtmfType">
   <xsd:complexContent>
    <xsd:extension base="Tcore">
  <xsd:sequence>
     <xsd:any namespace="##other" minOccurs="0"
      maxOccurs="unbounded" processContents="lax" />
     </xsd:sequence>
     <xsd:attribute name="digits"
      type="dtmfstring.datatype" use="required" />
     <xsd:attribute name="level" type="xsd:integer"
      default="-6" />
     <xsd:attribute name="duration"
      type="timedesignation.datatype" default="100ms" />
     <xsd:attribute name="interval"
      type="timedesignation.datatype" default="100ms" />
    </xsd:extension>
   </xsd:complexContent>
  </xsd:complexType>

  <xsd:element name="dtmf" type="dtmfType" />


  <!--  par  -->

  <xsd:complexType name="parType">
   <xsd:complexContent>
    <xsd:extension base="Tcore">
     <xsd:choice minOccurs="1" maxOccurs="unbounded">
      <xsd:element ref="media" />
      <xsd:element ref="variable" />
      <xsd:element ref="dtmf" />
            <xsd:element ref="seq" />
      <xsd:any namespace="##other"
```

```
      processContents="lax" />
    </xsd:choice>
    <xsd:attribute name="endsync" type="endsync.datatype"
    default="last"/>
   </xsd:extension>
  </xsd:complexContent>
 </xsd:complexType>

 <xsd:element name="par" type="parType" />

 <!--  seq  -->

 <xsd:complexType name="seqType">
  <xsd:complexContent>
   <xsd:extension base="Tcore">
    <xsd:choice minOccurs="1" maxOccurs="unbounded">
     <xsd:element ref="media" />
     <xsd:element ref="variable" />
     <xsd:element ref="dtmf" />
     <xsd:any namespace="##other"
      processContents="lax" />
    </xsd:choice>
   </xsd:extension>
  </xsd:complexContent>
 </xsd:complexType>

 <xsd:element name="seq" type="seqType" />

 <!-- control -->

 <xsd:complexType name="controlType">
  <xsd:complexContent>
   <xsd:extension base="Tcore">
 <xsd:sequence>
    <xsd:any namespace="##other" minOccurs="0"
      maxOccurs="unbounded" processContents="lax" />
    </xsd:sequence>
    <xsd:attribute name="skipinterval"
     type="timedesignation.datatype" default="6s" />
    <xsd:attribute name="ffkey" type="dtmfchar.datatype" />
    <xsd:attribute name="rwkey" type="dtmfchar.datatype" />
    <xsd:attribute name="pauseinterval"
     type="timedesignation.datatype" default="10s" />
    <xsd:attribute name="pausekey"
     type="dtmfchar.datatype" />
    <xsd:attribute name="resumekey"
     type="dtmfchar.datatype" />
    <xsd:attribute name="volumeinterval"
```

```
        type="percentage.datatype" default="10%" />
      <xsd:attribute name="volupkey"
       type="dtmfchar.datatype" />
      <xsd:attribute name="voldnkey"
       type="dtmfchar.datatype" />
      <xsd:attribute name="speedinterval"
       type="percentage.datatype" default="10%" />
      <xsd:attribute name="speedupkey"
       type="dtmfchar.datatype" />
      <xsd:attribute name="speeddnkey"
       type="dtmfchar.datatype" />
      <xsd:attribute name="gotostartkey"
       type="dtmfchar.datatype" />
      <xsd:attribute name="gotoendkey"
       type="dtmfchar.datatype" />
      <xsd:attribute name="external"
       type="dtmfstring.datatype" />
    </xsd:extension>
   </xsd:complexContent>
  </xsd:complexType>

  <xsd:element name="control" type="controlType" />


  <!-- collect -->

  <xsd:complexType name="collectType">
   <xsd:complexContent>
    <xsd:extension base="Tcore">
     <xsd:sequence>
      <xsd:element ref="grammar" minOccurs="0"
       maxOccurs="1" />
      <xsd:any namespace="##other" minOccurs="0"
       maxOccurs="unbounded" processContents="lax" />
     </xsd:sequence>
     <xsd:attribute name="cleardigitbuffer"
      type="xsd:boolean" default="true" />
     <xsd:attribute name="timeout"
      type="timedesignation.datatype" default="5s" />
     <xsd:attribute name="interdigittimeout"
      type="timedesignation.datatype" default="2s" />
     <xsd:attribute name="termtimeout"
      type="timedesignation.datatype" default="0s" />
     <xsd:attribute name="escapekey"
      type="dtmfchar.datatype" />
     <xsd:attribute name="termchar"
      type="dtmfchar.datatype" default="#" />
     <xsd:attribute name="maxdigits"
```

```
     type="xsd:positiveInteger" default="5" />
    </xsd:extension>
   </xsd:complexContent>
  </xsd:complexType>

  <xsd:element name="collect" type="collectType" />

  <!--  grammar -->
  <!--  doesn't extend tCore since its content model is mixed -->
  <xsd:complexType name="grammarType" mixed="true">
   <xsd:sequence>
    <xsd:any namespace="##other" minOccurs="0"
     maxOccurs="unbounded" processContents="lax" />
   </xsd:sequence>
   <xsd:attribute name="src" type="xsd:anyURI" />
   <xsd:attribute name="type" type="mime.datatype" />
   <xsd:attribute name="fetchtimeout"
    type="timedesignation.datatype" default="30s" />
   <xsd:anyAttribute namespace="##other" processContents="lax" />
  </xsd:complexType>

  <xsd:element name="grammar" type="grammarType" />

  <!-- record -->

  <xsd:complexType name="recordType">
   <xsd:complexContent>
    <xsd:extension base="Tcore">
    <xsd:sequence>
      <xsd:element ref="media" minOccurs="0"
       maxOccurs="unbounded" />
      <xsd:any namespace="##other" minOccurs="0"
       maxOccurs="unbounded" processContents="lax" />
     </xsd:sequence>
     <xsd:attribute name="timeout"
      type="timedesignation.datatype" default="5s" />
     <xsd:attribute name="beep" type="xsd:boolean"
      default="false" />
     <xsd:attribute name="vadinitial"
      type="xsd:boolean" default="false" />
     <xsd:attribute name="vadfinal"
      type="xsd:boolean" default="false" />
     <xsd:attribute name="dtmfterm"
      type="xsd:boolean" default="true" />
     <xsd:attribute name="maxtime"
      type="timedesignation.datatype" default="15s" />
     <xsd:attribute name="finalsilence"
      type="timedesignation.datatype" default="5s" />
```

```
    <xsd:attribute name="append" type="xsd:boolean"
     default="false" />
   </xsd:extension>
  </xsd:complexContent>
 </xsd:complexType>

 <xsd:element name="record" type="recordType" />

 <!--
   ####################################################

   AUDIT TYPES

   ####################################################
 -->


 <!-- audit -->

 <xsd:complexType name="auditType">
  <xsd:complexContent>
   <xsd:extension base="Tcore">
 <xsd:sequence>
    <xsd:any namespace="##other" minOccurs="0"
     maxOccurs="unbounded" processContents="lax" />
    </xsd:sequence>
   <xsd:attribute name="capabilities"
     type="xsd:boolean" default="true" />
   <xsd:attribute name="dialogs"
     type="xsd:boolean" default="true" />
     <xsd:attribute name="dialogid"
     type="dialogid.datatype"/>
   </xsd:extension>
  </xsd:complexContent>
 </xsd:complexType>

 <xsd:element name="audit" type="auditType" />

 <!-- auditresponse -->

 <xsd:complexType name="auditresponseType">
  <xsd:complexContent>
   <xsd:extension base="Tcore">
    <xsd:sequence>
     <xsd:element ref="capabilities" minOccurs="0"
      maxOccurs="1" />
     <xsd:element ref="dialogs" minOccurs="0"
      maxOccurs="1" />
```

```
      <xsd:any namespace="##other" minOccurs="0"
       maxOccurs="unbounded" processContents="lax" />
     </xsd:sequence>
     <xsd:attribute name="status" type="status.datatype"
      use="required" />
     <xsd:attribute name="reason" type="xsd:string" />
     <xsd:attribute name="desclang" type="xsd:language"/>
    </xsd:extension>
   </xsd:complexContent>
  </xsd:complexType>

  <xsd:element name="auditresponse" type="auditresponseType" />

  <!-- codec -->

  <xsd:complexType name="codecType">
   <xsd:complexContent>
    <xsd:extension base="Tcore">
     <xsd:sequence>
      <xsd:element ref="subtype" minOccurs="1"
       maxOccurs="1" />
      <xsd:element ref="params" minOccurs="0"
       maxOccurs="1" />
      <xsd:any namespace="##other" minOccurs="0"
       maxOccurs="unbounded" processContents="lax" />
     </xsd:sequence>
       <xsd:attribute name="name" type="xsd:string"
      use="required" />
    </xsd:extension>
   </xsd:complexContent>
  </xsd:complexType>

  <xsd:element name="codec" type="codecType" />

  <!-- subtype -->

  <xsd:simpleType name="subtypeType">
   <xsd:restriction base="xsd:string" />
  </xsd:simpleType>

  <xsd:element name="subtype" type="subtypeType" />


  <!-- codecs -->

  <xsd:complexType name="codecsType">
   <xsd:complexContent>
    <xsd:extension base="Tcore">
```

```
   <xsd:sequence>
    <xsd:element ref="codec" minOccurs="0"
     maxOccurs="unbounded" />
    <xsd:any namespace="##other" minOccurs="0"
     maxOccurs="unbounded" processContents="lax" />
   </xsd:sequence>
  </xsd:extension>
 </xsd:complexContent>
</xsd:complexType>

<xsd:element name="codecs" type="codecsType" />


<!-- capabilities -->

<xsd:complexType name="capabilitiesType">
 <xsd:complexContent>
  <xsd:extension base="Tcore">
   <xsd:sequence>
    <xsd:element ref="dialoglanguages" minOccurs="1"
     maxOccurs="1" />
    <xsd:element ref="grammartypes" minOccurs="1"
     maxOccurs="1" />
    <xsd:element ref="recordtypes" minOccurs="1"
     maxOccurs="1" />
    <xsd:element ref="prompttypes" minOccurs="1"
     maxOccurs="1" />
    <xsd:element ref="variables" minOccurs="1"
     maxOccurs="1" />
     <xsd:element ref="maxpreparedduration" minOccurs="1"
     maxOccurs="1" />
     <xsd:element ref="maxrecordduration" minOccurs="1"
     maxOccurs="1" />
    <xsd:element ref="codecs" minOccurs="1"
     maxOccurs="1" />
    <xsd:any namespace="##other" minOccurs="0"
     maxOccurs="unbounded" processContents="lax" />
   </xsd:sequence>
  </xsd:extension>
 </xsd:complexContent>
</xsd:complexType>

<xsd:element name="capabilities" type="capabilitiesType" />


<!-- mimetype -->

<xsd:element name="mimetype" type="mime.datatype" />
```

```
 <!-- dialoglanguages -->

 <xsd:complexType name="dialoglanguagesType">
  <xsd:complexContent>
   <xsd:extension base="Tcore">
    <xsd:sequence>
     <xsd:element ref="mimetype" minOccurs="0"
      maxOccurs="unbounded" />
     <xsd:any namespace="##other" minOccurs="0"
      maxOccurs="unbounded" processContents="lax" />
    </xsd:sequence>
   </xsd:extension>
  </xsd:complexContent>
 </xsd:complexType>

 <xsd:element name="dialoglanguages" type="dialoglanguagesType" />

 <!-- grammartypes -->

 <xsd:complexType name="grammartypesType">
  <xsd:complexContent>
   <xsd:extension base="Tcore">
    <xsd:sequence>
     <xsd:element ref="mimetype" minOccurs="0"
      maxOccurs="unbounded" />
     <xsd:any namespace="##other" minOccurs="0"
      maxOccurs="unbounded" processContents="lax" />
    </xsd:sequence>
   </xsd:extension>
  </xsd:complexContent>
 </xsd:complexType>

 <xsd:element name="grammartypes" type="grammartypesType" />


 <!-- recordtypes -->

 <xsd:complexType name="recordtypesType">
  <xsd:complexContent>
   <xsd:extension base="Tcore">
    <xsd:sequence>
     <xsd:element ref="mimetype" minOccurs="0"
      maxOccurs="unbounded" />
     <xsd:any namespace="##other" minOccurs="0"
      maxOccurs="unbounded" processContents="lax" />
    </xsd:sequence>
   </xsd:extension>
  </xsd:complexContent>
```

```
    </xsd:complexType>

  <xsd:element name="recordtypes" type="recordtypesType" />


     <!-- prompttypes -->

  <xsd:complexType name="prompttypesType">
   <xsd:complexContent>
    <xsd:extension base="Tcore">
     <xsd:sequence>
      <xsd:element ref="mimetype" minOccurs="0"
       maxOccurs="unbounded" />
      <xsd:any namespace="##other" minOccurs="0"
       maxOccurs="unbounded" processContents="lax" />
     </xsd:sequence>
    </xsd:extension>
   </xsd:complexContent>
  </xsd:complexType>

  <xsd:element name="prompttypes" type="prompttypesType" />

<!--  variables -->

  <xsd:complexType name="variablesType">
   <xsd:complexContent>
    <xsd:extension base="Tcore">
     <xsd:sequence>
      <xsd:element ref="variabletype" minOccurs="0"
       maxOccurs="unbounded" />
      <xsd:any namespace="##other" minOccurs="0"
       maxOccurs="unbounded" processContents="lax" />
     </xsd:sequence>
    </xsd:extension>
   </xsd:complexContent>
  </xsd:complexType>

  <xsd:element name="variables" type="variablesType" />

  <xsd:complexType name="variabletypeType">
   <xsd:complexContent>
    <xsd:extension base="Tcore">
     <xsd:sequence>
      <xsd:element ref="format" minOccurs="0"
       maxOccurs="unbounded" />
      <xsd:any namespace="##other" minOccurs="0"
       maxOccurs="unbounded" processContents="lax" />
     </xsd:sequence>
```

```
    <xsd:attribute name="type" type="xsd:string" use="required" />
    <xsd:attribute name="desc" type="xsd:string"/>
    <xsd:attribute name="desclang" type="xsd:language"/>
   </xsd:extension>
  </xsd:complexContent>
 </xsd:complexType>

 <xsd:element name="variabletype" type="variabletypeType" />

<!--  format  -->
<!--  doesn't extend tCore since its content model is mixed -->
 <xsd:complexType name="formatType" mixed="true">
  <xsd:sequence>
   <xsd:any namespace="##other" minOccurs="0"
    maxOccurs="unbounded" processContents="lax" />
  </xsd:sequence>
  <xsd:attribute name="desc" type="xsd:string" />
  <xsd:attribute name="desclang" type="xsd:language"/>
  <xsd:anyAttribute namespace="##other" processContents="lax" />
 </xsd:complexType>

 <xsd:element name="format" type="formatType" />

<!--  maxpreparedduration -->

 <xsd:element name="maxpreparedduration"
type="timedesignation.datatype"/>


<!--  maxrecordduration -->

 <xsd:element name="maxrecordduration"
type="timedesignation.datatype"/>


 <!-- dialogs -->

 <xsd:complexType name="dialogsType">
  <xsd:complexContent>
   <xsd:extension base="Tcore">
    <xsd:sequence>
     <xsd:element ref="dialogaudit" minOccurs="0"
      maxOccurs="unbounded" />
     <xsd:any namespace="##other" minOccurs="0"
      maxOccurs="unbounded" processContents="lax" />
    </xsd:sequence>
   </xsd:extension>
  </xsd:complexContent>
```

```
    </xsd:complexType>

    <xsd:element name="dialogs" type="dialogsType" />


    <!-- dialogaudit -->

    <xsd:complexType name="dialogauditType">
     <xsd:complexContent>
      <xsd:extension base="Tcore">
       <xsd:sequence>
        <xsd:element ref="codecs" minOccurs="0"
         maxOccurs="1" />
        <xsd:any namespace="##other" minOccurs="0"
         maxOccurs="unbounded" processContents="lax" />
       </xsd:sequence>
       <xsd:attribute name="dialogid"
        type="dialogid.datatype" use="required" />
       <xsd:attribute name="state" type="state.datatype"
        use="required" />
       <xsd:attributeGroup ref="fw:framework-attributes" />
      </xsd:extension>
     </xsd:complexContent>
    </xsd:complexType>

    <xsd:element name="dialogaudit" type="dialogauditType" />


    <!--
      ##################################################

      DATATYPES

      ##################################################
    -->


    <xsd:simpleType name="version.datatype">
     <xsd:restriction base="xsd:NMTOKEN">
      <xsd:enumeration value="1.0" />
     </xsd:restriction>
    </xsd:simpleType>
    <xsd:simpleType name="mime.datatype">
     <xsd:restriction base="xsd:string" />
    </xsd:simpleType>
    <xsd:simpleType name="dialogid.datatype">
     <xsd:restriction base="xsd:string" />
    </xsd:simpleType>
```

```
<xsd:simpleType name="gender.datatype">
 <xsd:restriction base="xsd:NMTOKEN">
  <xsd:enumeration value="female" />
  <xsd:enumeration value="male" />
 </xsd:restriction>
</xsd:simpleType>
<xsd:simpleType name="state.datatype">
 <xsd:restriction base="xsd:NMTOKEN">
  <xsd:enumeration value="preparing" />
  <xsd:enumeration value="prepared" />
  <xsd:enumeration value="starting" />
  <xsd:enumeration value="started" />
 </xsd:restriction>
</xsd:simpleType>
<xsd:simpleType name="status.datatype">
 <xsd:restriction base="xsd:positiveInteger">
  <xsd:pattern value="[0-9][0-9][0-9]" />
 </xsd:restriction>
</xsd:simpleType>
<xsd:simpleType name="media.datatype">
 <xsd:restriction base="xsd:string" />
</xsd:simpleType>
<xsd:simpleType name="label.datatype">
 <xsd:restriction base="xsd:string" />
</xsd:simpleType>
<xsd:simpleType name="direction.datatype">
 <xsd:restriction base="xsd:NMTOKEN">
  <xsd:enumeration value="sendrecv" />
  <xsd:enumeration value="sendonly" />
  <xsd:enumeration value="recvonly" />
  <xsd:enumeration value="inactive" />
 </xsd:restriction>
</xsd:simpleType>
<xsd:simpleType name="timedesignation.datatype">
 <xsd:annotation>
  <xsd:documentation>
   Time designation following Time in CSS2
  </xsd:documentation>
 </xsd:annotation>
 <xsd:restriction base="xsd:string">
  <xsd:pattern value="(\+)?([0-9]*\.)?[0-9]+(ms|s)" />
 </xsd:restriction>
</xsd:simpleType>
<xsd:simpleType name="dtmfchar.datatype">
 <xsd:annotation>
  <xsd:documentation>
   DTMF character [0-9#*A-D]
  </xsd:documentation>
```

```
  </xsd:annotation>
  <xsd:restriction base="xsd:string">
   <xsd:pattern value="[0-9#*A-D]" />
  </xsd:restriction>
 </xsd:simpleType>
 <xsd:simpleType name="dtmfstring.datatype">
  <xsd:annotation>
   <xsd:documentation>
    DTMF sequence [0-9#*A-D]
   </xsd:documentation>
  </xsd:annotation>
  <xsd:restriction base="xsd:string">
   <xsd:pattern value="([0-9#*A-D])+" />
  </xsd:restriction>
 </xsd:simpleType>
 <xsd:simpleType name="percentage.datatype">
  <xsd:annotation>
   <xsd:documentation>
    whole integer followed by '%'
   </xsd:documentation>
  </xsd:annotation>
  <xsd:restriction base="xsd:string">
   <xsd:pattern value="([0-9])+%" />
  </xsd:restriction>
 </xsd:simpleType>

 <xsd:simpleType name="prompt_termmode.datatype">
  <xsd:restriction base="xsd:NMTOKEN">
   <xsd:enumeration value="completed" />
   <xsd:enumeration value="bargein" />
   <xsd:enumeration value="stopped" />
  </xsd:restriction>
 </xsd:simpleType>

 <xsd:simpleType name="collect_termmode.datatype">
  <xsd:restriction base="xsd:NMTOKEN">
   <xsd:enumeration value="match" />
   <xsd:enumeration value="noinput" />
   <xsd:enumeration value="nomatch" />
   <xsd:enumeration value="stopped" />
  </xsd:restriction>
 </xsd:simpleType>

 <xsd:simpleType name="record_termmode.datatype">
  <xsd:restriction base="xsd:NMTOKEN">
   <xsd:enumeration value="noinput" />
   <xsd:enumeration value="dtmf" />
   <xsd:enumeration value="maxtime" />
```

```
    <xsd:enumeration value="finalsilence" />
    <xsd:enumeration value="stopped" />
   </xsd:restriction>
  </xsd:simpleType>

  <xsd:simpleType name="matchmode.datatype">
   <xsd:restriction base="xsd:NMTOKEN">
    <xsd:enumeration value="all" />
    <xsd:enumeration value="collect" />
    <xsd:enumeration value="control" />
   </xsd:restriction>
  </xsd:simpleType>

  <xsd:simpleType name="endsync.datatype">
   <xsd:restriction base="xsd:NMTOKEN">
    <xsd:enumeration value="first" />
    <xsd:enumeration value="last" />
   </xsd:restriction>
  </xsd:simpleType>

</xsd:schema>
```

6. Examples

    This section provides examples of the IVR Control Package.

6.1. AS-MS Dialog Interaction Examples

    The following example assume a Control Channel has been established
    and synced as described in the Media Control Channel Framework
    [RFC6230].

    The XML messages are in angled brackets (with the root <mscivr>
    omitted); the REPORT status is in round brackets. Other aspects of
    the protocol are omitted for readability.

6.1.1. Starting an IVR Dialog

    An IVR dialog is started successfully, and dialogexit notification
    <event> is sent from the MS to the AS when the dialog exits normally.

```
          Application Server (AS)              Media Server (MS)
                |                                     |
                |        (1) CONTROL: <dialogstart>   |
                | ----------------------------------> |
                |                                     |
                |        (2) 202                      |
                | <---------------------------------- |
                |                                     |
                |                                     |
                |        (3) REPORT: <response status="200"/> |
                |                  (terminate)        |
                | <---------------------------------- |
                |                                     |
                |        (4) 200                      |
                | ----------------------------------> |
                |                                     |
                |        (5) CONTROL: <event ... />   |
                |                                     |
                | <---------------------------------- |
                |                                     |
                |        (6) 200                      |
                | ----------------------------------> |
                |                                     |
```
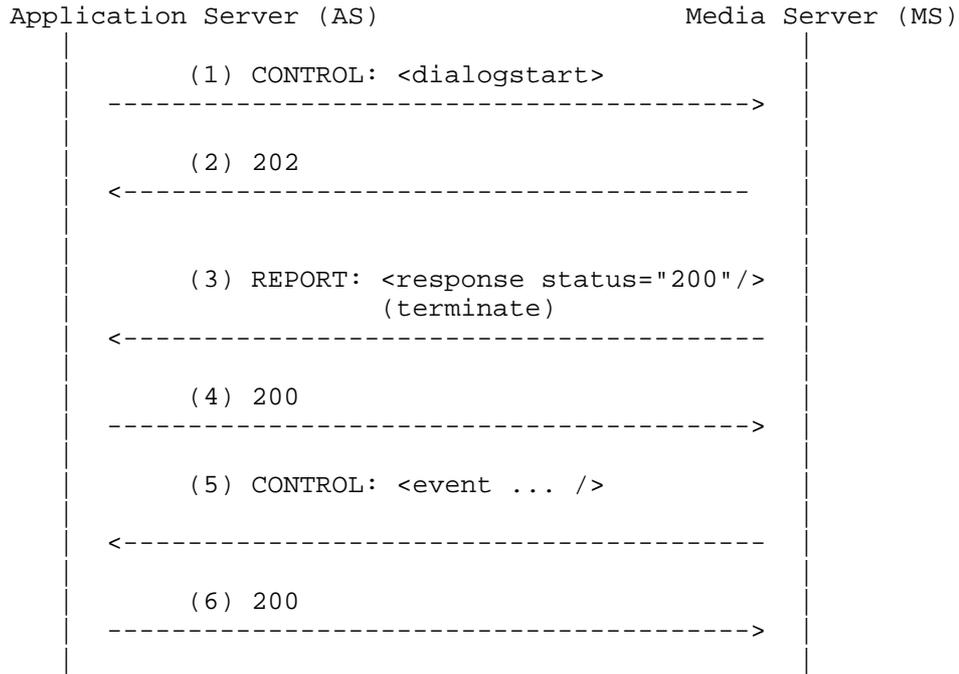
6.1.2. IVR Dialog Fails to Start

   An IVR dialog fails to start due to an unknown dialog language. The
   <response> is reported in a framework 200 message.

```
          Application Server (AS)              Media Server (MS)
                |                                     |
                |        (1) CONTROL: <dialogstart>   |
                | ----------------------------------> |
                |                                     |
                |        (2) 200: <response status="421"/>  |
                | <---------------------------------- |
                |                                     |
```
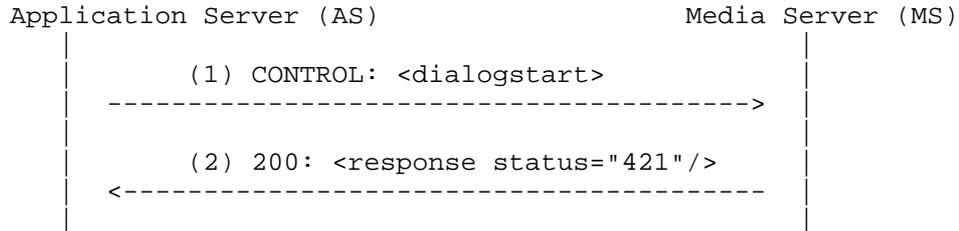
6.1.3. Preparing and Starting an IVR Dialog

   An IVR dialog is prepared and started successfully, and then the
   dialog exits normally.

```
            Application Server (AS)            Media Server (MS)
                 |                                  |
                 |      (1) CONTROL: <dialogprepare> |
                 | --------------------------------------> |
                 |                                  |
                 |      (2) 202                     |
                 | <-------------------------------------- |
                 |                                  |
                 |      (3) REPORT: <response status="200"/> |
                 |                 (terminate)      |
                 | <-------------------------------------- |
                 |                                  |
                 |      (4) 200                     |
                 | --------------------------------------> |
                 |                                  |
                 |      (5) CONTROL: <dialogstart>  |
                 | --------------------------------------> |
                 |                                  |
                 |      (6) 202                     |
                 | <-------------------------------------- |
                 |                                  |
                 |      (7) REPORT: <response status="200"/> |
                 |                 (terminate)      |
                 | <-------------------------------------- |
                 |                                  |
                 |      (8) 200                     |
                 | --------------------------------------> |
                 |                                  |
                 |      (9) CONTROL: <event .../>   |
                 | <-------------------------------------- |
                 |                                  |
                 |      (10) 200                    |
                 | --------------------------------------> |
                 |                                  |
```
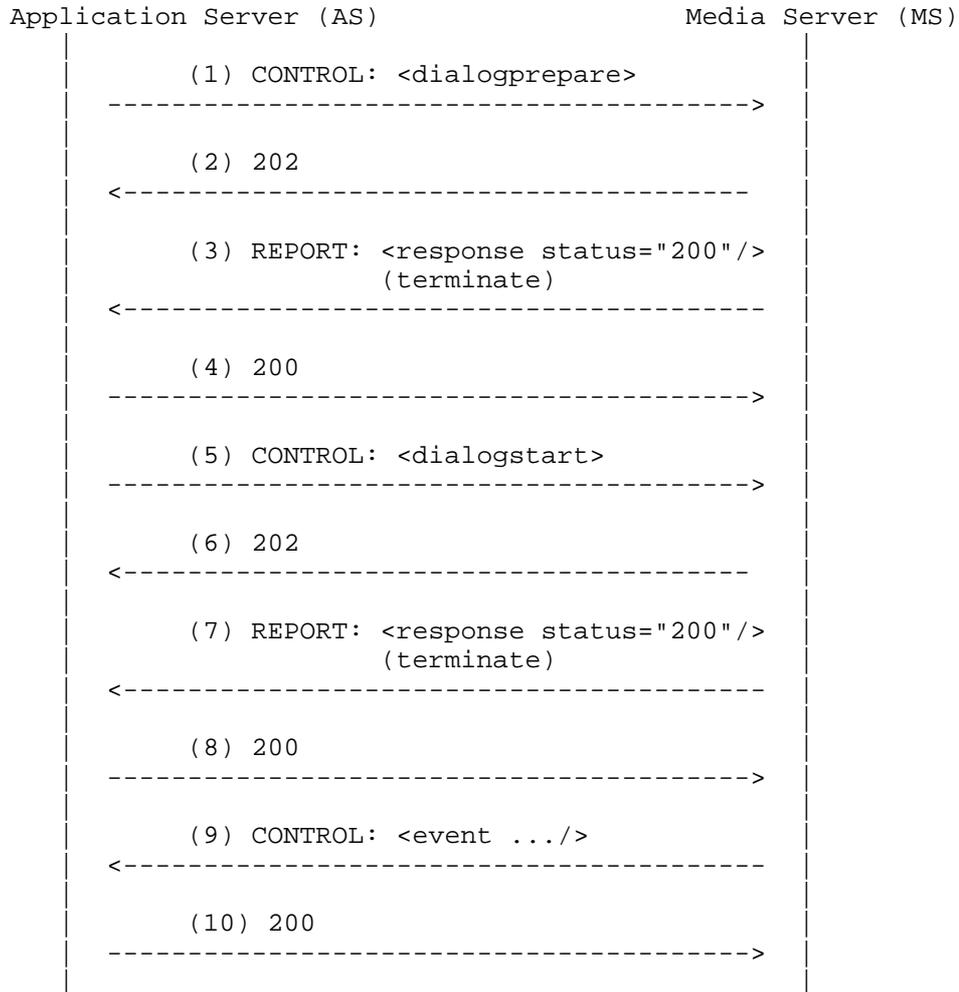
6.1.4. Terminating a Dialog

   An IVR dialog is started successfully, and then terminated by the AS.
   The dialogexit event is sent to the AS when the dialog exits.

```
         Application Server (AS)              Media Server (MS)
           |                                    |
           |        (1) CONTROL: <dialogstart>  |
           | -------------------------------------> |
           |                                    |
           |        (2) 202                     |
           | <------------------------------------- |
           |                                    |
           |        (3) REPORT: <response status="200"/> |
           |                   (terminate)      |
           | <------------------------------------- |
           |                                    |
           |        (4) 200                     |
           | -------------------------------------> |
           |                                    |
           |        (5) CONTROL: <dialogterminate> |
           | -------------------------------------> |
           |                                    |
           |        (6) 200: <response status="200"/> |
           | <------------------------------------- |
           |                                    |
           |        (7) CONTROL: <event .../>   |
           | <------------------------------------- |
           |                                    |
           |        (8) 200                     |
           | -------------------------------------> |
           |                                    |
```
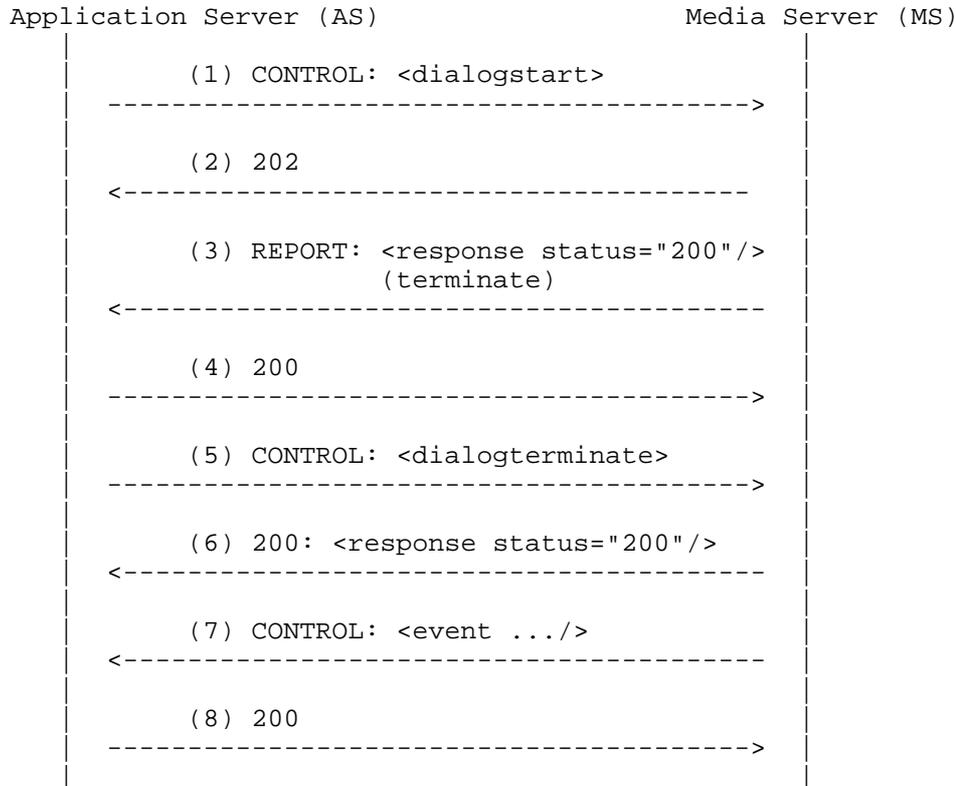
   Note that in (6) the <response> payload to the
   request is carried on a framework 200 response since it could
   complete the requested operation before the transaction timeout.

6.2. IVR Dialog Examples

   The following examples show how <dialog> is used with
   <dialogprepare>, <dialogstart>, and <event> elements to play prompts,
   set runtime controls, collect DTMF input, and record user input.

   The examples do not specify all messages between the AS and MS.

6.2.1. Playing Announcements

   This example prepares an announcement composed of two prompts where
   the dialog repeatCount is set to 2.

   <mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr">
   <dialogprepare>
      <dialog repeatCount="2">
       <prompt>
         <media loc="http://www.example.com/media/Number_09.wav"/>
         <media loc="http://www.example.com/media/Number_11.wav"/>
       </prompt>
      </dialog>
   </dialogprepare>
   </mscivr>

   If the dialog is prepared successfully, a <response> is returned with
   status 200 and a dialog identifier assigned by the MS:

   <mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr">
     <response status="200" dialogid="vxi78"/>
   </mscivr>

   The prepared dialog is then started on a conference playing the
   prompts twice:

   <mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr">
    <dialogstart prepareddialogid="vxi78" conferenceid="conference11"/>
   </mscivr>

   In the case of a successful dialog, the output is provided in
   <event>; for example:

   <mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr">
    <event dialogid="vxi78">
       <dialogexit status="1">
          <promptinfo termmode="completed" duration="24000"/>
       </dialogexit>
    </event>
   </mscivr>

6.2.2. Prompt and Collect

   In this example, a prompt is played and then the MS waits for 30s for
   a two digit sequence:

```
<mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr">
 <dialogstart connectionid="7HDY839:HJKSkyHS~HUwkuh7ns">
 <dialog>
  <prompt>
   <media loc="http://www.example.com/prompt1.wav"/>
  </prompt>
  <collect timeout="30s" maxdigits="2"/>
 </dialog>
 </dialogstart>
</mscivr>
```

If no user input is collected within 30s, then the following
notification event would be returned:

```
<mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr">
 <event dialogid="vxi81">
    <dialogexit status="1" >
       <promptinfo termmode="completed" duration="4000"/>
       <collectinfo termmode="noinput"/>
    </dialogexit>
 </event>
</mscivr>
```

The collect operation can be specified without a prompt. Here the MS
just waits for DTMF input from the user (the maxdigits attribute of
<collect> defaults to 5):

```
<mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr">
 <dialogstart connectionid="7HDY839:HJKSkyHS~HUwkuh7ns">
  <dialog>
   <collect/>
  </dialog>
 </dialogstart>
</mscivr>
```

If the dialog is successful, then dialogexit <event> contains the
dtmf collected in its result parameter:

```
<mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr">
 <event dialogid="vxi80">
    <dialogexit status="1">
       <collectinfo dtmf="12345" termmode="match"/>
    </dialogexit>
 </event>
</mscivr>
```

And finally, in this example, one of the input parameters is invalid:

```
<mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr">
<dialogstart connectionid="7HDY839:HJKSkyHS~HUwkuh7ns">
 <dialog repeatCount="two">
   <prompt>
     <media loc="http://www.example.com/prompt1.wav"/>
   </prompt>
   <collect cleardigitbuffer="true"
   timeout="4s" interdigittimeout="2s"
   termtimeout="0s" maxdigits="2"/>
 </dialog>
</dialogstart>
</mscivr>
```

The error is reported in the response:

```
<mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr">
 <response status="400" dialogid="vxi82"
  reason="repeatCount attribute value invalid: two"/>
</mscivr>
```

6.2.3. Prompt and Record

   In this example, the user is prompted, then their input is recorded
   for a maximum of 30 seconds.

```
<mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr">
<dialogstart connectionid="7HDY839:HJKSkyHS~HUwkuh7ns">
    <dialog>
      <prompt>
       <media loc="http://www.example.com/media/sayname.wav"/>
      </prompt>
      <record dtmfterm="false" maxtime="30s" beep="true"/>
    </dialog>
</dialogstart>
</mscivr>
```

   If successful and the recording is terminated by DTMF, the following
   is returned in a dialogexit <event>:

```
  <mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr">
   <event dialogid="vxi83">
    <dialogexit status="1">
     <recordinfo termmode="dtmf">
      <mediainfo type="audio/x-wav"
        loc="http://www.example.com/recording1.wav"/>
     </recordinfo>
    </dialogexit>
   </event>
  </mscivr>
```

6.2.4. Runtime Controls

   In this example, a prompt is played with the collect operation and
   runtime controls activated.

```
  <mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr">
   <dialogstart connectionid="7HDY839:HJKSkyHS~HUwkuh7ns">
   <dialog>
    <prompt bargein="true">
     <media loc="http://www.example.com/prompt1.wav"/>
    </prompt>
    <control ffkey="5" rwkey="6" speedupkey="3"
            speeddnkey="4"/>
    <collect maxdigits="2"/>
   </dialog>
   </dialogstart>
  </mscivr>
```

   Once the dialog is active, the user can press keys 3, 4, 5, and 6 to
   execute runtime controls on the prompt queue. The keys do not cause
   bargein to occur. If the user presses any other key, then the prompt
   is interrupted and DTMF collect begins. Note that runtime controls
   are not active during the collect operation.

   When the dialog is completed successfully, then both control and
   collect information is reported.

```
   <mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr">
    <event dialogid="vxi81">
       <dialogexit status="1">
          <promptinfo termmode="bargein"/>
          <controlinfo>
           <controlmatch dtmf="4" timestamp="2008-05-12T12:13:14Z"/>
           <controlmatch dtmf="3" timestamp="2008-05-12T12:13:15Z"/>
           <controlmatch dtmf="5" timestamp="2008-05-12T12:13:16Z"/>
          </controlinfo>
          <collectinfo termmode="match" dtmf="14"/>
       </dialogexit>
    </event>
   </mscivr>
```

6.2.5. Subscriptions and Notifications

   In this example, a looped dialog is started with subscription for
   notifications each time the user input matches the collect grammar:

```
   <mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr">
    <dialogstart connectionid="7HDY839:HJKSkyHS">
     <dialog repeatCount="0">
      <collect maxdigits="2"/>
     </dialog>
     <subscribe>
      <dtmfsub matchmode="collect"/>
     </subscribe>
    </dialogstart>
   </mscivr>
```

   Each time the user input the DTMF matching the grammar, the following
   notification event would be sent:

```
   <mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr">
    <event dialogid="vxi81">
       <dtmfnotify matchmode="collect" dtmf="12"
        timestamp="2008-05-12T12:13:14Z"/>
    </event>
   </mscivr>
```

   If no user input was provided, or the input did not match the
   grammar, the dialog would continue to loop until terminated (or an
   error occurred).

6.2.6. Dialog Repetition until DTMF Collection Complete

   This example is a prompt and collect dialog to collect the PIN from
   the user. The repeatUntilComplete attribute in the <dialog> is set

   to true in this case so that when the grammar collection is complete,
   the MS automatically terminates the dialog repeat cycle and reports
   the results in a <dialogexit> event.

```
      <mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr">
       <dialogstart connectionid="7HDY839:HJKSkyHS">
        <dialog repeatCount="3" repeatUntilComplete="true">
         <prompt bargein="true">
           <media loc="http://example.com/please_enter_your_pin.vox"/>
         </prompt>
         <collect maxdigits="4"/>
        </dialog>
       </dialogstart>
      </mscivr>
```

   If the user barges in on the prompt and <collect> receives DTMF input
   matching the grammar, the dialog cycle is considered complete and the
   MS returns the following:

```
      <mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr">
       <event dialogid="vxi81">
         <dialogexit status="1">
           <promptinfo duration="3654" termmode="bargein"/>
           <collectinfo dtmf="1234" termmode="match"/>
         </dialogexit>
       </event>
      </mscivr>
```

   If no user input was provided, or the input did not match the
   grammar, the dialog would loop for a maximum of 3 times.

6.3. Other Dialog Languages

   The following example requests that a VoiceXML dialog is started:

```
   <mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr">
    <dialogstart dialogid="d2"
                 connectionid="7HDY839:HJKSkyHS"
                 type="application/voicexml+xml"
                 src="http://www.example.com/mydialog.vxml"
                 fetchtimeout="15s">
     <params>
      <param name="prompt1">nfs://nas01/media1.3gp</param>
      <param name="prompt2">nfs://nas01/media2.3gp</param>
     </params>
    </dialogstart>
   </mscivr>
```

If the MS does not support this dialog language, then the response
would have the status code 421 (Section 4.5). However, if it does
support the VoiceXML dialog language, it would respond with a 200
status, activate the VoiceXML dialog, and make the <params> available
to the VoiceXML script as described in Section 9.

When the VoiceXML dialog exits, exit namelist parameters are
specified using <params> in the dialogexit event:

```
<mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr">
 <event dialogid="d2">
   <dialogexit status="1">
    <params>
     <param name="username">peter</param>
     <param name="pin">1234</param>
    </params>
   </dialogexit>
  </event>
</mscivr>
```

6.4. Foreign Namespace Attributes and Elements

An MS can support attributes and elements from foreign namespaces
within the <mscivr> element. For example, the MS could support a
<listen> element (in a foreign namespace) for speech recognition by
analogy to how <collect> supports DTMF collection.

In the following example, a prompt and collect request is extended
with a <listen> element:

```
<mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr"
 xmlns:ex="http://www.example.com/mediactrl/extensions/1">
 <dialogstart connectionid="7HDY839:HJKSkyHS~HUwkuh7ns">
 <dialog>
  <prompt>
   <media loc="http://www.example.com/prompt1.wav"/>
  </prompt>
  <collect timeout="30s" maxdigits="4"/>
  <ex:listen maxtimeout="30s" >
    <ex:grammar src="http://example.org/pin.grxml"/>
  </ex:listen>
 </dialog>
 </dialogstart>
</mscivr>
```

In the <mscivr> root element, the xmlns:ex attribute declares that
"ex" is associated with the foreign namespace URI
"http://www.example.com/mediactrl/extensions/1". The <ex:listen>,

   its attributes, and child elements are associated with this
   namespace. This <listen> could be defined so that it activates an
   SRGS grammar and listens for user input matching the grammar in a
   similar manner to DTMF collection.

   If an MS receives this request but does not support the <listen>
   element, then it would send a 431 response:

   <mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr">
    <response status="431" dialogid="d560"
     reason="unsupported foreign listen element"/>
   </mscivr>

   If the MS does support this foreign element, it would send a 200
   response and start the dialog with speech recognition. When the
   dialog exits, it provides information about the <listen> execution
   within <dialogexit>, again using elements in a foreign namespace such
   as <listeninfo> below:

   <mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr"
    xmlns:ex="http://www.example.com/mediactrl/extensions/1">
    <event dialogid="d560">
      <dialogexit status="1">
       <ex:listeninfo speech="1 2 3 4" termmode="match"/>
      </dialogexit>
    </event>
   </mscivr>

   Note that in reply the AS sends a Control Framework 200 response even
   though the notification event contains an element in a foreign
   namespace that it might not understand.

7. Security Considerations

   As this Control Package processes XML markup, implementations MUST
   address the security considerations of [RFC3023].

   Implementations of this Control Package MUST address security,
   confidentiality, and integrity of messages transported over the
   Control Channel as described in Section 12 of "Media Control Channel
   Framework" [RFC6230], including Transport Level Protection, Control
   Channel Policy Management, and Session Establishment. In addition,
   implementations MUST address security, confidentiality, and integrity
   of User Agent sessions with the MS, both in terms of SIP signaling
   and associated RTP media flow; see [RFC6230] for further details on
   this topic. Finally, implementations MUST address security,

confidentiality, and integrity of sessions where, following a URI
scheme, an MS uploads recordings or retrieves documents and resources
(e.g., fetching a grammar document from a web server using HTTPS).

Adequate transport protection and authentication are critical,
especially when the implementation is deployed in open networks. If
the implementation fails to correctly address these issues, it risks
exposure to malicious attacks, including (but not limited to):

Denial of Service: An attacker could insert a request message into
   the transport stream causing specific dialogs on the MS to be
   terminated immediately. For example, <dialogterminate
   dialogid="XXXX" immediate="true">, where the value of "XXXX" could
   be guessed or discovered by auditing active dialogs on the MS
   using an <audit> request. Likewise, an attacker could impersonate
   the MS and insert error responses into the transport stream so
   denying the AS access to package capabilities.

Resource Exhaustion: An attacker could insert into the Control
   Channel new request messages (or modify existing ones) with, for
   instance, <dialogprepare> elements with a very long fetchtimeout
   attribute and a bogus source URL. At some point, this will
   exhaust the number of connections that the MS is able to make.

Phishing: An attacker with access to the Control Channel could
   modify the "loc" attribute of the <media> element in a dialog to
   point to some other audio file that had different information from
   the original. This modified file could include a different phone
   number for people to call if they want more information or need to
   provide additional information (such as governmental, corporate,
   or financial information).

Data Theft: An attacker could modify a <record> element in the
   Control Channel so as to add a new recording location:

```
<mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr">
 <dialogstart>
  <dialog>
   <record>
      <media type="audio/x-wav" loc="(Good URI)"/>
      <media type="audio/x-wav" loc="(Attacker's URI)"/>
   </record>
  </dialog>
 </dialogstart>
</mscivr>
```

The recorded data would be uploaded to two locations indicated by the
"{Good URI}" and the "{Attacker's URI}". This allows the attacker to
steal the recorded audio (which could include sensitive or
confidential information) without the originator of the request
necessarily being aware of the theft.

The Media Control Channel Framework permits additional security
policy management, including resource access and Control Channel
usage, to be specified at the Control Package level beyond that
specified for the Media Control Channel Framework (see Section 12.3
of [RFC6230]).

Since creation of IVR dialogs is associated with media processing
resources (e.g., DTMF detectors, media playback and recording, etc.)
on the MS, the security policy for this Control Package needs to
address how such dialogs are securely managed across more than one
Control Channel. Such a security policy is only useful for secure,
confidential, and integrity-protected channels. The identity of
Control Channels is determined by the channel identifier, i.e., the
value of the cfw-id attribute in the SDP and 'Dialog-ID' header in
the channel protocol (see [RFC6230]). Channels are the same if they
have the same identifier; otherwise, they are different. This
Control Package imposes the following additional security policies:

Responses: The MS MUST only send a response to a dialog management
   or audit request using the same Control Channel as the one used to
   send the request.

Notifications: The MS MUST only send notification events for a
   dialog using the same Control Channel as it received the request
   creating the dialog.

Auditing: The MS MUST only provide audit information about dialogs
   that have been created on the same Control Channel as the one upon
   the <audit> request is sent.

Rejection: The MS SHOULD reject requests to audit or manipulate an
   existing dialog on the MS if the channel is not the same as the
   one used when the dialog was created. The MS rejects a request by
   sending a Control Framework 403 response (see Section 7.4 and
   Section 12.3 of [RFC6230]). For example, if a channel with
   identifier 'cfw1234' has been used to send a request to create a
   particular dialog and the MS receives on channel 'cfw98969' a
   request to audit or terminate the dialog, then the MS sends a 403
   framework response.

There can be valid reasons why an implementation does not reject an
audit or dialog manipulation request on a different channel from the
one that created the dialog. For example, a system administrator
might require a separate channel to audit dialog resources created by
system users and to terminate dialogs consuming excessive system
resources. Alternatively, a system monitor or resource broker might
require a separate channel to audit dialogs managed by this package
on an MS. However, the full implications need to be understood by
the implementation and carefully weighted before accepting these
reasons as valid. If the reasons are not valid in their particular
circumstances, the MS rejects such requests.

There can also be valid reasons for 'channel handover' including high
availability support or where one AS needs to take over management of
dialogs after the AS that created them has failed. This could be
achieved by the Control Channels using the same channel identifier,
one after another. For example, assume a channel is created with the
identifier 'cfw1234' and the channel is used to create dialogs on the
MS. This channel (and associated SIP dialog) then terminates due to
a failure on the AS. As permitted by the Control Framework, the
channel identifier 'cfw1234' could then be reused so that another
channel is created with the same identifier 'cfw1234', allowing it to
'take over' management of the dialogs on the MS. Again, the
implementation needs to understand the full implications and
carefully weight them before accepting these reasons as valid. If
the reasons are not valid for their particular circumstances, the MS
uses the appropriate SIP mechanisms to prevent session establishment
when the same channel identifier is used in setting up another
Control Channel (see Section 4 of [RFC6230]).

8. IANA Considerations

   IANA has registered a new Media Control Channel Framework Package, a
   new XML namespace, a new XML schema, and a new MIME type.

   IANA has further created a new registry for IVR prompt variable
   types.

8.1. Control Package Registration

   This section registers a new Media Control Channel Framework package,
   per the instructions in Section 13.1 of [RFC6230].

      Package Name: msc-ivr/1.0
      Published Specification(s): RFC 6231
      Person & email address to contact for further information:
         IETF MEDIACTRL working group (mediactrl@ietf.org),
         Scott McGlashan (smcg.stds01@mcglashan.org).

8.2. URN Sub-Namespace Registration

   This section registers a new XML namespace,
   "urn:ietf:params:xml:ns:msc-ivr", per the guidelines in RFC 3688
   [RFC3688].

  URI: urn:ietf:params:xml:ns:msc-ivr
  Registrant Contact: IETF MEDIACTRL working group (mediactrl@ietf.org),
     Scott McGlashan (smcg.stds01@mcglashan.org).
  XML:
     BEGIN
     <?xml version="1.0"?>
     <!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Strict//EN"
         "http://www.w3.org/TR/xhtml1/DTD/xhtml1-strict.dtd">
      <html xmlns="http://www.w3.org/1999/xhtml" xml:lang="en">
       <head>
        <title>Media Control Channel Framework IVR
              Package attributes</title>
       </head>
       <body>
        <h1>Namespace for Media Control Channel
            Framework IVR Package attributes</h1>
        <h2>urn:ietf:params:xml:ns:msc-ivr</h2>
          <p>See
          RFC 6231.</p>
       </body>
      </html>
     END

8.3. XML Schema Registration

   This section registers an XML schema as per the guidelines in RFC
   3688 [RFC3688].

  URI: urn:ietf:params:xml:ns:msc-ivr
  Registrant Contact: IETF MEDIACTRL working group (mediactrl@ietf.org),
     Scott McGlashan (smcg.stds01@mcglashan.org).
  Schema: The XML for this schema can be found in Section 5 of this
     document.

8.4. MIME Media Type Registration for application/msc-ivr+xml

   This section registers the application/msc-ivr+xml MIME type.

      Type name: application

      Subtype name: msc-ivr+xml

   Required parameters: (none)

   Optional parameters: charset
      Indicates the character encoding of enclosed XML. Default is
      UTF-8.

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

   Security considerations: No known security considerations outside
      of those provided by the Media Control Channel Framework IVR
      Package.

   Interoperability considerations: This content type provides
      constructs for the Media Control Channel Framework IVR package.

   Published specification: RFC 6231

   Applications that use this media type: Implementations of
      the Media Control Channel Framework IVR package.

   Additional information:
      Magic number(s): (none)
      File extension(s): (none)
      Macintosh file type code(s): (none)

   Person & email address to contact for further information:
      Scott McGlashan <smcg.stds01@mcglashan.org>

   Intended usage: LIMITED USE

   Author/Change controller: The IETF

   Other information: None.

8.5. IVR Prompt Variable Type Registration Information

   This specification establishes an IVR Prompt Variable Type registry
   for Control Packages and initiates its population as follows. New
   entries in this registry must be published in an RFC (either as an
   IETF submission or RFC Editor submission), using the IANA policy
   [RFC5226] "RFC Required".

```
      Variable Type      Control Package   Reference
      -------------      ---------------   ---------
         date            msc-ivr/1.0       [RFC6231]
         time            msc-ivr/1.0       [RFC6231]
         digits          msc-ivr/1.0       [RFC6231]
```

   The following information MUST be provided in an RFC in order to
   register a new prompt variable type:

   Variable Type: The value for the <variable> type attribute
      (Section 4.3.1.1.1). The RFC MUST specify permitted values (if
      any) for the format attribute of <variable> and how the value
      attribute is rendered for different values of the format
      attribute. The RFC MUST NOT weaken but MAY strengthen the valid
      values of <variable> attributes defined in Section 4.3.1.1.1 of
      this specification.

   Reference: The RFC number in which the variable type is registered.

   Control Package: The Control Package associated with the IVR
      variable type.

   Person & address to contact for further information:

9. Using VoiceXML as a Dialog Language

   The IVR Control Package allows, but does not require, the MS to
   support other dialog languages by referencing an external dialog
   document. This section provides MS implementations that support the
   VoiceXML dialog language ([VXML20], [VXML21], [VXML30]) with
   additional details about using these dialogs in this package. This
   section is normative for an MS that supports the VoiceXML dialog
   language.

   This section covers preparing (Section 9.1), starting (Section 9.2),
   terminating (Section 9.3), and exiting (Section 9.4) VoiceXML dialogs
   as well as handling VoiceXML call transfer (Section 9.5).

9.1. Preparing a VoiceXML Dialog

   A VoiceXML dialog is prepared by sending the MS a request containing
   a <dialogprepare> element (Section 4.2.1). The type attribute is set
   to "application/voicexml+xml" and the src attribute to the URI of the
   VoiceXML document that is to be prepared by the MS. For example:

```
<mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr">
 <dialogprepare type="application/voicexml+xml"
                src="http://www.example.com/mydialog.vxml"
                fetchtimeout="15s"/>
</mscivr>
```

The VoiceXML dialog environment uses the <dialogprepare> request as
an opportunity to fetch and validate the initial document indicated
by the src attribute along with any resources referenced in the
VoiceXML document marked as prefetchable. The maxage and maxstale
attributes, if specified, control how the initial VoiceXML document
is fetched using HTTP (see [RFC2616]). Note that the fetchtimeout
attribute is not defined in VoiceXML for an initial document, but the
MS MUST support this attribute in its VoiceXML environment.

If a <params> child element of <dialogprepare> is specified, then the
MS MUST map the parameter information into a VoiceXML session
variable object as described in Section 9.2.3.

The success or failure of the VoiceXML document preparation is
reported in the MS response. For example, if the VoiceXML document
cannot be retrieved, then a 409 error response is returned. If the
document is syntactically invalid according to VoiceXML, then a 400
response is returned. If successful, the response includes a
dialogid attribute whose value the AS can use in <dialogstart>
element to start the prepared dialog.

9.2. Starting a VoiceXML Dialog

A VoiceXML dialog is started by sending the MS a request containing a
<dialogstart> element (Section 4.2.2). If a VoiceXML dialog has
already been prepared using <dialogprepare>, then the MS starts the
dialog indicated by the prepareddialogid attribute. Otherwise, a new
VoiceXML dialog can be started by setting the type attribute to
"application/voicexml+xml" and the src attribute to the URI of the
VoiceXML document. For example:

```
<mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr">
 <dialogstart connectionid="ssd3r3:sds345b"
              type="application/voicexml+xml"
              src="http://www.example.com/mydialog.vxml"
              fetchtimeout="15s"/>
</mscivr>
```

The maxage and maxstale attributes, if specified, control how the
initial VoiceXML document is fetched using HTTP (see [RFC2616]).
Note that the fetchtimeout attribute is not defined in VoiceXML for
an initial document, but the MS MUST support this attribute in its

VoiceXML environment. Note also that support for <dtmfsub>
subscriptions (Section 4.2.2.1.1) and their associated dialog
notification events is not defined in VoiceXML. If such a
subscription is specified in a <dialogstart> request, then the MS
sends a 439 error response (see Section 4.5).

The success or failure of starting a VoiceXML dialog is reported in
the MS response as described in Section 4.2.2.

When the MS starts a VoiceXML dialog, the MS MUST map session
information into a VoiceXML session variable object. There are 3
types of session information: protocol information (Section 9.2.1),
media stream information (Section 9.2.2), and parameter information
(Section 9.2.3).

9.2.1. Session Protocol Information

If the connectionid attribute is specified, the MS assigns protocol
information from the SIP dialog associated with the connection to the
following session variables in VoiceXML:

session.connection.local.uri Evaluates to the SIP URI specified in
   the 'To:' header of the initial INVITE.

session.connection.remote.uri Evaluates to the SIP URI specified in
   the 'From:' header of the initial INVITE.

session.connection.originator Evaluates to the value of
   session.connection.remote (MS receives inbound connections but
   does not create outbound connections).

session.connection.protocol.name Evaluates to "sip". Note that this
   is intended to reflect the use of SIP in general, and does not
   distinguish between whether the connection accesses the MS via SIP
   or SIP Secure (SIPS) procedures.

session.connection.protocol.version Evaluates to "2.0".

session.connection.redirect This array is populated by information
   contained in the 'History-Info' header [RFC4244] in the initial
   INVITE or is otherwise undefined. Each entry (hi-entry) in the
   'History-Info' header is mapped, in the order it appeared in the
   'History-Info' header, into an element of the
   session.connection.redirect array. Properties of each element of
   the array are determined as follows:

   uri   Set to the hi-targeted-to-uri value of the History-Info
          entry

     pi   Set to 'true' if hi-targeted-to-uri contains a
             'Privacy=history' parameter, or if the INVITE 'Privacy'
             header includes 'history'; 'false' otherwise

     si   Set to the value of the 'si' parameter if it exists;
             undefined otherwise

     reason Set verbatim to the value of the 'Reason' parameter of hi-
             targeted-to-uri

   session.connection.aai Evaluates to the value of a SIP header with
      the name "aai" if present; undefined otherwise.

   session.connection.protocol.sip.requesturi This is an associative
      array where the array keys and values are formed from the URI
      parameters on the SIP Request-URI of the initial INVITE. The
      array key is the URI parameter name. The corresponding array
      value is obtained by evaluating the URI parameter value as a
      string. In addition, the array's toString() function returns the
      full SIP Request-URI.

   session.connection.protocol.sip.headers This is an associative array
      where each key in the array is the non-compact name of a SIP
      header in the initial INVITE converted to lowercase (note the case
      conversion does not apply to the header value). If multiple
      header fields of the same field name are present, the values are
      combined into a single comma-separated value. Implementations
      MUST at a minimum include the 'Call-ID' header and MAY include
      other headers. For example,
      session.connection.protocol.sip.headers["call-id"] evaluates to
      the Call-ID of the SIP dialog.

   If a conferenceid attribute is specified, then the MS populates the
   following session variables in VoiceXML:

   session.conference.name Evaluates to the value of the conferenceid
      attribute.

9.2.2. Session Media Stream Information

   The media streams of the connection or conference to use for the
   dialog are described in Section 4.2.2, including use of <stream>
   elements (Section 4.2.2.2) if specified. The MS maps media stream
   information into the VoiceXML session variable
   session.connection.protocol.sip.media for a connection, and
   session.conference.media for a conference. In both variables, the
   value of the variable is an array where each array element is an
   object with the following properties:

type This required property indicates the type of the media
   associated with the stream (see Section 4.2.2.2 <stream> type
   attribute definition).

direction This required property indicates the directionality of the
   media relative to the endpoint of the dialog (see Section 4.2.2.2
   <stream> direction attribute definition).

format This property is optional. If defined, the value of the
   property is an array. Each array element is an object that
   specifies information about one format of the media stream. The
   object contains at least one property called name whose value is
   the subtype name of the media format [RFC4855]. Other properties
   may be defined with string values; these correspond to required
   and, if defined, optional parameters of the format.

As a consequence of this definition, when a connectionid is specified
there is an array entry in session.connection.protocol.sip.media for
each media stream used by the VoiceXML dialog. For an example,
consider a connection with bidirectional G.711 mu-law audio sampled
at 8kHz where the dialog is started with

```
<mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr">
 <dialogstart connectionid="ssd3r3:sds345b"
              type="application/voicexml+xml"
              src="http://www.example.com/mydialog.vxml"
              fetchtimeout="15s">
  <stream media="audio" direction="recvonly"/>
 </dialogstart>
</mscivr>
```

In this case, session.connection.protocol.sip.media[0].type evaluates
to "audio", session.connection.protocol.sip.media[0].direction
evaluates to "recvonly" (i.e., the endpoint only receives media from
the dialog -- the endpoint does not send media to the dialog),
session.connection.protocol.sip.media[0].format[0].name evaluates to
"PCMU", and session.connection.protocol.sip.media[0].format[0].rate
evaluates to "8000".

Note that the session variable is updated if the connection or
conference media session characteristics for the VoiceXML dialog
change (e.g., due to a SIP re-INVITE).

9.2.3. Session Parameter Information

   Parameter information is specified in the <params> child element of
   <dialogprepare> and <dialogstart> elements, where each parameter is
   specified using a <param> element. The MS maps parameter information
   into VoiceXML session variables as follows:

   session.values This is an associative array mapped to the <params>
      element. It is undefined if no <params> element is specified. If
      a <params> element is specified in both <dialogprepare> and
      <dialogstart> elements for the same dialog, then the array is
      first initialized with the <params> specified in the
      <dialogprepare> element and then updated with the <params>
      specified in the <dialogstart> element; in cases of conflict, the
      <dialogstart> parameter value take priority. Array keys and
      values are formed from <param> children of the <params> element.
      Each array key is the value of the name attribute of a <param>
      element. If the same name is used in more than one <param>
      element, then the array key is associated with the last <param> in
      document order. The corresponding value for each key is an object
      with two required properties: a "type" property evaluating to the
      value of the type attribute, and a "content" property evaluating
      to the content of the <param>. In addition, this object's
      toString() function returns the value of the "content" property as
      a string.

   For example, a VoiceXML dialog started with one parameter:

   <mscivr version="1.0" xmlns="urn:ietf:params:xml:ns:msc-ivr">
    <dialogstart connectionid="ssd3r3:sds345b"
                 type="application/voicexml+xml"
                 src="http://www.example.com/mydialog.vxml"
                 fetchtimeout="15s">
      <params>
       <param name="mode">playannouncement</param>
      </params>
    </dialogstart>
   </mscivr>

   In this case, session.values would be defined with one item in the
   array where session.values['mode'].type evaluates to "text/plain"
   (the default value), session.values['mode'].content evaluates to
   "playannouncement", and session.values['mode'].toString() also
   evaluates to "playannouncement".

   The MS sends an error response (see Section 4.2.2) if a <param> is
   not supported by the MS (e.g., the parameter type is not supported).

9.3. Terminating a VoiceXML Dialog

   When the MS receives a request with a <dialogterminate> element
   (Section 4.2.3), the MS throws a 'connection.disconnect.hangup' event
   into the specified VoiceXML dialog. Note that if the immediate
   attribute has the value true, then the MS MUST NOT return <params>
   information when the VoiceXML dialog exits (even if the VoiceXML
   dialog provides such information) -- see Section 9.4.

   If the connection or conference associated with the VoiceXML dialog
   terminates, then the MS throws a 'connection.disconnect.hangup' event
   into the specified VoiceXML dialog.

9.4. Exiting a VoiceXML Dialog

   The MS sends a <dialogexit> notification event (Section 4.2.5.1) when
   the VoiceXML dialog is complete, has been terminated, or exits due to
   an error. The <dialogexit> status attribute specifies the status of
   the VoiceXML dialog when it exits and its <params> child element
   specifies information, if any, returned from the VoiceXML dialog.

   A VoiceXML dialog exits when it processes a <disconnect> element, an
   <exit> element, or an implicit exit according to the VoiceXML form
   interpretation algorithm (FIA). If the VoiceXML dialog executes a
   <disconnect> and then subsequently executes an <exit> with namelist
   information, the namelist information from the <exit> element is
   discarded.

   The MS reports namelist variables in the <params> element of the
   <dialogexit>. Each <param> reports on a namelist variable. The MS
   set the <param> name attribute to the name of the VoiceXML variable.
   The MS sets the <param> type attribute according to the type of the
   VoiceXML variable. The MS sets the <param> type to 'text/plain' when
   the VoiceXML variable is a simple ECMAScript value. If the VoiceXML
   variable is a recording, the MS sets the <param> type to the MIME
   media type of the recording and encodes the recorded content as CDATA
   in the <param> (see Section 4.2.6.1 for an example). If the VoiceXML
   variable is a complex ECMAScript value (e.g., object, array, etc.),
   the MS sets the <param> type to 'application/json' and converts the
   variable value to its JSON value equivalent [RFC4627]. The behavior
   resulting from specifying an ECMAScript object with circular
   references is not defined.

   If the expr attribute is specified on the VoiceXML <exit> element
   instead of the namelist attribute, the MS creates a <param> element
   with the reserved name '__exit'. If the value is an ECMAScript
   literal, the <param> type is 'text/plain' and the content is the
   literal value. If the value is a variable, the <param> type and

content are set in the same way as a namelist variable; for example,
an expr attribute referencing a variable with a simple ECMAScript
value has the type 'text/plain' and the content is set to the
ECMAScript value. To allow the AS to differentiate between a
<dialogexit> notification event resulting from a VoiceXML
<disconnect> from one resulting from an <exit>, the MS creates a
<param> with the reserved name '__reason', the type 'text/plain', and
a value of "disconnect" (without brackets) to reflect the use of
VoiceXML's <disconnect> element, and the value of "exit" (without
brackets) to an explicit <exit> in the VoiceXML dialog. If the
VoiceXML session terminates for other reasons (such as encountering
an error), this parameter MAY be omitted or take on platform-specific
values prefixed with an underscore.

Table 2 provides some examples of VoiceXML <exit> usage and the
corresponding <params> element in the <dialogexit> notification
event. It assumes the following VoiceXML variable names and values:
userAuthorized=true, pin=1234, and errors=0. The <param> type
attributes ('text/plain') are omitted for clarity.

<exit> Usage	<params> Result
<exit>	<params> <param name="__reason">exit</param> </params>
<exit expr="5">	<params> <param name="__reason">exit</param> <param name="__exit">5</param> </params>
<exit expr="'done'">	<params> <param name="__reason">exit</param> <param name="__exit">'done'</param> </params>
<exit expr="userAuthorized">	<params> <param name="__reason">exit</param> <param name="__exit">true</param> </params>
<exit namelist="pin errors">	<params> <param name="__reason">exit</param> <param name="pin">1234</param> <param name="errors">0</param> </params>

Table 2: VoiceXML <exit> Mapping Examples

9.5. Call Transfer

   While VoiceXML is at its core a dialog language, it also provides
   optional call transfer capability. It is NOT RECOMMENDED to use
   VoiceXML's call transfer capability in networks involving application
   servers. Rather, the AS itself can provide call routing

functionality by taking signaling actions based on the data returned
to it, either through VoiceXML's own data submission mechanisms or
through the mechanism described in Section 9.4. If the MS encounters
a VoiceXML dialog requesting call transfer capability, the MS SHOULD
raise an error event in the VoiceXML dialog execution context: an
error.unsupported.transfer.blind event if blind transfer is
requested, error.unsupported.transfer.bridge if bridge transfer is
requested, or error.unsupported.transfer.consultation if consultation
transfer is requested.

10. Contributors

Asher Shiratzky provided valuable support and contributions to the
early versions of this document.

The authors would like to thank the IVR design team consisting of
Roni Even, Lorenzo Miniero, Adnan Saleem, Diego Besprosvan, Mary
Barnes, and Steve Buko, who provided valuable feedback, input, and
text to this document.

11. Acknowledgments

The authors would like to thank Adnan Saleem, Gene Shtirmer, Dave
Burke, Dan York, Steve Buko, Jean-Francois Bertrand, Henry Lum, and
Lorenzo Miniero for expert reviews of this work.

Ben Campbell carried out the RAI expert review on this specification
and provided a great deal of invaluable input. Donald Eastlake
carried out a thorough security review.

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