              Internet Calendar Scheduling Protocol (iSchedule)
                     draft-desruisseaux-ischedule-05

Abstract

   This document defines the Internet Calendar Scheduling Protocol
   (iSchedule), which is a binding from the iCalendar Transport-
   independent Interoperability Protocol (iTIP) to the Hypertext
   Transfer Protocol (HTTP) to enable interoperability between
   calendaring and scheduling systems over the Internet.

Status of This Memo

   This Internet-Draft is submitted in full conformance with the
   provisions of BCP 78 and BCP 79.

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   time. It is inappropriate to use Internet-Drafts as reference
   material or to cite them other than as "work in progress."

   This Internet-Draft will expire on November 3, 2013.

Table of Contents

1. Introduction

   This binding document provides the transport specific information
   necessary to convey iCalendar Transport-independent Interoperability
   Protocol (iTIP) [RFC5546] messages over the Hypertext Transfer
   Protocol (HTTP) [RFC2616].

   The Internet Calendar Scheduling Protocol (iSchedule) enables
   interoperability between different calendaring and scheduling
   systems. Calendaring and scheduling systems that provide support for
   iSchedule allow their users to perform scheduling transactions such
   as schedule, reschedule, respond to scheduling request or cancel
   scheduled calendar components, as well as search for busy time
   information with users of other calendaring and scheduling systems on
   the Internet.

   iSchedule leverages the DomainKeys Identified Mail (DKIM) service
   [RFC6376] to provide end-to-end domain-level authentication based on
   message content that is transparent to end users.

   Discussion of this Internet-Draft is taking place on the mailing list
   <https://www.ietf.org/mailman/listinfo/ischedule>.

1.1. Motivations

   The iCalendar Message-Based Interoperability Protocol (iMIP)
   [RFC6047], has proven to be insufficient to allow users to seamlessly
   perform the same scheduling operations with users of other
   calendaring and scheduling systems on the Internet as with users of
   their own system. This section clarifies the motivations for a
   binding from the iCalendar Transport-independent Interoperability
   Protocol (iTIP) [RFC5546] to a transport that allows synchronous end-
   to-end connectivity.

   A binding to an email-based transport is clearly inadequate to search
   for busy time information since users need and expect to get an
   immediate response. As such, some calendaring and scheduling systems
   allow users to publish their free busy information in a resource
   accessible to others on the Internet. In the absence of a
   standardized mechanism to locate the resource that provides the free
   busy information of a user, one thus needs to know the location of
   this resource in addition to the calendar user address of the users
   one wishes to schedule with.

   With an email-based transport, the transparent processing of incoming
   scheduling messages on the server is only possible when the
   calendaring and scheduling system is integrated with the email
   system. Commonly, the processing of incoming scheduling messages

occurs on the client and requires user intervention, which yields the following consequences:

1. The processing of incoming scheduling messages and the corresponding updates to the calendar only occur when the client is active. As a result, free busy information may be inaccurate (e.g., user still appears busy when the organizer actually rescheduled or canceled the meeting).

2. Calendaring and scheduling systems generally restrain the number of updates sent to users to reduce the number of messages that will clutter their email inbox. As a result, attendees rarely obtain up to date participation status of other attendees.

3. The client becomes responsible for verification of the authenticity and integrity of the scheduling message.

1.2. Related Memos

Implementers will need to be familiar with other documents that, along with this document, form a framework for Internet calendaring and scheduling standards.

This document specifies a binding from iTIP to HTTP.

o iCalendar [RFC5545] specifies a core specification of objects, data types, properties and property parameters;

o iTIP [RFC5546] specifies an interoperability protocol for scheduling between different implementations.

Furthermore, implementers will need to be familiar with the DomainKeys Identified Mail (DKIM) service defined in [RFC6376]. An overview of DKIM can be found in [RFC5585].

This document does not attempt to repeat the specification of concepts or definitions from these other documents. Where possible, references are made to the document that provides the specification of these concepts or definitions.

1.3. Terminology

This specification reuses much of the same terminology as iCalendar [RFC5545], iTIP [RFC5546], HTTP [RFC2616], and DKIM [RFC6376]. Additional terms used by this specification are:

Scheduling message: An iCalendar [RFC5545] object conforming to the
   requirements of iTIP [RFC5546].

Originator: The calendar user who is sending a scheduling message to
   one or more other calendar users.

Recipient: A calendar user to whom a scheduling message is being
   sent.

iSchedule Sender: The iSchedule service responsible for sending
   scheduling messages.

iSchedule Receiver: The iSchedule service responsible for receiving
   scheduling messages.

1.4. Notational Conventions

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT",
"SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this
document are to be interpreted as described in [RFC2119].

The Augmented BNF (ABNF) syntax used by this document to describe
protocol elements is defined in [RFC5234].

Definitions of XML elements in this document use XML element type
declarations (as found in XML Document Type Declarations), described
in Section 3.2 of [W3C.REC-xml-20081126].

The namespace "urn:ietf:params:xml:ns:ischedule" is reserved for the
XML elements defined in this specification, or in other Standards
Track IETF RFCs written to extend iSchedule. It MUST NOT be used for
proprietary extensions. When XML element types in this namespace are
referenced in this document outside of the context of an XML
fragment, the string "IS:" will be prefixed to the element type
names.

Note that the XML declarations used in this document are incomplete,
in that they do not include namespace information. Thus, the reader
MUST NOT use these declarations as the only way to validate iSchedule
XML element types.

2. iSchedule Model

The iSchedule design can be pictured as:

```
     +----------+   +-----------+              +-----------+   +----------+
     | Calendar |   | Calendar  |              | Calendar  |   | Calendar |
     | Store    |   | Service   | iSchedule    | Service   |   | Store    |
     |  or      |-->|===========|------------->|===========|-->|  or      |
     | User     |   | iSchedule |              | iSchedule |   | User     |
     | Agent    |   | Sender    |              | Receiver  |   | Agent    |
     +----------+   +-----------+              +-----------+   +----------+
                          |                          |
                          <-------------------------->
                          DKIM Signature/Verification
```
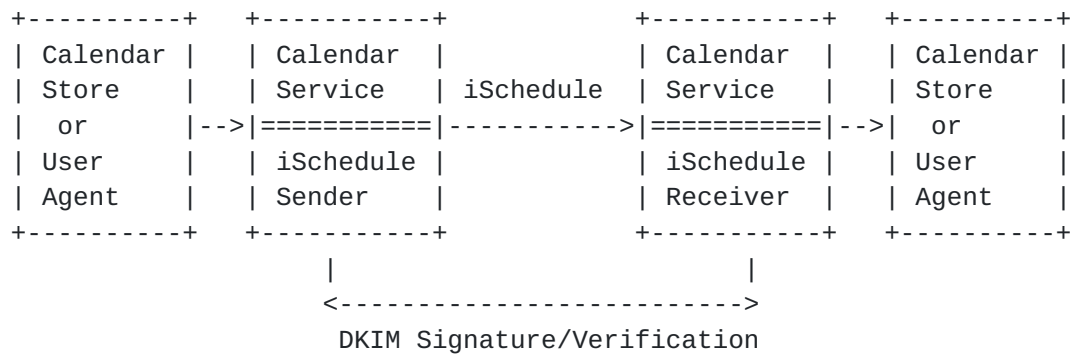
When an iSchedule Sender has a scheduling message to transmit, it
determines the iSchedule Receivers to which to deliver the message
and sends the appropriate iSchedule message. The iSchedule Receiver
verifies the authenticity and content of the iSchedule message and
delivers it to the Calendar Service.

The means by which a Calendar Store or User Agent instructs a
Calendar Service, acting as an iSchedule Sender, to transmit
scheduling messages is outside the scope of this document. A
Calendar Service could provide support for a standard calendar access
protocol, such as CalDAV [RFC4791], [RFC6638] or any other protocol,
to allow a Calendar User Agent to perform scheduling operations with
users of other Calendar Services.

Likewise, the actual processing of scheduling messages received by a
Calendar Service, acting as an iSchedule Receiver, is also outside
the scope of this document. Some Calendar Service implementations
may decide to process some or all received scheduling messages, while
other implementations may decide to leave that work to Calendar User
Agent implementations.

3. iSchedule Overview

This section provides an overview of the various steps involved for
iSchedule Senders and Receivers to transmit scheduling messages
between Calendar Services. It references later sections describing
the precise details of each step.

3.1. iSchedule Sender Actions

A Calendar Service will generate an iTIP [RFC5546] scheduling message
for transmission. It will additionally provide details of the
Originator and Recipients. The Calendar Service will "submit" the
scheduling message and details to the iSchedule Sender, through a
process that is outside the scope of this document.

The iSchedule Sender MUST verify the authenticity of the Originator

and the Originator's authorization to send the scheduling message.
In particular the "ORGANIZER" iCalendar property value MUST match the
Originator calendar user address. The process by which this
authentication and authorization is done is outside the scope of this
document.

For each Recipient, the iSchedule Sender will attempt to lookup a
matching iSchedule Receiver to which the iSchedule message can be
sent, following the rules in Section 4. After determining the
iSchedule Receiver to use, the iSchedule Sender MUST check the
capabilities of the iSchedule Receiver to ensure it will be able to
accept the scheduling message that needs to be sent, as per
Section 5.

The iSchedule Sender MUST group together Recipients for whom the
iSchedule Receiver is the same, so that a single scheduling message
is sent for multiple Recipients, within the limits of the IS:max-
recipients (Section 9.2.1.10) value specified in the iSchedule
Receiver's capabilities.

For each group of Recipients handled by the same iSchedule Receiver,
the iSchedule Sender will construct an HTTP request, as per
Section 6, with the body of the HTTP request containing the iSchedule
message. Note, in the case of a "VFREEBUSY" iSchedule message, the
iSchedule Sender MUST ensure that iCalendar "ATTENDEE" properties in
the iSchedule message match one-for-one with the Recipients listed in
the HTTP request header.

After constructing the HTTP request, the iSchedule Sender MUST
generate a DKIM signature for the request and include a "DKIM-
Signature" (Section 8.1) request header, as per Section 7.

The iSchedule Sender then sends the HTTP request to the iSchedule
Receiver handling the Recipient group, and receives the HTTP
response, which will be an XML document with either an IS:schedule-
response or IS:error element as the root element.

The iSchedule Sender aggregates the results for each Recipient group
receiving an iSchedule message, and returns the resulting status
information for each Recipient to the Calendar Service that generated
the schedule message. The process by which this is done is outside
the scope of this document.

3.2. iSchedule Receiver Actions

iSchedule Receivers MUST provide a capabilities document to Senders,
as per Section 5.

Upon receipt of an iSchedule HTTP request, the iSchedule Receiver
verifies the message as per Section 7.4.

Once the authenticity of the message is confirmed, the iSchedule
Receiver delivers the scheduling message to the indicated recipients,
collects and aggregates the delivery status for each recipient, and
returns the result in the HTTP response body.

In the event of a processing error related to the overall request,
iSchedule Receivers MUST return an error response as per
Section 6.1.2.

4. iSchedule Receiver Discovery

This section describes how an iSchedule Sender can discover the host
name, port, and the path to use to submit an HTTP request to an
iSchedule Receiver.

For each Recipient to whom a scheduling message is being sent, the
iSchedule Sender will "resolve" the associated calendar user address
into a domain name, as per Section 4.1.

The iSchedule Sender then uses the extracted domain name to issue a
DNS SRV query for the iSchedule service (Section 4.2) expected to be
hosted at the domain.

The result of an SRV record lookup will be a target host name and a
port, as per [RFC2782]. An iSchedule Sender uses these to contact
the iSchedule Receiver. iSchedule Senders MUST honor the full
behavior of SRV records, in particular the TTL, Priority and Weight
options in the record, as well as handling multiple records being
returned, as per [RFC2782].

Since an iSchedule Receiver is an HTTP server, an iSchedule Sender
needs to supply a Request-URI in the HTTP request it makes to the
iSchedule Receiver, in addition to the host name and port
information. iSchedule Senders MUST use the path specified in any TXT
records accompanying the SRV record (as per Section 4.3), or in the
absence of a matching TXT record, MUST use the .well-known URI (as
per Section 4.4).

4.1. Resolving Calendar User Addresses

To deliver a scheduling message via the iSchedule protocol, an
iSchedule Sender needs to determine which iSchedule Receiver to use
for a particular recipient. Each recipient's calendar user address
is specified in one or more Recipient request headers.

A calendar user address as defined by iCalendar is simply a URI.
This is typically a mailto URI, but could potentially be any URI
type. However, only URIs containing a "host" element can be used to
extract the necessary information to locate an iSchedule Receiver.

To get the SRV record name to query for a given mailto URI, the
"domain" portion of the mailto URI is extracted and appended to the
service label "_ischedules._tcp.".

Example:

   Calendar User Address: mailto:cyrus@example.com

   Query SRV Record Name: _ischedules._tcp.example.com

In cases where the "domain" portion of the mailto URI contains one or
more levels of sub-domain, iSchedule Senders MAY choose to remove
successive levels of "sub-domain" if queries for that sub-domain fail
to return any SRV records. For example, a mailto URI with the full
domain "host.calendar.example.com" would first trigger a query using
the domain "host.calendar.example.com", then if that failed, the
domain "calendar.example.com" would be tried, then if that failed the
domain "example.com" would be tried.

4.2. iSchedule SRV Service Type

This specification adds an SRV service label for use with iSchedule:

ischedules: Identifies an iSchedule Receiver that uses HTTP with
   transport layer security ([RFC2818]).

Example: service record for iSchedule Receiver with transport layer
security

_ischedules._tcp.example.com. IN SRV 0 1 443 ischedule.example.com.

4.3. iSchedule Service TXT Records

When SRV RRs are used to advertise iSchedule services, it is also
convenient to be able to specify a "context path" in the DNS to be
retrieved at the same time. To enable that, this specification uses
a TXT RR that follows the syntax defined in Section 6 of [RFC6763]
and defines a "path" key for use in that record. The value of the
key MUST be the actual "context path" to the corresponding service on
the iSchedule Receiver.

A site might provide TXT records in addition to SRV records for the
service. When present, iSchedule Senders MUST use the "path" value

as the "context path" for the service in HTTP requests. When not
present, iSchedule Senders use the ".well-known" URI approach
described next.

Example: text record for service with TLS

_ischedules._tcp   TXT path=/ischedule

4.4. iSchedule Receiver Request-URI

This specification registers a well-known URI [RFC5785] for the
iSchedule service, namely, "ischedule" (see Section 11.3.1).
iSchedule Receivers MUST support requests targeted at this well-known
URI. iSchedule Senders MUST handle HTTP redirects on this well-known
URI.

5. iSchedule Receiver Capabilities

iSchedule Receivers supporting the features described in this
document MUST allow iSchedule Senders to query their capabilities by
accepting GET requests targeted at the Request-URI found during
discovery (Section 4). The response body for a successful GET
request targeted at this URI MUST be an XML document with IS:query-
result as its root element.

   Informative rationale: The GET method was favored over the POST
   method to allow iSchedule Senders to query capabilities with
   "conditional GET" requests (see Section 9.3 of [RFC2616]).

iSchedule Receivers SHOULD use normal HTTP expiration mechanisms (as
per Section 13.1.3 of [RFC2616]) to ensure caches do not cache the
capabilities response for too long. iSchedule Senders SHOULD use
normal HTTP conditional GET requests when re-checking capabilities to
avoid re-transferring already cached data.

iSchedule Senders SHOULD use the information in the capabilities to
determine whether the iSchedule Receiver supports a version of the
protocol that the iSchedule Sender can use, and if not, not issue any
iSchedule requests with scheduling messages to the iSchedule
Receiver. iSchedule Senders SHOULD verify that the scheduling message
to be sent to the iSchedule Receiver is in line with the restrictions
on scheduling messages indicated by the capabilities before sending
the scheduling message.

5.1. Example: Querying iSchedule Receiver Capabilities

```
>> Request <<

GET /.well-known/ischedule?action=capabilities HTTP/1.1
Host: cal.example.com

>> Response <<

HTTP/1.1 200 OK
Date: Mon, 15 Dec 2008 09:32:12 GMT
Content-Type: application/xml; charset=utf-8
Content-Length: xxxx
iSchedule-Version: 1.0
iSchedule-Capabilities: 123
ETag: "afasdf-132afds"

<?xml version="1.0" encoding="utf-8" ?>
<query-result xmlns="urn:ietf:params:xml:ns:ischedule">
  <capabilities>
    <serial-number>123</serial-number>
    <versions>
      <version>1.0</version>
    </versions>
    <scheduling-messages>
      <component name="VEVENT">
        <method name="REQUEST"/>
        <method name="ADD"/>
        <method name="REPLY"/>
        <method name="CANCEL"/>
      </component>
      <component name="VTODO">
        <method name="REQUEST"/>
        <method name="ADD"/>
        <method name="REPLY"/>
        <method name="CANCEL"/>
      </component>
      <component name="VFREEBUSY">
        <method name="REQUEST"/>
      </component>
    </scheduling-messages>
    <calendar-data-types>
      <calendar-data-type
       content-type="text/calendar" version="2.0"/>
    </calendar-data-types>
    <attachments>
      <inline/>
      <external/>
```

```
      </attachments>
      <max-content-length>102400</max-content-length>
      <min-date-time>19910101T000000Z</min-date-time>
      <max-date-time>20381231T000000Z</max-date-time>
      <max-instances>150</max-instances>
      <max-recipients>250</max-recipients>
      <administrator>mailto:ischedule-admin@example.com<
      /administrator>
    </capabilities>
  </query-result>
```

6. Scheduling

This section defines how an iSchedule Sender can use the HTTP POST
method to submit a scheduling message to an iSchedule Receiver.
Note, this describes the HTTP request prior to generating a DKIM
signature as per Section 7.

6.1. POST Method

The POST method submits a scheduling message to one or more
Recipients by targeting the request at the Request-URI of an
iSchedule Receiver. The request body of a POST method MUST contain a
scheduling message (i.e., an iCalendar object that follows the iTIP
semantic).

The submitted scheduling message will be delivered to the Recipients,
with status information about per-recipient delivery returned in the
HTTP response. However, when the scheduling message is a request for
free-busy time, the iSchedule Receiver will immediately execute the
free-busy request for the Recipients and return per-recipient
iCalendar data in the response for successful free-busy queries.

Every POST request MUST include the "iSchedule-Version"
(Section 11.2.2) general header.

Every POST request SHOULD include the "iSchedule-Message-ID"
(Section 11.2.4) request header.

Every POST request MUST include the "Cache-Control" HTTP general
header containing the cache-directives "no-cache" and "no-transform"
to prevent intermediary caches from caching or transforming
responses.

Every POST request MUST include a single "Originator"
(Section 11.2.5) request header that specifies the calendar user
address of the Originator of the scheduling message. The value of
the "Originator" request header MUST match the value of the

"ORGANIZER" iCalendar property or one of the specified "ATTENDEE"
iCalendar properties in the scheduling message, depending on the
specified "METHOD" iCalendar property value as summarized in the
following table:

```
      +----------------+----------------------------------+
      | Method         | Originator Requirement           |
      +----------------+----------------------------------+
      | PUBLISH        | MUST match ORGANIZER             |
      | REQUEST        | MUST match ORGANIZER (see Note 1)|
      | REPLY          | MUST match ATTENDEE              |
      | ADD            | MUST match ORGANIZER             |
      | CANCEL         | MUST match ORGANIZER             |
      | REFRESH        | MUST match ATTENDEE              |
      | COUNTER        | MUST match ATTENDEE              |
      | DECLINECOUNTER | MUST match ORGANIZER             |
      +----------------+----------------------------------+
```

                              Table 1

Note 1: iTIP does allow an Attendee to forward a "METHOD:REQUEST"
scheduling message to another attendee. However, due to complexity
of managing the authorization of such requests, this specification
does not allow scheduling message forwarding.

Every POST request MUST include one or more "Recipient"
(Section 11.2.6) request headers. The value of this header is a list
of one or more calendar user addresses and corresponds to the set of
calendar users who will have the scheduling message delivered to
them. The value of the "Recipient" request header MUST match the
value of the "ORGANIZER" iCalendar property or one of the specified
"ATTENDEE" iCalendar properties in the scheduling message, depending
on the specified "METHOD" iCalendar property value as summarized in
the following table:

```
      +----------------+--------------------------------+
      | Method         | Recipient Requirement          |
      +----------------+--------------------------------+
      | PUBLISH        | None (see Note 1)              |
      | REQUEST        | MUST match ATTENDEE (see Note 1)|
      | REPLY          | MUST match ORGANIZER           |
      | ADD            | MUST match ATTENDEE (see Note 1)|
      | CANCEL         | MUST match ATTENDEE (see Note 1)|
      | REFRESH        | MUST match ORGANIZER           |
      | COUNTER        | MUST match ORGANIZER           |
      | DECLINECOUNTER | MUST match ATTENDEE             |
      +----------------+--------------------------------+
```

Table 2

Note 1: iTIP does allow an Organizer to send scheduling message to
calendar users who are not listed as Attendees, e.g., to inform other
calendar users of an event taking place. However, due to complexity
of managing the authorization of such requests, this specification
does not allow such scheduling messages.

The Content-Type general header MUST include the type parameters
"component" and "method" defined in [RFC5545]. The value of the
"component" MUST correspond to the iCalendar component type (e.g.,
"VEVENT") specified in the scheduling message. The value of the
"method" parameter MUST be the same as the value of the "METHOD"
iCalendar property in the scheduling message.

6.1.1. Schedule Response

A POST request may deliver a scheduling message to one or more
calendar users specified in the Recipient request header. Since the
behavior of each recipient may vary, it is useful to get response
status information for each recipient in the overall POST response.
This specification defines a new XML response to convey multiple
recipient status.

A response to a POST method that indicates status for one or more
recipients MUST be an XML document with IS:schedule-response as its
root element. This MUST contain one or more response elements for
each recipient, with each of those containing elements that indicate
which recipient they correspond to, the scheduling status of the
request for that recipient, any error codes and an optional
description.

In the case of a free-busy request, the response elements can also
contain calendar-data elements which contain free busy information
(e.g., an iCalendar VFREEBUSY component) indicating the busy state of
the corresponding recipient, assuming that the free-busy request for
that recipient succeeded.

Every POST response MUST include the "Cache-Control" HTTP general
header containing the cache-directives "no-cache" and "no-transform"
to prevent intermediary caches from caching or transforming
responses.

6.1.2. Failed Schedule Response

When there is an overall, as opposed to per-recipient, failure of the
POST request, the iSchedule Receiver SHOULD return an XML document
with IS:error as its root element. The child elements of the IS:

error element are used to indicate an error code and description,
primarily meant for service administrators.

The following XML elements are error codes which can be used within
an IS:error element to represent errors:

IS:version-not-supported: The POST request was either missing an
"iSchedule-Version" header, or had an "iSchedule-Version" header
value for a version not supported by the iSchedule Receiver, as
advertised in the IS:versions capability.

IS:invalid-calendar-data-type: The resource submitted in the POST
request was not a supported media type (i.e. text/calendar) for
scheduling or free-busy messages;

IS:invalid-calendar-data: The resource submitted in the POST
request was not valid data for the media type being specified;

IS:invalid-scheduling-message: The resource submitted in the POST
request did not obey all restrictions specified for the POST
request, violating the IS:scheduling-message capability element,
or the requirements of iTIP;

IS:verification-failed: The POST request failed DKIM verification;

IS:originator-missing: The POST request did not include an
"Originator" request header specifying the calendar user address
of the Originator of the scheduling message.

IS:too-many-originators: The POST request contained more than one
"Originator" request header.

IS:originator-invalid: The "Originator" header in the POST request
did not include a valid calendar user address for the Originator
of the scheduling message.

IS:originator-denied: The calendar user identified by the
"Originator" header in the POST request is not allowed to use this
service.

IS:recipient-missing: The POST request did not include one or more
valid "Recipient" request headers specifying the calendar user
address of users to whom the scheduling message will be delivered.

IS:recipient-mismatch: The POST request did not include
"Recipient" request header values which exactly match the list of
"ATTENDEE" property values in a "VFREEBUSY" request.

IS:max-recipients: The POST request had too many calendar user addresses specified in "Recipient" request headers, violating the IS:max-recipients capability.

IS:attachment-type-not-supported: The scheduling message submitted in the POST request had iCalendar data with "ATTACH" properties whose value type is not supported, violating the IS:attachments capability.

IS:max-content-length: The scheduling message submitted in the POST request had iCalendar data violating the IS:max-content-length capability.

IS:min-date-time: The scheduling message submitted in the POST request had iCalendar data violating the IS:min-date-time capability.

IS:max-date-time: The scheduling message submitted in the POST request had iCalendar data violating the IS:max-date-time capability.

IS:max-instances: The scheduling message submitted in the POST request had iCalendar data violating the IS:max-instances capability.

The following are examples of response codes one would expect to be used for this method. Note, however, that unless explicitly prohibited any 2/3/4/5xx series response code may be used in a response. Typically a 403 response code would be used when an XML document with an IS:error element as its root is also returned.

200 (OK) - The command succeeded.

400 (Bad Request) - The Sender has provided an invalid scheduling message, or invalid iSchedule request headers.

403 (Forbidden) - The Sender cannot submit a scheduling message to the specified Request-URI.

404 (Not Found) - The URL in the Request-URI was not present.

507 (Insufficient Storage) - The server did not have sufficient space to record the scheduling message.

7. iSchedule Domain-Level Authentication

   iSchedule uses and extends the mechanism defined by DomainKeys
   Identified Mail (DKIM) [RFC6376]. DKIM defines a domain-level
   digital signature authentication framework for email, using public-
   key cryptography, with the domain name service (DNS) as one possible
   key server technology.

   This specification extends the applicability of DKIM to the HTTP
   protocol, with a specific "profile" for use with iSchedule messages.
   Additionally, DKIM support is REQUIRED for all iSchedule requests,
   and iSchedule Receivers MUST reject any messages which cannot be
   verified according to the requirements of DKIM. This is a much
   stronger requirement than the email use of DKIM, which has to deal
   with legacy systems.

   iSchedule Senders MUST only send iSchedule messages for Originators
   whose authenticity they have verified. iSchedule Receivers that
   verify a DKIM signature on an iSchedule request can assume that the
   iSchedule Sender is not only taking responsibility for sending the
   message, but has also verified the authenticity of the Originator.
   As such, iSchedule Receivers can reliably use the Originator
   information to perform their own authorization based on that value.
   e.g., the Calendar Service to which an iSchedule Receiver delivers a
   scheduling message, can apply "filtering" rules to such messages
   based on the guarantee that the Originator calendar user address has
   been verified at both the iSchedule Sender and Receiver ends.

   This specification uses the syntactic elements of DKIM [RFC6376], but
   modified for use with HTTP. Where definitions of syntactic elements
   of DKIM [RFC6376] are applicable to HTTP, they will be used by
   reference. In cases where the HTTP definition is different, the same
   ABNF rule name will be used, but the value modified as appropriate.

   The following sections describe how the DomainKeys Identified Mail
   (DKIM) service can fit into a scheduling service.

7.1. Signature Content

   The following HTTP headers MUST be included in the signature of a
   message:

   o Content-Type

   o iSchedule-Version

   o Originator

o Recipient

The iSchedule Receiver MUST verify that the above HTTP headers are
included in the signature.

iSchedule Senders and Receivers might use HTTP authentication
[RFC2617] in requests, though the process through which credentials
are managed are out of scope for this document. If HTTP
authentication is used, then the "Authorization" HTTP request header
MUST be included in the signature of the message.

The following HTTP headers, if present, SHOULD be included in the
signature of a message:

o iSchedule-Message-ID

o User-Agent

To allow iSchedule messages to transit via HTTP intermediaries, hop-
by-hop headers, such as the following HTTP/1.1 headers MUST NOT be
included in the signature of a message:

o Cache-Control

o Connection

o Host

o Keep-Alive

o Proxy-Authenticate

o Proxy-Authorization

o TE

o Trailer

o Transfer-Encoding

o Upgrade

The "Content-Length" header MUST NOT be signed, since the DKIM
signature is generated prior to transfer encoding, and the header
value represents the length after any transfer encodings have been
applied.

iSchedule Senders MAY include an "x=" DKIM signature tag in the

"DKIM-Signature" header to indicate an expiration time for the
signature. When doing so, the "x=" value SHOULD be set to at least 1
minute ahead of the "t=" DKIM signature tag value, to account for
processing time between the iSchedule Sender and Receiver.

7.2. Canonicalization

iSchedule Senders and Receivers MUST use the "simple" body
canonicalization algorithm defined in Section 3.4.3 of DKIM [RFC6376]
to canonicalize the HTTP request message body used for the body hash
computation. The iSchedule Sender MUST calculate the body hash prior
to any HTTP transfer encodings being applied to the request message
body. The iSchedule Receiver MUST calculate the body hash after any
HTTP transfer encoding have been removed from the request message
body.

iSchedule Senders and Receivers MUST use the new "ischedule-relaxed"
header canonicalization algorithm defined below to canonicalize the
HTTP request headers used for the signature computation.

7.2.1. The "ischedule-relaxed" Header Canonicalization Algorithm

The "ischedule-relaxed" header canonicalization algorithm is used to
canonicalize HTTP header fields where multiple headers fields with
the same name might be combined by an HTTP intermediary. The
following steps MUST be applied in order:

1. Convert all header field names (not the header field values) to
    lowercase. For example, convert "SUBJect: AbC" to "subject:
    AbC".

2. Unfold all header field continuation lines; in particular, lines
    with terminators embedded in continued header field values (that
    is, CRLF sequences followed by LWS) MUST be interpreted without
    the CRLF. Implementations MUST NOT remove the CRLF at the end of
    the header field value.

3. Combine multiple header fields with the same field name into one
    one header field value; specifically, append each subsequent
    field value to the combined field value in order, separated by a
    comma. For example, combine
    "recipient:mailto:cyrus@example.com,mailto:mike@example.com" and
    "recipient:mailto:ken@example.org" into "recipient:mailto:cyrus@
    example.com,mailto:mike@example.com,mailto:ken@example.org"

4. Convert all sequences of one or more LWS characters to a single
    SP character. LWS characters here include those before and after
    a line folding boundary.

5. Delete all WS characters at the end of each unfolded header field
    value.

6. Delete any LWS characters remaining before and after the colon
    separating the header field name from the header field value.
    The colon separator MUST be retained.

7. Delete any LWS characters remaining before and after any commas
    in the header field value.

Since this canonicalization algorithm "collapses" multiple HTTP
header fields into a single header field, the h= tag used in the
"DKIM-Signature" request header MUST contain only a single value for
each different header field name being signed.

7.3. Key Management

7.3.1. DNS-based Public Key Management

Section 3.6.2 of DKIM [RFC6376] defines a DNS-based key-binding for
public key retrieval. iSchedule Senders and Receivers MUST support
this method of public key retrieval. To allow public keys to be
restricted to just an iSchedule service, this specification defines a
new service type "ischedule" to constrain the use of a key to
iSchedule:

        ABNF:

    key-s-tag-type /= "ischedule"

7.3.2. HTTP-based Public Key Management

This specification defines a new HTTP-based public key management
method for use with DKIM [RFC6376]. The "DKIM-Signature" header "q"
tag value associated with this method is "http/well-known":

        ABNF:

    sig-q-tag-method /= "http/well-known"

Key lookup first involves retrieving an SRV record that will provide
the HTTP server host name and port to use for actual key retrieval.
Then the key retrieval is done via an HTTP GET request on a .well-
known resource. This new key management approach off-loads the key

handling from DNS to an HTTP server, only requiring the DNS
administrator to provide the SRV records for authorized HTTP key
management servers.

7.3.2.1. SRV Service Type

This specification adds one SRV service label for use with HTTP key
management:

domainkey_lookup: Identifies an HTTP server from which public keys
   for DKIM signatures can be retrieved. The HTTP server MUST
   support transport layer security ([RFC2818]).

The iSchedule Receiver determines the appropriate SRV name using the
"d=" DKIM signature tag value in the "DKIM-signature" header being
verified:

_domainkey_lookup._tcp.{d}.

; {d} is the d= value from the "DKIM-Signature" header.

7.3.2.2. Well-known Request-URI

This specification registers a well-known URI [RFC5785] for the DKIM
HTTP-based public key management information, "domainkey" (see
Section 11.3.2). To retrieve information about the public key used
to sign an iSchedule message, the iSchedule Sender constructs a URI
of the form:

https://{srv-host}:{srv-port}/.well-known/domainkey/{d}/{s}

; {srv-host} is the host name from the _domainkey_lookup SRV record
; {srv-port} is the port number from the _domainkey_lookup SRV record
; {d} is the d= value from the "DKIM-Signature" header.
; {s} is the s= value from the "DKIM-Signature" header.

Documents retrieved from the well-known URI MUST be text documents
with a media-type of "text/plain". The format of the text document
is:

key-doc = 1*(tag-list CRLF)
; tag-list is defined in Section 3.2 of <xref target="RFC6376"/>

where tag-list is the unstructured textual form defined in Section
3.6.1. of [RFC6376] - i.e., the same data that would be placed in a
DNS TXT record for DNS-based public key management. Note that this
allows information for multiple keys to be returned for each {domain-
name}, {selector} pair. iSchedule Receivers must use HTTP+TLS

(https:) to retrieve the public key information document, and follow
the certificate-verification process specified in [RFC6125].

7.3.2.3. Example Lookup Procedure

Given the following (partial) DKIM-Signature header, the steps below
describe how a public key is retrieved from the HTTP pubic key
management system.

DKIM-Signature:q=http/well-known;d=cal.example.com;s=isched; ...

1. The iSchedule Receiver first does an SRV record lookup for
    "_domainkey_lookup._tcp.cal.example.com", and gets back the
    following example record:

 _domainkey_lookup._tcp.cal.example.com. IN SRV 0 1 443 is.example.com.

2. the iSchedule Receiver then makes an HTTP request:

 https://is.example.com:443/.well-known/domainkey/cal.example.com/isched

3. It parses the returned document to determine the appropriate
    public key to use to verify the DKIM signature.

7.3.3. Private Exchange Public Key Management

This specification defines a new public key management method for use
with DKIM [RFC6376]. This method is used to indicate that the
associated public key has been transferred to the recipient through
some (unspecified, secure) private exchange. The "DKIM-Signature"
header "q" tag value associated with this method is "private-
exchange":

    ABNF:

sig-q-tag-method /= "private-exchange"

This method is useful, for example, in situations where an "internal"
deployment of iSchedule is being used to connect different calendar
systems within an organization. It avoids the need to setup other
public key discovery mechanisms when a simple, secure public key
exchange can be accomplished between the system administrators.

7.4. Verification Requirements

iSchedule Receivers MUST verify the follow details:

> The HTTP request contains an "iSchedule-Version" header that
> matches a version of the iSchedule protocol that the iSchedule
> Receiver supports.
>
> Only one Originator HTTP request header is present in the request
> and it matches the appropriate iCalendar property as per Table 1.
>
> One or more Recipient HTTP request headers are present in the
> request and they match the appropriate iCalendar properties as per
> Table 2.
>
> The "DKIM-Signature" header contains valid information and the
> signature and body hash values can be verified correctly. Note,
> for the t= value in the "DKIM-Signature", iSchedule Receivers
> SHOULD accept values that are no more than 5 minutes in the
> future, to account for possible clock skew between iSchedule
> Sender and Receiver.

If the signature cannot be verified, the iSchedule Receiver MUST
reject the iSchedule message outright.

If the signature is valid, then iSchedule Receivers have a guarantee
that the iSchedule Sender has verified the authenticity of the
Originator and determined they are authorized to send the enclosed
iTIP message. This allows iSchedule Receivers to use the Originator
calendar user address value for access control purposes.

7.5. Authorized Third-Party Signatures

The third-party signature authorization protocol defined in [RFC6541]
MAY be used by iSchedule Senders and Receivers.

8. HTTP Headers

This section defines the syntax and semantics of additional HTTP/1.1
header fields.

The header's syntax uses the optional whitespace (OWS) rule defined
as follows:

    OWS = *([CRLF] WSP)

8.1. DKIM-Signature Request Header

The "DKIM-Signature" request header MUST be specified by the
iSchedule Sender on all scheduling requests to specify all of the
signature and key-fetching data.

```
DKIM-Signature   = "DKIM-Signature" ":" OWS DKIM-Signature-v
DKIM-Signature-v = tag-list
; tag-list is defined in Section 3.2 of <xref target="RFC6376"/>
```

8.2. iSchedule-Version General Header

The "iSchedule-Version" general header field MUST be specified by the
iSchedule Sender on requests, and by the iSchedule Receiver on
responses. It SHOULD be included in a response to any "OPTIONS *"
HTTP request targeting the iSchedule Receiver, or any "OPTIONS"
request on a resource supporting the iSchedule behaviors described in
this specification (e.g., the .well-known resource or any resource
that .well-known redirects to).

```
iSchedule-Version      = "iSchedule-Version" ":" OWS
                           iSchedule-Version-v
iSchedule-Version-v    = iSchedule-Version-elem
                           *( OWS "," OWS iSchedule-Version-elem )
iSchedule-Version-elem =  1*DIGIT "." 1*DIGIT
```

8.3. iSchedule-Capabilities Response Header

The "iSchedule-Capabilities" response header field MUST be specified
by the iSchedule Receiver on all responses. iSchedule Senders SHOULD
cache this value and use it to detect a change in the iSchedule
Receiver capabilities that cause the iSchedule Sender to reload
capabilities. The value of this header is maintained by the
iSchedule Receiver as described in Section 9.2.1.1.

```
iSchedule-Capabilities = "iSchedule-Capabilities" ":" OWS 1*DIGIT
```

8.4. iSchedule-Message-ID Request Header

The "iSchedule-Message-ID" request header field SHOULD be specified
by the iSchedule Sender on requests. This header provides a unique
identifier that refers to the specific iSchedule request in which it
is included. The uniqueness of this identifier is guaranteed by the
iSchedule Sender that generates it. This identifier is intended to
be machine readable and not necessarily meaningful to humans.

```
iSchedule-Message-ID   = "iSchedule-Message-ID" ":" OWS token
```

8.5. Originator Request Header

   The "Originator" request header value is a URI which specifies the
   calendar user address of the originator of the scheduling message.
   Note that the absoluteURI rule is defined in [RFC3986].

      Originator   = "Originator" ":" OWS Originator-v
      Originator-v = absoluteURI

8.6. Recipient Request Header

   The "Recipient" request header value is a URI which specifies the
   calendar user address of the recipients to which the POST method
   should deliver the submitted scheduling message. Note that the
   absoluteURI rule is defined in [RFC3986].

      Recipient   = "Recipient" ":" OWS Recipient-v
      Recipient-v   = Recipient-elem *(OWS "," OWS Recipient-elem)
      Recipient-elem = absoluteURI

9. XML Element Definitions

9.1. schedule-response XML Element

   Name: schedule-response

   Namespace: urn:ietf:params:xml:ns:ischedule

   Purpose: Contains the set of responses for a POST method request.

   Description: See Section 6.1.1.

   Definition:

   <!ELEMENT schedule-response (response*)>

9.1.1. response XML Element

   Name: response

   Namespace: urn:ietf:params:xml:ns:ischedule

   Purpose: Contains a single response for a POST method request.

   Description: See Section 6.1.1.

Definition:

```
<!ELEMENT response (recipient,
                    request-status,
                    calendar-data?,
                    error?,
                    response-description?)>
```

9.1.1.1. recipient XML Element

Name: recipient

Namespace: urn:ietf:params:xml:ns:ischedule

Purpose: The calendar user address (recipient header value) that the
   enclosing response for a POST method request is for.

Description: See Section 6.1.1.

Definition:

```
<!ELEMENT recipient (#PCDATA)>
```

9.1.1.2. request-status XML Element

Name: request-status

Namespace: urn:ietf:params:xml:ns:ischedule

Purpose: The iTIP REQUEST-STATUS property value for this response.

Description: See Section 6.1.1.

Definition:

```
<!ELEMENT request-status (#PCDATA)>
```

9.1.1.3. calendar-data XML Element

Name: calendar-data

Namespace: urn:ietf:params:xml:ns:ischedule

Purpose: An iCalendar object in a response to a search for busy time
   information.

Description: See [Section 6.1.1](#).

Definition:

`<!ELEMENT calendar-data (#PCDATA)>`

9.1.1.4. error XML Element

Name: error

Namespace: urn:ietf:params:xml:ns:ischedule

Purpose: Error responses sometimes need more information to indicate
   what went wrong.

Description: See [Section 6.1.1](#).

Definition:

`<!ELEMENT error ANY>`

9.1.1.5. response-description XML Element

Name: response-description

Namespace: urn:ietf:params:xml:ns:ischedule

Purpose: Contains information about a status response

Description: See [Section 6.1.1](#).

Definition:

`<!ELEMENT response-description (#PCDATA)>`

9.2. query-result XML Element

Name: query-result

Namespace: urn:ietf:params:xml:ns:ischedule

Purpose: Contains result of a query request.

Description: A generic container for the result of a query request,
   such as a query of the capabilities of an iSchedule Receiver.

   Definition:

   <!ELEMENT query-result (capabilities)>

9.2.1. capabilities XML Element

   Name: capabilities

   Namespace: urn:ietf:params:xml:ns:ischedule

   Purpose: Contains iSchedule Receiver capabilities.

   Description: The capabilities element contains capabilities of the
      iSchedule Receiver.

   Definition:

   <!ELEMENT capabilities (
       serial-number,
       versions,
       scheduling-messages,
       calendar-data-types,
       attachments,
       max-content-length,
       min-date-time,
       max-date-time,
       max-instances,
       max-recipients,
       administrator) >

9.2.1.1. serial-number XML Element

   Name: serial-number

   Namespace: urn:ietf:params:xml:ns:ischedule

   Purpose: Identifies the version of the capabilities information.

   Description: This is a numeric value maintained by the iSchedule
      Receiver. The value is incremented by the iSchedule Receiver each
      time there has been a substantive change to the capabilities that
      would require an iSchedule Sender to reload the capabilities to
      adjust its behavior. The value of this element MUST be returned
      by the iSchedule Receiver in all HTTP requests via the "iSchedule-
      Capabilities" response header (Section 8.3). This allows
      iSchedule Senders to detect changes to the iSchedule Receiver's
      capabilities during the normal course of making requests, without
      the need to poll the iSchedule Receiver for such changes.

   Definition:

   <!ELEMENT serial-number (#PCDATA)>
   <!-- PCDATA value: a numeric value (positive integer) -->

9.2.1.2. versions XML Element

   Name: versions

   Namespace: urn:ietf:params:xml:ns:ischedule

   Purpose: Identifies the iSchedule versions supported by the
      iSchedule Receiver.

   Description: An iSchedule Receiver MAY advertise support for
      multiple versions of the iSchedule protocol. iSchedule Senders
      check this value to ensure they can send iSchedule messages with a
      matching version.

   Definition:

   <!ELEMENT versions (version)+>

9.2.1.2.1. version XML Element

   Name: version

   Namespace: urn:ietf:params:xml:ns:ischedule

   Purpose: Identifies an iSchedule protocol version.

   Definition:

   <!ELEMENT version (#PCDATA)>
   <!-- PCDATA value: version number -->

9.2.1.3. scheduling-messages XML Element

   Name: scheduling-messages

   Namespace: urn:ietf:params:xml:ns:ischedule

   Purpose: Identifies the type of supported scheduling messages.

   Description: An iSchedule Receiver advertises which iCalendar
      component types it will accept for iTIP messages sent to it. In
      addition, for each component, it can specify the allowed iTIP
      "METHOD" property values.

Definition:

```
<!ELEMENT scheduling-messages (component)+>
```

9.2.1.3.1. component XML Element

Name: component

Namespace: urn:ietf:params:xml:ns:ischedule

Purpose: Identifies a calendar component type.

Description: Used to specify a supported iCalendar component type
   for scheduling messages. If a IS:method child element is not
   present, then any iTIP "METHOD" property value can be used in iTIP
   messages sent to the iSchedule Receiver. If one or more IS:method
   elements are present, then those indicate the allowed set of iTIP
   "METHOD" property values.

Definition:

```
<!ELEMENT component (method)*>

<!ATTLIST component name CDATA #REQUIRED>
<!-- name value: a calendar component name -->
```

9.2.1.3.1.1. method XML Element

Name: method

Namespace: urn:ietf:params:xml:ns:ischedule

Purpose: Identifies an iCalendar method type.

Description: See IS:component.

Definition:

```
<!ELEMENT method EMPTY>

<!ATTLIST method name CDATA #REQUIRED>
<!-- name value: a method type -->
```

9.2.1.4. calendar-data-types XML Element

   Name: calendar-data-types

   Namespace: urn:ietf:params:xml:ns:ischedule

   Purpose: Identifies what formats of iCalendar data are acceptable.

   Definition:

   <!ELEMENT calendar-data-types (calendar-data-type)+>

9.2.1.4.1. calendar-data-type XML Element

   Name: calendar-data-type

   Namespace: urn:ietf:params:xml:ns:ischedule

   Purpose: Identifies a supported media type and version for iTIP
      messages.

   Definition:

   <!ELEMENT calendar-data-type EMPTY>

   <!ATTLIST calendar-data-type content-type CDATA "text/calendar"
                                version CDATA "2.0">
   <!-- content-type value: a MIME media type -->
   <!-- version value: a version string -->

9.2.1.5. attachments XML Element

   Name: attachments

   Namespace: urn:ietf:params:xml:ns:ischedule

   Purpose: Identifies the attachment values supported.

   Description: iSchedule Receivers might restrict what form of
      attachments are allowed in iTIP messages that are sent to it, for
      performance, or security reasons. In iCalendar data, attachments
      can either be specified using "inline" data in the form of a
      base64 encoded property value, or "external" data in the form of a
      URI property value. With this capability, an iSchedule Receiver
      can specify which of "inline" or "external" values it will accept
      in iTIP messages. See Section 10.4 for additional details.

Definition:

   <!ELEMENT attachments (inline?, external?)>

9.2.1.5.1. inline XML Element

   Name: inline

   Namespace: urn:ietf:params:xml:ns:ischedule

   Purpose: Identifies "inline" attachments as a supported attachment
      value.

   Definition:

   <!ELEMENT inline EMPTY>

9.2.1.5.2. external XML Element

   Name: external

   Namespace: urn:ietf:params:xml:ns:ischedule

   Purpose: Identifies "external" attachments as a supported attachment
      value.

   Definition:

   <!ELEMENT external EMPTY>

9.2.1.6. max-content-length XML Element

   Name: max-content-length

   Namespace: urn:ietf:params:xml:ns:ischedule

   Purpose: Identifies the maximum size allowed for a scheduling
      message in octets.

   Definition:

   <!ELEMENT max-content-length (#PCDATA)>
   <!-- PCDATA value: a numeric value (positive integer) -->

9.2.1.7. **min-date-time XML Element**

   Name: min-date-time

   Namespace: urn:ietf:params:xml:ns:ischedule

   Purpose: A DATE-TIME value indicating the earliest date and time in
      UTC that the iSchedule Receiver is willing to accept for any DATE
      or DATE-TIME value in a scheduling message.

   Definition:

   <!ELEMENT min-date-time (#PCDATA)>
   <!-- PCDATA value: an iCalendar format DATE-TIME value in UTC -->

9.2.1.8. **max-date-time XML Element**

   Name: max-date-time

   Namespace: urn:ietf:params:xml:ns:ischedule

   Purpose: A DATE-TIME value indicating the latest date and time in
      UTC that the iSchedule Receiver is willing to accept for any DATE
      or DATE-TIME value in a scheduling message.

   Definition:

   <!ELEMENT max-date-time (#PCDATA)>
   <!-- PCDATA value: an iCalendar format DATE-TIME value in UTC -->

9.2.1.9. **max-instances XML Element**

   Name: max-instances

   Namespace: urn:ietf:params:xml:ns:ischedule

   Purpose: The maximum number of recurrence instances allowed in a
      scheduling message.

   Definition:

   <!ELEMENT max-instances (#PCDATA)>
   <!-- PCDATA value: a numeric value (positive integer) -->

[9.2.1.10](). max-recipients XML Element

   Name: max-recipients

   Namespace: urn:ietf:params:xml:ns:ischedule

   Purpose: The maximum number of recipients allowed for a scheduling
      message.

   Definition:

   <!ELEMENT max-recipients (#PCDATA)>
   <!-- PCDATA value: a numeric value (positive integer) -->

[9.2.1.11](). administrator XML Element

   Name: administrator

   Namespace: urn:ietf:params:xml:ns:ischedule

   Purpose: Provides contact information for the administrator of the
      iSchedule Receiver.

   Definition:

   <!ELEMENT administrator (#PCDATA)>
   <!-- PCDATA value: URI to contact administrator -->

[10](). Security Considerations

   The process of scheduling involves the sending and receiving of
   scheduling messages. As a result, the security problems related to
   messaging in general are relevant here. In particular the
   authenticity of the scheduling messages needs to be verified.

   Potential attacks described in the security considerations of DKIM
   [[RFC6376]()] are also applicable to iSchedule.

[10.1](). Privacy

   iSchedule Senders and iSchedule Receivers MUST use an HTTP connection
   protected with TLS [[RFC5246]()] as defined in [[RFC2818]()] for all
   transactions.

[10.2](). Authentication

   iSchedule uses and extends the mechanism defined by DomainKeys
   Identified Mail (DKIM) [[RFC6376]()]. DKIM defines a domain-level

digital signature authentication framework for email, using public-key cryptography, with the domain name service as its key server technology.

10.3. DNS Considerations

DNS security issues are addressed by DNSSEC [RFC4033].

10.4. Attachment Considerations

iCalendar data can include "inline" attachment data in the form of a base64-encoded "ATTACH" property value. iSchedule Receivers MUST take care when allowing "inline" attachments in scheduling messages as such data might contain malicious content, and SHOULD use some form of content scanner on the attachment data to verify its safety (e.g., a content scanner used for email messages). In addition, "inline" attachment data is likely to be much larger than the actual calendar-related data in a scheduling message, and thus could adversely affect the performance of an iSchedule Receiver processing it. If an iSchedule Receiver allows "inline" attachment data, it MUST apply a limit on the size of acceptable scheduling messages to prevent possible denial-of-service attacks using large "inline" attachment data. In general, it is best for iSchedule Receivers to simply disable the ability for scheduling messages to contain "inline" attachment data, and instead rely solely on "external" attachments in the form of URI attachment values.

11. IANA Considerations

11.1. Namespace Registration

This specification registers a new URN to identify a new XML namespace as per [RFC3688].

11.1.1. iSchedule Namespace Registration

Registration request for the iSchedule namespace:

URI: urn:ietf:params:xml:ns:ischedule

Registrant Contact: See the "Authors' Addresses" section of this document.

XML: None. Namespace URIs do not represent an XML specification.

11.2. HTTP Headers Registration

This specification registers new headers for use with HTTP as per
[RFC3864].

11.2.1. DKIM-Signature Request Header Registration

Header field name: DKIM-Signature

Applicable protocol: http

Status: standard

Author/Change controller: IETF

Specification document(s): this specification

Related information: none

11.2.2. iSchedule-Version General Header Registration

Header field name: iSchedule-Version

Applicable protocol: http

Status: standard

Author/Change controller: IETF

Specification document(s): this specification

Related information: none

11.2.3. iSchedule-Capabilities Response Header Registration

Header field name: iSchedule-Capabilities

Applicable protocol: http

Status: standard

Author/Change controller: IETF

Specification document(s): this specification

Related information: none

11.2.4. iSchedule-Message-ID Request Header Registration

Header field name: iSchedule-Message-ID

Applicable protocol: http

Status: standard

Author/Change controller: IETF

Specification document(s): this specification

Related information: none

11.2.5. Originator Request Header Registration

Header field name: Originator

Applicable protocol: http

Status: standard

Author/Change controller: IETF

Specification document(s): this specification

Related information: none

11.2.6. Recipient Request Header Registration

Header field name: Recipient

Applicable protocol: http

Status: standard

Author/Change controller: IETF

Specification document(s): this specification

Related information: none

11.3. Well-Known URI Registration

This specification registers a new well-known URI as per [RFC5785].

11.3.1. iSchedule Well-Known URI Registration

   URI suffix: ischedule

   Change controller: IETF.

   Specification document(s): this specification

   Related information: none

11.3.2. DKIM Well-Known URI Registration

   URI suffix: domainkey

   Change controller: IETF.

   Specification document(s): this specification

   Related information: none

11.4. DKIM Parameters Registration

11.4.1. DKIM-Signature Query Method Registry

   This specification registers two new query mechanisms that can be
   used in DKIM-Signature fields. The following values should be added
   to the DKIM-Signature Query Method Registry established in Section
   7.3 of [RFC6376]:

```
   +------------------+------------+-------------------------+--------+
   | Type             | Option     | Reference               | Status |
   +------------------+------------+-------------------------+--------+
   | http             | well-known | (this document          | active |
   |                  |            | Section 7.3.2)          |        |
   | private-exchange |            | (this document          | active |
   |                  |            | Section 7.3.3)          |        |
   +------------------+------------+-------------------------+--------+
```

11.4.2. DKIM Service Type Registration

   This specification registers a new DKIM service type to specify that
   a given public key MUST only be used to verify messages of iSchedule
   services. The following value should be added to the DKIM Service
   Type Registry established in Section 7.8 of [RFC6376]:

```
+-----------+-----------------------------+--------+
| Type      | Reference                   | Status |
+-----------+-----------------------------+--------+
| ischedule | (this document Section 7.3.1) | active |
+-----------+-----------------------------+--------+
```

12. Acknowledgments

The authors would like to thank the following individuals for
contributing their ideas and support for writing this specification:
Mattias Amnefelt, Mike Douglass, Tomas Hnetila, Ciny Joy, Barry
Leiba, Ken Murchison, Simon Pilette, Arnaud Quillaud, Simon
Vaillancourt, and Wilfredo Sanchez Vega.

The authors would also like to thank CalConnect, The Calendaring and
Scheduling Consortium, for advice with this specification, and for
organizing interoperability testing events to help refine it.

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## Appendix A.  Example Scheduling Transactions

   This section describes some example scheduling transactions that give
   a general idea of how scheduling is carried out between an iSchedule
   Sender and an iSchedule Receiver.

## A.1.  Example: Simple Meeting Invitation

   In the following example, the iSchedule Sender requests the iSchedule
   Receiver to deliver a meeting invitation (scheduling REQUEST) to the
   calendar user mailto:cyrus@example.org.  The response indicates that
   delivery of the scheduling message was successful.

>> Request <<

```
POST /.well-known/ischedule HTTP/1.1
DKIM-Signature: a=rsa-sha256; d=example.com; s=jupiter;
 c=ischedule-relaxed/simple; q=dns/txt:http/well-known;
 t=1268069852; x=1283918400;
 h=Originator:Recipient:Content-Type:
 iSchedule-Version:iSchedule-Message-ID;
 bh=XXXxxxXXXxxxxXXXXxxxXXXXxxxXXXXxxxXXXxxx;
 b=XXXxxxXXXxxxXXXXxxxXXXXxxxXXXXxxxXXXXxxxXXXXxxxXXXxxxXXXxxx
Host: cal.example.org
iSchedule-Version: 1.0
iSchedule-Message-ID: 798F00BB-5B45-4634-B083-0D0CD3A2BB39
Originator: mailto:bernard@example.com
Recipient: mailto:cyrus@example.org
Cache-Control: no-cache, no-transform
Content-Type: text/calendar; component=VEVENT; method=REQUEST
Content-Length: xxxx

BEGIN:VCALENDAR
VERSION:2.0
PRODID:-//Example Corp.//EN
METHOD:REQUEST
BEGIN:VEVENT
DTSTAMP:20040901T200200Z
ORGANIZER:mailto:bernard@example.com
DTSTART:20040902T130000Z
DTEND:20040902T140000Z
SUMMARY:Design meeting
UID:34222-232@example.com
ATTENDEE;PARTSTAT=ACCEPTED;ROLE=CHAIR;CUTYPE=IND
 IVIDUAL;CN=Bernard Desruisseaux:mailto:bernard@
 example.com
ATTENDEE;PARTSTAT=NEEDS-ACTION;RSVP=TRUE;ROLE=RE
 Q-PARTICIPANT;CUTYPE=INDIVIDUAL;CN=Cyrus Daboo:
 mailto:cyrus@example.org
END:VEVENT
END:VCALENDAR
```

```
>> Response <<

HTTP/1.1 200 OK
Date: Thu, 02 Sep 2004 16:53:32 GMT
Content-Type: application/xml; charset=utf-8
Content-Length: xxxx
Cache-Control: no-cache, no-transform
iSchedule-Version: 1.0
iSchedule-Capabilities: 123

<?xml version="1.0" encoding="utf-8" ?>
<schedule-response xmlns="urn:ietf:params:xml:ns:ischedule">
  <response>
    <recipient>mailto:cyrus@example.org</recipient>
    <request-status>2.0;Success</request-status>
    <response-description>Delivered to recipient<
    /response-description>
  </response>
</schedule-response>
```

A.2. Example: Search for Busy Time Information

In the following example, the iSchedule Sender requests the iSchedule
Receiver to determine the busy information of the calendar users
mailto:cyrus@example.org and mailto:mike@example.org, over the time
range specified by the scheduling message sent in the request. The
response includes VFREEBUSY components with the busy time for one
calendar user, and an error for the other calendar user.

```
>> Request <<

POST /.well-known/ischedule HTTP/1.1
DKIM-Signature: a=rsa-sha256; d=example.com; s=jupiter;
 c=ischedule-relaxed/simple; q=dns/txt:http/well-known;
 t=1268069852; x=1283918400;
 h=Originator:Recipient:Content-Type:
 iSchedule-Version:iSchedule-Message-ID;
 bh=XXXxxxXXXxxxxXXXxxxxXXXxxxxXXXxxxxXXXxxx;
 b=XXXxxxXXXxxxxXXXxxxxXXXxxxxXXXxxxxXXXxxxxXXXxxxxXXXxxx
Host: cal.example.org
iSchedule-Version: 1.0
iSchedule-Message-ID: A98ADF24-9490-4F01-81C8-FE924F86A9FD
Originator: mailto:bernard@example.com
Recipient: mailto:cyrus@example.org
Recipient: mailto:mike@example.org
Cache-Control: no-cache, no-transform
Content-Type: text/calendar; component=VFREEBUSY; method=REQUEST
Content-Length: xxxx

BEGIN:VCALENDAR
VERSION:2.0
PRODID:-//Example Corp.//EN
METHOD:REQUEST
BEGIN:VFREEBUSY
DTSTAMP:20040901T200200Z
ORGANIZER:mailto:bernard@example.com
DTSTART:20040902T000000Z
DTEND:20040903T000000Z
UID:34222-232@example.com
ATTENDEE;CN=Cyrus Daboo:mailto:cyrus@example.org
ATTENDEE;CN=Mike Douglass:mailto:mike@example.org
END:VFREEBUSY
END:VCALENDAR
```

>> Response <<

```
HTTP/1.1 200 OK
Date: Thu, 02 Sep 2004 16:53:32 GMT
Content-Type: application/xml; charset=utf-8
Content-Length: xxxx
Cache-Control: no-cache, no-transform
iSchedule-Version: 1.0
iSchedule-Capabilities: 123

<?xml version="1.0" encoding="utf-8" ?>
<schedule-response xmlns="urn:ietf:params:xml:ns:ischedule">
  <response>
    <recipient>mailto:cyrus@example.org</recipient>
    <request-status>2.0;Success</request-status>
    <calendar-data>BEGIN:VCALENDAR
VERSION:2.0
PRODID:-//Example Corp.//EN
METHOD:REPLY
BEGIN:VFREEBUSY
DTSTAMP:20040901T200200Z
ORGANIZER:mailto:bernard@example.com
DTSTART:20040902T000000Z
DTEND:20040903T000000Z
UID:34222-232@example.com
ATTENDEE;CN=Cyrus Daboo:mailto:cyrus@example.org
FREEBUSY;FBTYPE=BUSY-UNAVAILABLE:20040902T000000Z/
 20040902T090000Z,20040902T170000Z/20040903T000000Z
FREEBUSY;FBTYPE=BUSY:20040902T120000Z/20040902T130000Z
END:VFREEBUSY
END:VCALENDAR
    </calendar-data>
  </response>
  <response>
    <recipient>mailto:mike@example.org</recipient>
    <request-status>5.3;No scheduling support for user<
    /request-status>
    <response-description>Unknown calendar user<
    /response-description>
  </response>
</schedule-response>
```

A.3. Example: Failed Request

In the following example, the iSchedule Sender requests the iSchedule
Sender to deliver a task assignment (scheduling REQUEST) to the
calendar user mailto:cyrus@example.org. For some reason the

verification of the request fails as is indicated by the error
response.

>> Request <<

```
POST /.well-known/ischedule HTTP/1.1
DKIM-Signature: a=rsa-sha256; d=example.com; s=jupiter;
 c=ischedule-relaxed/simple; q=dns/txt:http/well-known;
 t=1268069852; x=1283918400;
 h=Originator:Recipient:Content-Type:
 iSchedule-Version:iSchedule-Message-ID;
 bh=XXXxxxXXXxxxXXXxxxXXXxxxXXXxxxXXXxxx;
 b=XXXxxxXXXxxxXXXxxxXXXxxxXXXxxxXXXxxxXXXxxxXXXxxxXXXxxx
Host: cal.example.org
iSchedule-Version: 1.0
Originator: mailto:bernard@example.com
Recipient: mailto:cyrus@example.org
Cache-Control: no-cache, no-transform
Content-Type: text/calendar; component=VTODO; method=REQUEST
Content-Length: xxxx

BEGIN:VCALENDAR
VERSION:2.0
PRODID:-//Example Corp.//CalDAV Client//EN
METHOD:REQUEST
BEGIN:VTODO
DTSTAMP:20040901T200200Z
ORGANIZER:mailto:bernard@example.com
DUE:20070505
SUMMARY:Review Internet-Draft
UID:34222-456@example.com
ATTENDEE;PARTSTAT=NEEDS-ACTION;RSVP=TRUE;ROLE=RE
 Q-PARTICIPANT;CUTYPE=INDIVIDUAL;CN=Cyrus Daboo:
 mailto:cyrus@example.org
END:VEVENT
END:VCALENDAR
```

```
>> Response <<

HTTP/1.1 403 FORBIDDEN
Date: Thu, 02 Sep 2004 16:53:32 GMT
Content-Type: application/xml; charset=utf-8
Content-Length: xxxx
iSchedule-Version: 1.0
iSchedule-Capabilities: 123

<?xml version="1.0" encoding="utf-8" ?>
<error xmlns="urn:ietf:params:xml:ns:ischedule">
  <verification-failed />
  <response-description>Unable to verify request<
  /response-description>
</error>
```

Appendix B. Change Log (to be removed by RFC Editor prior to publication)

B.1. Changes in -05

a. Fixed missing Recipient header in example.
b. Added statements about what happens when a signature is or is not valid.
c. Removed _ischedule SRV record type as we only support HTTPS.
d. Removed text about adding an extra Recipient header as we no longer need that.

B.2. Changes in -04

a. Added some addition error codes to match MUST requirements.
b. Free busy example now shows a failed calendar user response.
c. Fixed capabilities response example to add method elements for VTODO and VFREEBUSY.
d. More details added to XML element definitions.

B.3. Changes in -03

a. Removed http= tag from DKIM header.
b. Updated lists of must and must not sign headers.
c. Stated that Recipient list must match ATTENDEE list for VFREEBUSY requests.
d. Recommend 5 minute skew for t=.
e. Added serial-number to capabilities and iSchedule-Capabilities response header.

   f.   Added "ischedule-relaxed" header canonicalization.

   g.   Fixed examples.

[B.4](). Changes in -02

   a.   Major structural changes as well as addition of new sections,
        including an Overview.

   b.   Changed capabilities XML schema.

   c.   XML error elements are now named for the actual error as opposed
        to WebDAV style pre-conditions.

   d.   Removed intermediary support and iSchedule-Via header.

   e.   Added TXT path= lookup to accompany SRV lookup.

   f.   Added http/well-known public key lookup mechanism.

   g.   Added iSchedule-Message-ID header.

   h.   Provided suggested values for t= and x= to cope with clock skew
        and processing time issues.

   i.   Indicated that iSchedule-Version header can be returned in
        OPTIONS responses.

   j.   Clarified that Attendee list for VFREEBUSY has to be the same as
        the Recipient list.

[B.5](). Changes in -01

   a.   Introduced use of DKIM for calendaring and scheduling services.

   b.   The XML elements "supported-calendar-data" and "calendar-data"
        were renamed to "supported-calendar-data-type" and "calendar-
        data-type" respectively to avoid confusion with the "calendar-
        data" XML element being used in the "response" XML element.

   c.   The "recipient" XML element was redefined to accept (#PCDATA)
        instead of an "href" XML element.

   d.   The grammar of new HTTP headers is now using the ABNF syntax
        defined in [[RFC5234]()].

   e.   Fixed various typos.

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