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**Time Zone Data Distribution Service
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Abstract

This document defines a time zone data distribution service that allows reliable, secure and fast delivery of time zone data to client systems such as calendaring and scheduling applications or operating systems.

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1. Introduction

Time zone data typically combines a coordinated universal time (UTC) offset with daylight saving time (DST) rules. Time zones are typically tied to specific geographic and geopolitical regions. Whilst the UTC offset for particular regions changes infrequently, DST rules can change frequently and sometimes with very little notice (maybe hours before a change comes into effect).

Calendaring and scheduling systems, such as those that use iCalendar [RFC5545], as well as operating systems, critically rely on time zone data to determine the correct local time. As such they need to be kept up to date with changes to time zone data. To date there has been no fast and easy way to do that. Time zone data is often

supplied in the form of a set of data files that have to be "compiled" into a suitable database format for use by the client application or operating system. In the case of operating systems, often those changes only get propagated to client machines when there is an operating system update, which can be infrequent, resulting in inaccurate time zone data being present for significant amounts of time.

This specification defines a time zone data distribution service protocol that allows for fast, reliable and accurate delivery of time zone data to client systems. This protocol is based on HTTP [[RFC7230](#)] using a REST style API, with JSON [[RFC7159](#)] responses.

This specification does not define the source of the time zone data. It is assumed that a reliable and accurate source is available. One such source is the IANA hosted time zone database [[RFC6557](#)].

Discussion of this document should take place on the tzdist working group mailing list <tzdist@ietf.org>.

[1.1.](#) 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](#)].

Unless otherwise indicated, if an [[RFC3339](#)] UTC date-time value is used, that refers to a date-time value with a "Z" suffix, and not one that includes a numeric offset.

[1.2.](#) Glossary of terms

The following terms with the given meanings are used throughout this document.

Time Zone: A description of the historical and predicted timekeeping practices of a collection of clocks that are intended to agree;

Time Zone Data: Data that defines a single time zone, including an identifier, UTC offset values, DST rules, and other information such as time zone abbreviations;

Time Zone Server: A server implementing the Time Zone Data Distribution Service Protocol defined by this specification;

Time Zone Identifier: A globally unique name which identifies time zone data, and which may include other information such as time zone abbreviations.

Observance: Data that defines a portion of a time zone where the UTC offset is a constant. A time zone with varying rules for the UTC offset will have many adjacent observances, with the total set covering the range of validity of the time zone data.

Note that the term "time zone" does not have the common meaning of a region of the world at a specific UTC offset, possibly modified by daylight saving time. For example, the "Central European Time" zone can correspond to several timezones "Europe/Berlin", "Europe/Paris", etc., because subregions have kept time differently in the past.

2. Architectural Overview

The overall process for the delivery of time zone data can be visualized via the diagram shown below.

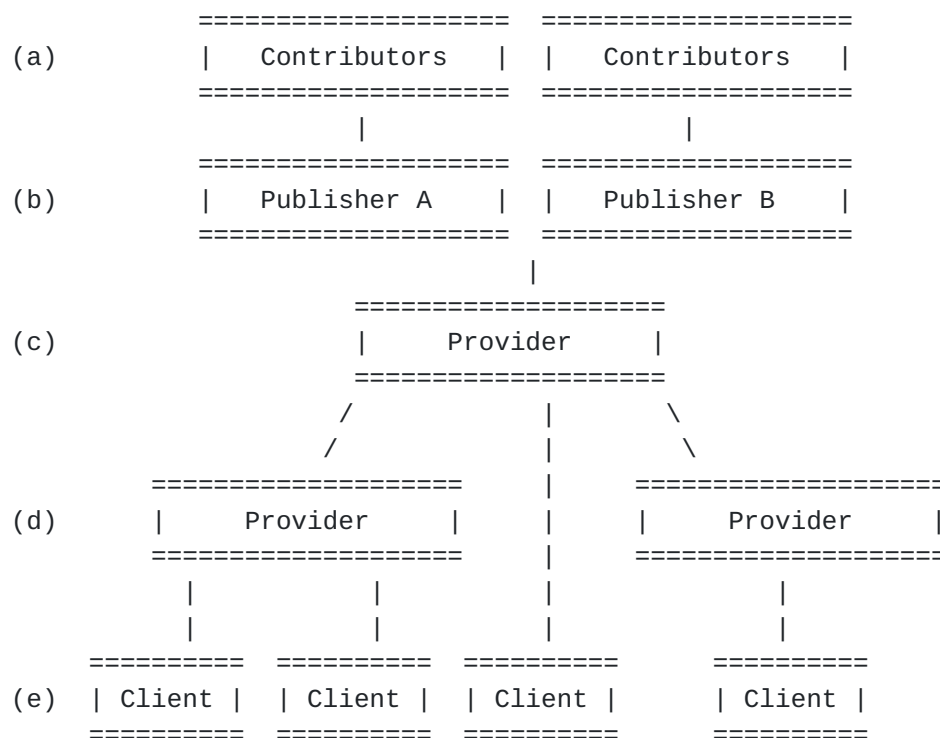


Figure 1: Time Zone Data Distribution Service Architecture

The overall service is made up of several layers:

- (a) Contributors: Individuals, governments or organizations which provide information about time zones to the publishing process. There can be many contributors.
- (b) Publishers: Publishers aggregate information from contributors, determine the reliability of the information and, based on that,

generate time zone data. There can be many publishers, each getting information from many different contributors. In some cases a publisher may choose to "re-publish" data from another publisher.

- (c) Root Providers: Servers which obtain and then provide the time zone data from publishers and make that available to other servers or clients. There can be many root providers. Root providers can choose to supply time zone data from one or more publishers.
- (d) Secondary Providers: Servers which handle the bulk of the requests and reduce the load on root servers. These will typically be simple caches of the root server, located closer to clients. For example a large Internet Service Provider (ISP) may choose to setup their own secondary provider to allow clients within their network to make requests of that server rather than making requests of servers outside their network. Secondary servers will cache and periodically refresh data from the root servers.
- (e) Clients: Applications, operating systems etc., that make use of time zone data and retrieve that from either root or secondary providers.

Some of those layers may be coalesced by implementors. For example, a vendor may choose to implement the entire service as a single monolithic virtual server with the address embedded in distributed systems. Others may choose to provide a service consisting of multiple layers of providers, many secondary servers and a small number of root servers.

This specification is concerned only with the protocol used to exchange data between providers and from provider to client. This specification does not define how contributors pass their information to publishers, nor how those publishers vet that information to obtain trustworthy data, nor the format of the data produced by the publishers.

3. General Considerations

3.1. Time Zone Identifiers

Time zone identifiers are unique names associated with each time zone, as defined by publishers. The iCalendar [[RFC5545](#)] specification has a "TZID" property and parameter whose value is set to the corresponding time zone identifier, and used to identify time zone data and relate time zones to start and end dates in events, etc. This specification does not define what format of time zone

identifiers should be used. It is possible that time zone identifiers from different publishers overlap, and there might be a need for a provider to distinguish those with some form of "namespace" prefix identifying the publisher. However, development of a standard (global) time zone identifier naming scheme is out of scope for this specification.

[3.2.](#) Time Zone Aliases

Time zone aliases map a name onto a time zone identifier. For example "US/Eastern" is usually mapped on to "America/New_York". Time zone aliases are typically used interchangeably with time zone identifiers when presenting information to users.

A time zone data distribution service needs to maintain time zone alias mapping information, and expose that data to clients as well as allow clients to query for time zone data using aliases. When returning time zone data to a client, the server returns the data with an identifier matching the query, but it can include one or more equivalent identifiers in the data to provide a hint to the client that alternative identifiers are available. For example, a query for "US/Eastern" could include equivalent identifiers for "America/New_York" or "America/Montreal".

The set of aliases may vary depending on whether timezone data is truncated (see [Section 3.4](#)). For example, a client located in the US state of Michigan may see "US/Eastern" as an alias for "America/Detroit" whereas a client in the US state of New Jersey may see it as an alias for "America/New_York", and all three names may be aliases if timezones are truncated to post-2013 data.

[3.3.](#) Time Zone Localized Names

Localized names are names for time zones which can be presented to a user in their own language. Each time zone may have one or more localized names associated with it. Names would typically be unique in their own locale as they might be presented to the user in a list. Localized names are distinct from abbreviations commonly used for UTC offsets within a time zone. For example, the time zone "America/New_York" may have the localized name "Nueva York" in a Spanish locale, as distinct from the abbreviations "EST" and "EDT" which may or may not have their own localizations.

A time zone data distribution service might need to maintain localized name information, for one or more chosen languages, as well as allow clients to query for time zone data using localized names.

3.4. Truncating Time Zones

Time zones and daylight saving times rules have been in use for over a century. Time zone data can thus contain a large amount of "historical" information that may not be relevant for a particular server's intended clients. For example, calendaring and scheduling clients are likely most concerned with time zone data that covers a period for one or two years in the past on into the future, as users typically create only new events for the present and future. Similarly, time zone data might contain a large amount of "future" information about transitions occurring many decades into the future. Again, clients might be concerned only with a smaller range into the future, and data past that point might be redundant.

To avoid having to send unnecessary data, servers are allowed to truncate time zone data to a range determined by start and end point date and time values, and provide only offsets and rules between those points. The server will need to advertise the ranges it is using so that clients can take appropriate action if they need time zone data for times outside of those ranges.

The truncation points at the start and end of a range are always a UTC date-time value, with both points being "inclusive" to the overall range. A server will advertise a truncation range for the truncated data it can supply, or provide an indicator that it can truncate at any start or end point to produce arbitrary ranges. In addition, the server can advertise that it supplies untruncated data - that is data that covers the full range of times available from the source publisher. In the absence of any indication of truncated data available on the server, the server will supply only untruncated data.

When truncating the start of a "VTIMEZONE" component, the server MUST include either a "STANDARD" or "DAYLIGHT" sub-component with a "DTSTART" property value that matches the start point of the truncation range, and appropriate "TZOFFSETFROM" and "TZOFFSETTO" properties to indicate the correct offset in effect right before and after the truncation range start point. This sub-component, which is the first observance defined by the time zone data, thus represents the earliest valid date-time covered by the time zone data in the truncated "VTIMEZONE" component.

When truncating the end of a "VTIMEZONE" component, the server MUST include a "TZUNTIL" iCalendar property ([Section 8.1](#)) in the "VTIMEZONE" component to indicate the end point of the truncation range.

4. Time Zone Data Distribution Service Protocol

4.1. Server Protocol

The time zone data distribution service protocol uses HTTP [[RFC7230](#)] for query and delivery of data. Queries are made on a single HTTP resource using the GET method, with specific client request attributes passed in request-URI parameters.

The "action" request-URI parameter defines the overall function being requested, with other request parameters acting as arguments to that function. All request parameters used by this protocol that contain text values MUST be encoded using the UTF-8 [[RFC3629](#)] character set.

All responses MUST return data using the UTF-8 [[RFC3629](#)] character set.

Most security considerations are already handled adequately by HTTP. However, given the nature of the data being transferred and the requirement it be correct, all interactions between client and server SHOULD use an HTTP connection protected with TLS [[RFC5246](#)] as defined in [[RFC2818](#)].

4.1.1. Time Zone Queries

Time zone identifiers, aliases or localized names can be used to query for time zone data. This will be more explicitly defined below for each action. In general however, if a "tzid" request parameter is used then the value may be an identifier or an alias. When the "pattern" parameter is used it may be an identifier, an alias or a localized name.

4.1.2. Time Zone Formats

The default format for returning time zone definitions is the iCalendar [[RFC5545](#)] data format. In addition, the iCalendar-in-XML [[RFC6321](#)], and iCalendar-in-JSON [[RFC7265](#)] representations are also available. The "format" request-URI parameter can be used to select which data format is returned.

4.1.3. Conditional Time Zone Requests

Time zone data is generally slow moving, with the set of time zones that change from even year-to-year being relatively small. However, any changes that do occur, need to be distributed in a timely manner. Typically it is more efficient to just provide the set of changes to time zone data, so a client can do updates to any locally cached data.

When listing time zones, a timestamp is returned by the server, and that can be used later by clients to determine if any "substantive" change has occurred in the time zone data. Clients can use a conditional "list" action (see [Section 6.2](#)), supplying a previous timestamp value, to limit the results to time zones which have changed in a "substantive" manner since that previous timestamp. This allows clients to cache the last timestamp and to periodically poll the server for possible changes.

A "substantive" change is one which affects the calculated onsets for a time zone. Changes to properties such as a description are not treated as a "substantive" change.

Clients SHOULD poll for such changes at least once a day. A server acting as a secondary provider, caching time zone data from another server, SHOULD poll for changes once per hour. See [Section 9](#) on expected client and server behavior regarding high request rates.

[4.1.4.](#) Expanded Time Zone Data

Determining time zone offsets at a particular point in time is often a complicated process, as the rules for daylight saving time can be complex. To help with this, the time zone data distribution service provides an action that allows clients to request the server to expand a time zone definition into a set of "observances" over a fixed period of time (see [Section 6.4](#)). Each of these observances describes a UTC onset time and UTC offsets for the prior time and the observance time. Together, these provide a quick way for "thin" clients to determine an appropriate UTC offset for an arbitrary date without having to do full time zone expansion themselves.

[4.1.5.](#) Server Requirements

To enable a simple client implementation, servers SHOULD ensure that they provide or cache data for all commonly used time zones, from various publishers. That allows client implementations to configure a single server to get all time zone data. In turn, any server can refresh any of the data from any other server - though the root servers may provide the most up-to-date copy of the data.

[4.1.6.](#) Error Responses

The following are examples of response codes one would expect to be used by the server. Note, however, that unless explicitly prohibited any 2/3/4/5xx series response code may be used in a response.

200 (OK) - The command succeeded.

400 (Bad Request) - The Sender has provided an invalid request parameter.

404 (Not Found) - The time zone was not found.

When an HTTP error response is returned to the client, the server SHOULD return a JSON error object in the response body, as per [Section 7.4](#), with some suitable descriptive text in the "description" member of the JSON object, in addition to the applicable error code (as per [Section 6](#)).

[4.1.7](#). Extensions

This protocol is designed to be extensible through a standards based registration mechanism (see [Section 10](#)). It is anticipated that other useful time zone actions will be added in the future (e.g., mapping a geographical location to time zone identifiers, getting change history for time zones), and so, servers MUST return a description of their capabilities. This will allow clients to determine if new features have been installed and, if not, fall back on earlier features or disable some client capabilities.

[4.2](#). Client Guidelines

[4.2.1](#). Discovery

Client implementations need to either know where the time zone data distribution service is located or discover it through some mechanism. To use a time zone data distribution service, a client needs a fully qualified domain name (FQDN), port and HTTP request-URI path.

[4.2.1.1](#). Time Zone Data Distribution Service SRV Service Labels

[RFC2782] defines a DNS-based service discovery protocol that has been widely adopted as a means of locating particular services within a local area network and beyond, using SRV RR records. This can be used to discover a service's FQDN and port.

This specification adds two service types for use with SRV records:

timezone: Identifies a Time Zone Data Distribution server that uses HTTP without transport layer security ([\[RFC2818\]](#)).

timezones: Identifies a Time Zone Data Distribution server that uses HTTP with transport layer security ([\[RFC2818\]](#)).

Clients MUST honor "TTL", "Priority" and "Weight" values in the SRV records, as described by [\[RFC2782\]](#).

Example: service record for server without transport layer security.

```
_timezone._tcp SRV 0 1 80 tz.example.com.
```

Example: service record for server with transport layer security.

```
_timezones._tcp SRV 0 1 443 tz.example.com.
```

[4.2.1.2.](#) Time Zone Data Distribution Service TXT records

When SRV RRs are used to advertise a time zone data distribution service, 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 server.

A site might provide TXT records in addition to SRV records for each service. When present, clients MUST use the "path" value as the "context path" for the service in HTTP requests. When not present, clients use the ".well-known" URI approach described next.

Example: text record for service with transport layer security.

```
_timezones._tcp TXT path=/timezones
```

[4.2.1.3.](#) Time Zone Data Distribution Service Well-Known URI

A "well-known" URI [\[RFC5785\]](#) is registered by this specification for the Time Zone Data Distribution service, "timezone" (see [Section 10](#)). This URI points to a resource that the client can use as the initial "context path" for the service they are trying to connect to. The server MUST redirect HTTP requests for that resource to the actual "context path" using one of the available mechanisms provided by HTTP (e.g., using an appropriate 3xx status response). Clients MUST handle HTTP redirects on the ".well-known" URI. Servers MUST NOT locate the actual time zone data distribution service endpoint at the ".well-known" URI as per [Section 1.1 of \[RFC5785\]](#).

Servers SHOULD set an appropriate Cache-Control header value (as per [Section 5.2 of \[RFC7234\]](#)) in the redirect response to ensure caching occurs as needed, or as required by the type of response generated. For example, if it is anticipated that the location of the redirect might change over time, then a "no-cache" value would be used.

To facilitate "context path's" that might differ from user to user, the server MAY require authentication when a client tries to access the ".well-known" URI (i.e., the server would return a 401 status response to the unauthenticated request from the client, then return the redirect response after a successful authentication by the client).

4.2.1.3.1. Example: well-known URI redirects to actual context path

A Time Zone Data Distribution server has a "context path" that is `/servlet/timezone`. The client will use `/.well-known/timezone` as the path for the service after it has first found the FQDN and port number via an SRV lookup or via manual entry of information by the user. When the client makes its initial HTTP request against `/.well-known/timezone`, the server would issue an HTTP 301 redirect response with a Location response header using the path `/servlet/timezone`. The client would then "follow" this redirect to the new resource and continue making HTTP requests there.

4.2.2. Initial Synchronization of All Time Zones

When a secondary service or a client wishing to cache all time zone data first starts, or wishes to do a full refresh, it synchronizes with another server by first issuing a "list" action. The client would preserve the returned datestamp for subsequent use. Each time zone in the returned list can then be fetched and stored locally. In addition a mapping of aliases to time zones can be built.

4.2.3. Subsequent Synchronization of All Time Zones

A secondary service or a client caching all time zone data needs to periodically synchronize with a server. To do so it would issue a "list" action with the "changesince" parameter set to the value of the datestamp returned by the last synchronization. The client would again preserve the returned datestamp for subsequent use. Each time zone in the returned list can then be fetched and stored locally.

Note, this process makes no provision for handling deleted time zones. In general it is bad practice to delete time zones as they might still be in use by consumers of time zone data.

5. Request Parameters

The "action" request-URI parameter MUST be included in all requests to define what action is required of the server.

The following request-URI parameters are used with the various actions.

5.1. "action" Parameter

Name: action

Description: Specify the action to be carried out.

Value: Any IANA registered action name (see [Section 10.2.1](#)).

5.2. "format" Parameter

Name: format

Description: Specify the format of the time zone data returned by the server as a standard MIME [\[RFC2046\]](#) media-type. If absent, the iCalendar [\[RFC5545\]](#) format will be returned with the time zones contained within a "VCALENDAR" object (i.e., a default media-type of "text/calendar").

Value: A MIME [\[RFC2046\]](#) media-type. The following values MAY be used, with servers advertising the values they do support via the "capabilities" action response (see [Section 6.1](#)):

text/calendar: Return data as "VTIMEZONE" components embedded in a "VCALENDAR" object as per [\[RFC5545\]](#).

application/calendar+xml: Return data using the XML representation of iCalendar data as per iCalendar-in-XML [\[RFC6321\]](#).

application/calendar+json: Return data using the JSON representation of iCalendar data as per iCalendar-in-JSON.

5.3. "changedsince" Parameter

Name: changedsince

Description: Specify the timestamp for a conditional "list" (see [Section 6.2](#)) or "expand" (see [Section 6.4](#)) action in order to restrict the results to changes only since the given timestamp.

Value: An [\[RFC3339\]](#) UTC date-time value, typically a value returned by a previous request.

5.4. "start" Parameter

Name: start

Description: Specify the inclusive start of a period.

Value: An [[RFC3339](#)] UTC date-time value.

5.5. "end" Parameter

Name: end

Description: Specify the exclusive end of a period.

Value: An [[RFC3339](#)] UTC date-time value.

5.6. "lang" Parameter

Name: lang

Description: Specify the language in which locale specific values are to be returned. e.g., if a language is specified, only localized names for that language would be returned.

Value: The value follows the specifications in [[RFC5646](#)].

5.7. "tzid" Parameter

Name: tzid

Description: Specify a time zone to be targeted by an action.

Value: A time zone identifier or alias.

5.8. "pattern" Parameter

Name: pattern

Description: Specify a pattern for queries.

Value: A time zone identifier, alias or localized name pattern.
This parameter is used when searching for matching time zones (see [Section 6.5](#)).

5.9. "truncate" Parameter

Name: truncate

Description: A period of time specified using two, comma-separated, UTC date-time values to indicate a time zone data truncation range. One of the two components can be a single "*" character to indicate that the server's own minimum or maximum start or end point should be used.

Value: A comma-separated list containing two components. Each component can be a [[RFC3339](#)] UTC date-time value, or the single character "*". The use of this depends on the "truncated" object returned in the server's "capabilities" response:

If the "truncated" object is not present in the "capabilities" response, then the "truncated" parameter MUST NOT be used - the server will always return untruncated time zone data.

If the "any" member in the "truncated" object is set to "true", then any date-time values are valid for the truncation start or end points. The "*" indicator can also be used for either the start or end point.

If the "any" member is "false" and the "ranges" member is present with at least one value, then any of the values in the "ranges" array can be used. The "ranges" array will contain objects with a "start" and an "end" member which describe the range of truncation supported by the server. Those two members are used to form the comma-separated value of the "truncated" parameter.

If the "untruncated" member is set to "true", then omitting the "truncated" parameter will result in untruncated data being returned.

If the "untruncated" member is set to "false", and the "ranges" member contains only one value, and the "truncated" query parameter is omitted, then the server will return time zone data truncated using the one value specified in "ranges".

Example: a server that can return only one set of truncated data - the client can omit the "truncate" query parameter.

```
"truncated": {
  "any": false,
  "ranges": [
    {
      "start": "1970-01-01T00:00:00Z",
      "end": "2020-12-31T11:59:59Z"
    }
  ],
  "untruncated": false
}
```


Example: a server that can return truncated data for any range, as well as untruncated data if client omits the "truncate" query parameter.

```
"truncated": {  
  "any": true,  
  "untruncated": true  
}
```

Example: a server that can return only untruncated data - the "truncate" query parameter would always be omitted.

```
"truncated": {  
  "any": false,  
  "untruncated": true  
}
```

6. Actions

Servers MUST support the following actions. The information below shows details about each action: a description, the set of allowed query parameters, the nature of the response, and a set of possible error codes for the response (see [Section 7.4](#)).

If an invalid "action" query parameter is sent, the following error code is returned to the client in the response:

invalid-action The "action" query parameter has an incorrect value, or appears more than once, or is missing.

6.1. "capabilities" Action

Name: capabilities

Description: This action returns the capabilities of the server, allowing clients to determine if a specific feature has been deployed and/or enabled. Note that each request always includes an "action" query parameter set to the name of the action, even though that parameter is not listed in the "capabilities" response for each action.

Parameters:

action REQUIRED with value "capabilities"

Response A JSON object containing a "version" member, an "info" member, and an "actions" member, see [Section 7.1](#).

Possible Error Codes No specific code.

6.1.1. Example: Get Capabilities

>> Request <<

```
GET /?action=capabilities HTTP/1.1
Host: tz.example.com
```

>> Response <<

```
HTTP/1.1 200 OK
Date: Wed, 4 Jun 2008 09:32:12 GMT
Content-Type: application/json; charset="utf-8"
Content-Length: xxxx
```

```
{
  "version": 1,

  "info": {
    "primary-source": "Olson:2011m",
    "truncate" : {
      "any": false,
      "ranges": [
        {
          "start": "1970-01-01T00:00:00Z",
          "end": "*"
        },
        {
          "start": "2010-01-01T00:00:00Z",
          "end": "2019-12-31T11:11:59Z"
        }
      ],
      "untruncated": true
    },
    "provider-details": "http://tz.example.com/about.html",
    "contacts": ["mailto:tzs@example.org"]
  },

  "actions": [
    {
      "name": "list",
      "parameters": [
        {
          "name": "lang",
          "required": false,
          "multi": true
        }
      ]
    }
  ]
}
```



```
    {
      "name": "changedsince",
      "required": false,
      "multi": false
    }
  ]
},
{
  "name": "get",
  "parameters": [
    {
      "name": "format",
      "required": false,
      "multi": false,
      "values": [
        "text/calendar",
        "application/calendar+xml",
        "application/calendar+json"
      ]
    },
    {
      "name": "lang",
      "required": false,
      "multi": true
    },
    {
      "name": "tzid",
      "required": true,
      "multi": false
    },
    {
      "name": "truncate",
      "required": false,
      "multi": false
    }
  ]
},
{
  "name": "expand",
  "parameters": [
    {
      "name": "tzid",
      "required": true,
      "multi": false
    },
  ],
}
```



```
        "name": "start",
        "required": false,
        "multi": false
      },
      {
        "name": "end",
        "required": false,
        "multi": false
      }
    ]
  },
  {
    "name": "find",
    "parameters": [
      {
        "name": "pattern",
        "required": true,
        "multi": false
      },
      {
        "name": "lang",
        "required": false,
        "multi": true
      }
    ]
  },
  {
    "name": "capabilities",
    "parameters": []
  }
]
```

6.2. "list" Action

Name: list

Description: This action lists all time zone identifiers or the requested time zone identifiers, in summary format, with aliases and optional localized data. In addition, it returns a timestamp which is the current server last modification value. If the "changesince" query parameter is present its value MUST correspond to a previously returned timestamp value. When "changesince" timestamp is used, the server MUST return only those time zones that have changed since the specified timestamp. If the "tzid" parameter is present one or more times, then the

server MUST return only information for the specified time zone identifiers.

Parameters:

action REQUIRED with value "list"

lang=<lang-code> OPTIONAL, but MAY occur multiple times.

changedsince OPTIONAL, but MUST occur only once. MUST NOT be present if the "tzid" parameter is present.

tzid=<identifier> OPTIONAL, and MAY occur multiple times. MUST NOT be present if the "changedsince" parameter is present. The value of the "dtstamp" member in the response applies to the entire set of data, rather than the subset requested with the "tzid" query parameter, and allows the client to determine if it needs to refresh its full set of time zone data.

Response: A JSON object containing a "dtstamp" member and a "timezones" member, see [Section 7.2](#).

Possible Error Codes

invalid-changedsince The "changedsince" query parameter has an incorrect value, or appears more than once.

invalid-tzid The "tzid" query parameter is present along with the "changedsince", or has an incorrect value.

[6.2.1](#). Example: List time zone identifiers

In this example the client requests the time zone identifiers and in addition requests that the US-English local names be returned.

>> Request <<

```
GET /?action=list&lang=en_US HTTP/1.1
Host: tz.example.com
```

>> Response <<

```
HTTP/1.1 200 OK
Date: Wed, 4 Jun 2008 09:32:12 GMT
Content-Type: application/json; charset="utf-8"
Content-Length: xxxx
```

```
{
  "dtstamp": "2009-10-11T09:32:11Z",
  "timezones": [
    {
      "tzid": "America/New_York",
      "last-modified": "2009-09-17T01:39:34Z",
      "aliases": ["US/Eastern"],
      "local-names": [
        {
          "name": "America/New_York",
          "lang": "en_US"
        }
      ]
    },
    ...
  ]
}
```

6.3. "get" Action

Name: get

Description: This action returns a time zone. The response MUST contain an ETag response header field indicating the current value of the strong entity tag of the time zone resource.

If the identifier is actually a time zone alias, the server will return the matching time zone data with the alias as the identifier in the time zone data. The server MAY include one or more "EQUIVALENT-TZID" properties (see [Section 8.2](#)) in the time zone data to indicate equivalent identifiers for the alias.

Parameters:

action REQUIRED with value "get"

format=<media-type> OPTIONAL, but MUST occur only once.

lang=<lang-code> OPTIONAL, but MAY occur multiple times.

tzid=<identifier> REQUIRED, and MUST occur only once.

truncate=<date-time,date-time> OPTIONAL, and MUST occur only once. See [Section 5.9](#) for details.

Response: A document containing all the requested time zone data in the format specified.

Possible Error Codes

invalid-tzid The "tzid" query parameter is not present, or appears more than once.

tzid-not-found No time zone associated with the specified "tzid" query parameter value was found.

invalid-format The "format" query parameter appears more than once, or has an invalid value.

invalid-truncate The "truncate" query parameter appears more than once, or has an invalid value.

[6.3.1](#). Example: Get time zone

In this example the client requests the time zone with a specific time zone identifier to be returned.

>> Request <<

```
GET /?action=get&tzid=America/New_York
    &format=text/calendar HTTP/1.1
Host: tz.example.com
```

>> Response <<

```
HTTP/1.1 200 OK
Date: Wed, 4 Jun 2008 09:32:12 GMT
Content-Type: text/calendar; charset="utf-8"
Content-Length: xxxx
ETag: "123456789-000-111"
```

```
BEGIN:VCALENDAR
...
BEGIN:VTIMEZONE
TZID:America/New_York
...
END:VTIMEZONE
END:VCALENDAR
```

[6.3.2.](#) Example: Get time zone alias

In this example the client requests the time zone with an aliased time zone identifier to be returned, and the server returns the time zone data with that identifier, and two equivalents.

>> Request <<

```
GET /?action=get&tzid=US/Eastern
    &format=text/calendar HTTP/1.1
Host: tz.example.com
```

>> Response <<

```
HTTP/1.1 200 OK
Date: Wed, 4 Jun 2008 09:32:12 GMT
Content-Type: text/calendar; charset="utf-8"
Content-Length: xxxx
ETag: "123456789-000-111"

BEGIN:VCALENDAR
...
BEGIN:VTIMEZONE
TZID:US/Eastern
EQUIVALENT-TZID:America/New_York
EQUIVALENT-TZID:America/Montreal
...
END:VTIMEZONE
END:VCALENDAR
```

6.3.3. Example: Get truncated time zone

Assume the server advertises a "truncated" object in its "capabilities" response that appears as:

```
"truncated": {
  "any": false,
  "ranges": [
    {"start": "1970-01-01T00:00:00Z", "end": "*"},
    {"start": "2010-01-01T00:00:00Z", "end": "2019-12-31T11:11:59Z"}
  ],
  "untruncated": false
}
```


In this example the client requests the time zone with a specific time zone identifier truncated at one of the ranges specified by the server, to be returned. Note the presence of a "STANDARD" component that matches the start point of the truncation range (converted to the local time for the UTC offset in effect at the matching UTC time). Also, note the presence of the "TZUNTIL" ([Section 8.1](#)) iCalendar property in the "VTIMEZONE" component, indicating the upper bound on the validity of the time zone data.

>> Request <<

```
GET /?action=get&tzid=America/New_York
    &format=text/calendar
    &truncate=2010-01-01T00:00:00Z,2019-12-31T11:11:59Z
    HTTP/1.1
Host: tz.example.com
```

>> Response <<

```
HTTP/1.1 200 OK
Date: Wed, 4 Jun 2008 09:32:12 GMT
Content-Type: text/calendar; charset="utf-8"
Content-Length: xxxx
ETag: "123456789-000-111"
```

```
BEGIN:VCALENDAR
...
BEGIN:VTIMEZONE
TZID:America/New_York
TZUNTIL:20191231T111159Z
BEGIN:STANDARD
DTSTART:20101231T190000
TZNAME:EST
TZOFFSETFROM:-0500
TZOFFSETTO:-0500
END:STANDARD
...
END:VTIMEZONE
END:VCALENDAR
```

[6.4.](#) "expand" Action

Name: expand

Description: This action expands the specified time zone into a list of onset start date/time (in UTC) and UTC offsets. The response MUST contain an ETag response header field indicating the current value of the strong entity tag for the expanded data.

Parameters:

action REQUIRED with value "expand"

tzid=<identifier> REQUIRED, but MUST occur only once.

lang=<lang-code> OPTIONAL, but MAY occur multiple times.

start=<date-time>: REQUIRED, but MUST occur only once. Specifies the inclusive UTC date-time value for the start of the period of interest.

end=<date-time>: OPTIONAL, but MUST occur only once. If present, specifies the exclusive UTC date-time value for the end of the period of interest. If "end" is omitted, the value is the "start" parameter value plus 10 years. Note that this is the exclusive end value - i.e., it represents the date just after the range of interest. e.g., if a client wants the expanded date just for the year 2014, it would use a start value of "2014-01-01T00:00:00Z" and an end value of "2015-01-01T00:00:00Z". An error occurs if the end value is less than or equal to the start value.

changesince OPTIONAL, but MUST occur only once. If present, its value MUST be taken from the "dtstamp" result of a previous expand result. If the targeted time zone has not changed over the expansion range queried in the request, then the server MUST return a 304 HTTP status response.

Response: A JSON object containing "dtstamp" and "tzid" members, and an "observances" member, see [Section 7.3](#). The server MUST include an expanded observance representing the time zone information in effect at the start of the period.

Possible Error Codes

invalid-tzid The "tzid" query parameter is not present, or appears more than once.

tzid-not-found No time zone associated with the specified "tzid" query parameter value was found.

invalid-start The "start" query parameter has an incorrect value, or appears more than once, or is missing.

invalid-end The "end" query parameter has an incorrect value, or appears more than once, or has a value less than or equal to the "start" query parameter.

invalid-changedsince The "changedsince" query parameter has an incorrect value, or appears more than once.

6.4.1. Example: Expanded JSON Data Format

In this example the client requests a time zone in the expanded form.

>> Request <<

```
GET /?action=expand&tzid=America/New_York
    &start=2008-01-01T00:00:00Z
    &end=2009-01-01T00:00:00Z
    HTTP/1.1
Host: tz.example.com
```

>> Response <<

```
HTTP/1.1 200 OK
Date: Mon, 11 Oct 2009 09:32:12 GMT
Content-Type: application/json; charset="utf-8"
Content-Length: xxxx
ETag: "123456789-000-111"
```

```
{
  "dtstamp": "2009-10-11T09:32:11Z",
  "tzid": "America/New_York",
  "observances": [
    {
      "name": "Standard",
      "onset": "2008-01-01T00:00:00Z",
      "utc-offset-from": -18000,
      "utc-offset-to": -18000
    },
    {
      "name": "Daylight",
      "onset": "2008-03-09T07:00:00Z",
      "utc-offset-from": -18000,
      "utc-offset-to": -14400
    },
    {
      "name": "Standard",
      "onset": "2008-11-02T06:00:00Z",
      "utc-offset-from": -14400,
      "utc-offset-to": -18000
    },
  ],
}
```


6.5. "find" Action

Name: find

Description: This action allows a client to query the time zone data distribution service for a matching identifier, alias or localized name, using a simple "glob" style pattern match against the names known to the server (with an asterisk * as the wildcard character). Pattern match strings have the following options:

- * not present An exact text match is done, e.g., "xyz"
- * first character only An ends-with text match is done, e.g.,
"xyz"
- * last character only A starts-with text match is done, e.g.,
"xyz"
- * first and last characters only A sub-string text match is done,
e.g., "xyz"

In addition, when matching, underscore characters (0x5F) SHOULD be mapped to a single space character (0x20) prior to string comparison. This allows time zone identifiers such as "America/New_York" to match a query for "*New York*". ASCII characters in the range 0x41 ("A") through 0x5A ("Z") SHOULD be mapped to their lowercase equivalents.

Parameters:

action REQUIRED with value "find"

pattern=<text> REQUIRED, but MUST occur only once.

lang=<lang-code> OPTIONAL, but MAY occur multiple times.

Response: The response has the same format as the "list" action, with one result object per successful match, see [Section 7.2](#).

Possible Error Codes

invalid-pattern The "pattern" query parameter is not present, or appears more than once.

6.5.1. Example: Find action

In this example the client asks for data about the time zone "US/Eastern".

>> Request <<

```
GET /?action=find&pattern=US/Eastern HTTP/1.1
Host: tz.example.com
```

>> Response <<

```
HTTP/1.1 200 OK
Date: Wed, 4 Jun 2008 09:32:12 GMT
Content-Type: application/json; charset="utf-8"
Content-Length: xxxx
```

```
{
  "dtstamp": "2009-10-11T09:32:11Z",
  "timezones": [
    {
      "tzid": "America/New_York",
      "last-modified": "2009-09-17T01:39:34Z",
      "aliases": ["US/Eastern"],
      "local-names": [
        {
          "name": "America/New_York",
          "lang": "en_US"
        }
      ]
    },
    {
      "tzid": "America/Detroit",
      "last-modified": "2009-09-17T01:39:34Z",
      "aliases": ["US/Eastern"],
      "local-names": [
        {
          "name": "America/Detroit",
          "lang": "en_US"
        }
      ]
    },
    ...
  ]
}
```


7. JSON Definitions

JSON members used by this specification are defined here using the syntax in [[I-D.newton-json-content-rules](#)]. Clients MUST ignore any JSON members they do not expect.

7.1. capabilities action response

JSON Content Rules for the JSON document returned for a "capabilities" action request.

; root object

```
root {  
  version,  
  info,  
  actions  
}
```

; The version number of the protocol supported - MUST be 1
version "version" : integer 1..1

; object containing service information

```
info "info" {  
  primary_source / secondary_source,  
  ?truncated,  
  ?provider_details,  
  ?contacts  
}
```

; The source of the time zone data provided by a "primary" server
primary_source "primary-source" : string

; The time zone server from which data is provided by a "secondary"

; server
secondary_source "secondary-source" : uri

; Present if the server is providing truncated time zone data. The
; value is an object providing details of the supported truncation
; modes.

```
truncated "truncated" : {  
  any,  
  ?ranges,  
  ?untruncated  
}
```

; Indicates whether the server can truncate time zone data at any
; start or end point. When set to "true" any start or end point is


```
; a valid value for use with the "truncated" query parameter in an
; action "get" request
any "any" : boolean

; Indicates which ranges of time the server has truncated data for.
; A value from this list may be used with the "truncated" query
; parameter in an action "get" request. Not present if "any" is set
; to "true"
ranges "ranges" : [ * : range ]

; A range of time
range {
    range-start,
    range-end
}

; [RFC3339] UTC date-time value for inclusive start of the range,
; or the single character "*" to indicate a value corresponding to
; the lower bound supplied by the publisher of the time zone data
range-start "start" : date-time

; [RFC3339] UTC date-time value for inclusive end of the range,
; or the single character "*" to indicate a value corresponding to
; the upper bound supplied by the publisher of the time zone data
range-end "end" : date-time

; Indicates whether the server can supply untruncated data. When
; set to "true" indicates that, in addition to truncated data being
; available, the server can return untruncated data if an action
; "get" request is executed without a "truncated" query parameter
untruncated "untruncated" : boolean

; A URI where human readable details about the time zone service
; is available
provider_details "provider-details" : uri

; Array of URIs providing contact details for the server
; administrator
contacts "contacts" [ * : uri ]

; Array of actions supported by the server
actions "actions" [ * action ]

; An action supported by the server
action {
    action_name,
    action_params
}
```



```
; Name of the action
action_name "name" : string

; Array of request-URI query parameters supported by the action
action_params "parameters" [ * parameter ]

; Object defining an action parameter
parameter {
    param_name,
    ?param_required,
    ?param_multi,
    ?param_values
}

; Name of the parameter
param_name "name" : string

; If true the parameter has to be present in the request-URI
; default is false
param_required "required" : boolean

; If true the parameter can occur more than once in the request-URI
; default is false
param_multi "multi" : boolean,

; An array that defines the allowed set of values for the parameter
; In the absence of this member, any string value is acceptable
param_values "values" [ * : string ]
```

[7.2.](#) list action response

JSON Content Rules for the JSON document returned for a "list" action request.


```
; root object

root {
    dtstamp,
    timezones
}

; Server generated timestamp used for synchronizing changes,
; [RFC3339] UTC value
dtstamp "dtstamp" : date-time

; Array of time zone objects
timezones "timezones" [ * timezone ]

; Information about a time zone available on the server
timezone {
    tzid,
    last_modified,
    ?aliases,
    ?local_names,
}

; Time zone identifier
tzid "tzid" : string

; Date/time when the time zone data was last modified
; [RFC3339] UTC value
last_modified "last-modified" : date-time

; An array that lists the set of time zone aliases available
; for the corresponding time zone
aliases "aliases" [ * : string ]

; An array that lists the set of localized names available
; for the corresponding time zone
local_names "local-names" [ * local_name ]

local_name [lang, lname, ?pref]

; Language tag for the language of the associated name
lang : string

; Localized name
lname : string

; Indicates whether this is the preferred name for the associated
; language default: false
pref : boolean
```


7.3. expand action response

JSON Content Rules for the JSON document returned for a "expand" action request.

; root object

```
root {  
    dtstamp,  
    tzid,  
    observances  
}
```

; Server generated timestamp used for synchronizing changes

; [\[RFC3339\]](#) UTC value

```
dtstamp "dtstamp" : date-time
```

; Time zone identifier

```
tzid "tzid" : string
```

; Array of time zone objects

```
observances "observances" [ * observance ]
```

; Information about a time zone available on the server

```
observance {  
    oname,  
    ?olocal_names,  
    onset,  
    utc_offset_from,  
    utc_offset_to  
}
```

; Observance name

```
oname "name" : string
```

; Array of localized observance names

```
olocal_names "local-names" [ * : string]
```

; [\[RFC3339\]](#) UTC date-time value at which the observance takes effect

```
onset "onset" : date-time
```

; The UTC offset in seconds before the start of this observance

```
utc_offset_from "utc-offset-from" : integer
```

; The UTC offset in seconds at and after the start of this observance

```
utc_offset_to "utc-offset-to" : integer
```


7.4. error response

JSON Content Rules for the JSON document returned when an error occurs.

```
; root object

root {
    error,
    ?description
}

; Error code
error "error" : string

; Description of the error
description "description" : string
```

8. New iCalendar Properties

8.1. Time Zone Upper Bound

Property Name: TZUNTIL

Purpose: This property specifies an upper bound for the validity of data within a "VTIMEZONE" component.

Value Type: DATE-TIME

Property Parameters: IANA and non-standard property parameters can be specified on this property.

Conformance: This property can be specified zero or one time within "VTIMEZONE" calendar components.

Description: The value MUST be specified in the UTC time format.

Time zone data in a "VTIMEZONE" component might cover only a fixed period of time. The start of such a period is clearly indicated by the earliest observance defined by the "STANDARD" and "DAYLIGHT" sub-components. However, [\[RFC5545\]](#) does not define a way to indicate an upper bound on the validity of the time zone data, which cannot be simply derived from the observance with the latest onset time. This specification introduces the "TZUNTIL" property for that purpose. It specifies an "inclusive" UTC date-time value that indicates the last time at which the time zone data is to be considered valid. For example, a time zone based on astronomical observations might have well defined values up to

only the year 2025. In that case, the "TZUNTIL" value would match the last accurately known observance transition in that year.

This property is also used by time zone data distribution servers to indicate the truncation range end point of time zone data (as described in [Section 3.4](#)).

Format Definition: This property is defined by the following notation:

```
tzuntil      = "TZUNTIL" tzuntilparam ":" date-time CRLF
```

```
tzuntilparam = *(";" other-param)
```

Example: The following is an example of this property:

```
TZUNTIL:20371231T115959Z
```

[8.2.](#) Equivalent Time Zone Identifier Property

Property Name: EQUIVALENT-TZID

Purpose: This property specifies an equivalent time zone identifier representing the same time zone data as the aliased "VTIMEZONE" component.

Value Type: TEXT

Property Parameters: IANA and non-standard property parameters can be specified on this property.

Conformance: This property can be specified zero or more times within "VTIMEZONE" calendar components.

Description: This property specifies an equivalent time zone identifier for a "VTIMEZONE" component when the "TZID" property of the time zone is an alias identifier.

Format Definition: This property is defined by the following notation:

```
equivalent-tzid = "EQUIVALENT-TZID" etzidparam ":"  
                  [tzidprefix] text CRLF
```

```
etzidparam      = *(";" other-param)
```

;tzidprefix defined in [\[RFC5545\]](#).

Example: The following is an example of this property:

EQUIVALENT-TZID:US/Eastern

9. Security Considerations

Time zone data is critical in determining local or UTC time for devices and in calendaring and scheduling operations. As such, it is vital that a reliable source of time zone data is used. Servers providing a time zone data distribution service MUST support HTTP over Transport Layer Security (TLS) (as defined by [\[RFC2818\]](#)) with a valid certificate. Clients and servers making use of a time zone data distribution service SHOULD use HTTP over TLS and verify the authenticity of the service being used before accepting and using any time zone data from that source.

Clients that support transport layer security as defined by [\[RFC2818\]](#) SHOULD try the "_timezones" service first before trying the "_timezone" service. Clients MUST follow the certificate verification process specified in [\[RFC6125\]](#).

A malicious attacker with access to the DNS server data, or able to get spoofed answers cached in a recursive resolver, can potentially cause clients to connect to any server chosen by the attacker. In the absence of a secure DNS option, clients SHOULD check that the target FQDN returned in the SRV record matches the original service domain that was queried. If the target FQDN is not in the queried domain, clients SHOULD verify with the user that the SRV target FQDN is suitable for use before executing any connections to the host.

Time zone servers SHOULD protect themselves against errant or malicious clients by throttling high request rates or frequent requests for large amounts of data. Clients can avoid being throttled by using the polling capabilities outlined in [Section 4.1.3](#). Servers MAY require some form of authentication or authorization of clients (including secondary servers) to restrict which clients are allowed to access their service, or provide better identification of errant clients. As such, servers MAY require HTTP-based authentication as per [\[RFC7235\]](#).

10. IANA Considerations

This specification defines a new registry of "actions" for the time zone data distribution service protocol, defines a "well-known" URI using the registration procedure and template from [Section 5.1 of \[RFC5785\]](#), creates two new SRV service label aliases, and defines one new iCalendar property parameter as per the registration procedure in [\[RFC5545\]](#).

10.1. Service Actions Registration

This section defines the process to register new or modified time zone data distribution service actions with IANA.

10.1.1. Service Actions Registration Procedure

The IETF will create a mailing list, `tzdist-service@ietf.org`, which can be used for public discussion of time zone data distribution service actions proposals prior to registration. Use of the mailing list is strongly encouraged. The IESG will appoint a designated expert who will monitor the `tzdist-service@ietf.org` mailing list and review registrations.

Registration of new time zone data distribution service actions MUST be reviewed by the designated expert and published in an RFC. A Standard Tracks RFC is REQUIRED for the registration of new time zone data distribution service actions. A Standard Tracks RFC is also REQUIRED for changes to actions previously documented in a Standard Tracks RFC.

The registration procedure begins when a completed registration template, defined in the sections below, is sent to `tzdist-service@ietf.org` and `iana@iana.org`. The designated expert is expected to tell IANA and the submitter of the registration within two weeks whether the registration is approved, approved with minor changes, or rejected with cause. When a registration is rejected with cause, it can be re-submitted if the concerns listed in the cause are addressed. Decisions made by the designated expert can be appealed to the IESG Applications Area Director, then to the IESG. They follow the normal appeals procedure for IESG decisions.

10.1.2. Registration Template for Actions

An action is defined by completing the following template.

Name: The name of the action. This is also the value of the "action" parameter used in time zone data distribution service requests.

Description: A general description of the action, its purpose, etc.

Parameters: A list of allowed request parameters, indicating whether they are "REQUIRED" or "OPTIONAL" and whether they can occur only once or multiple times.

Response The nature of the response to the HTTP request, e.g., what format the response data is in.

10.1.3. Registration Template for Action Parameters

An action parameter is defined by completing the following template.

Name: The name of the parameter.

Description: A general description of the parameter, its purpose, etc.

Value: The format of the parameter value, or an indication that the parameter has no value.

10.2. Initial Time Zone Data Distribution Service Registries

The IANA is requested to create and maintain the following registries for time zone data distribution service actions with pointers to appropriate reference documents.

10.2.1. Actions Registry

The following table is to be used to initialize the actions registry.

Action Name	Status	Reference
capabilities	Current	RFCXXXX, Section 6.1
list	Current	RFCXXXX, Section 6.2
get	Current	RFCXXXX, Section 6.3
expand	Current	RFCXXXX, Section 6.4
find	Current	RFCXXXX, Section 6.5

10.2.2. Action Parameters Registry

The following table is to be used to initialize the parameters registry.

Parameter	Status	Reference
action	Current	RFCXXXX, Section 5.1
changesince	Current	RFCXXXX, Section 5.3
end	Current	RFCXXXX, Section 5.5
format	Current	RFCXXXX, Section 5.2
lang	Current	RFCXXXX, Section 5.6
pattern	Current	RFCXXXX, Section 5.8
start	Current	RFCXXXX, Section 5.4
truncate	Current	RFCXXXX, Section 5.9
tzid	Current	RFCXXXX, Section 5.7

[10.3.](#) timezone Well-Known URI Registration

URI suffix: `timezone`

Change controller: IETF.

Specification document(s): This RFC.

Related information:

[10.4.](#) Service Name Registrations

This document registers two new service names as per [[RFC6335](#)]. Both are defined within this document.

[10.4.1.](#) timezone Service Name Registration

Service Name: `timezone`

Transport Protocol(s): `TCP`

Assignee: IESG <iesg@ietf.org>

Contact: IETF Chair <chair@ietf.org>

Description: Time Zone Data Distribution Service - non-TLS

Reference: [This Draft]

Assignment Note: This is an extension of the http service. Defined
 TXT keys: `path=<context path>`

10.4.2. timezones Service Name Registration

Service Name: timezones

Transport Protocol(s): TCP

Assignee: IESG <iesg@ietf.org>

Contact: IETF Chair <chair@ietf.org>

Description: Time Zone Data Distribution Service - over TLS

Reference: [This Draft]

Assignment Note: This is an extension of the https service. Defined
TXT keys: path=<context path>

10.5. iCalendar Property Registrations

This document defines the following new iCalendar properties to be added to the registry defined in [Section 8.2.3 of \[RFC5545\]](#):

Property	Status	Reference
TZUNTIL	Current	RFCXXXX, Section 8.1
EQUIVALENT-TZID	Current	RFCXXXX, Section 8.2

11. Acknowledgements

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Appendix A. Change History (to be removed prior to publication as an RFC)

Changes for -01

1. Query attribute: "name" -> "pattern"
(<https://tools.ietf.org/wg/tzdist/trac/ticket/4>).
2. UTF-8 used for time zone ids and in all responses.
3. Added glossary term and note for "time zone"
(<https://tools.ietf.org/wg/tzdist/trac/ticket/12>).
4. Glossary term change and alias text from
(<https://tools.ietf.org/wg/tzdist/trac/ticket/13>).
5. "Local Provider" -> "Secondary Provider".

6. Additional security text for (<https://tools.ietf.org/wg/tzdist/trac/ticket/25>).
7. Added additional text to better describe localized names.
8. Added "tzid" member to expand response.
9. Added optional "provider-details" member to capabilities response, and also made "contacts" optional.
10. Definition of "invalid-action" moved to [Section 6](#), and clarified text related to error responses in Sections [4.1.6](#) and [6](#) (<https://tools.ietf.org/wg/tzdist/trac/ticket/17>).
11. Added "Observance" to glossary.
12. Added "TZUNTIL" iCalendar property (part of <https://tools.ietf.org/wg/tzdist/trac/ticket/15>).
13. Revamped truncation to always use UTC date-time values and support end points (<https://tools.ietf.org/wg/tzdist/trac/ticket/21>, and <https://tools.ietf.org/wg/tzdist/trac/ticket/10>).
14. Expand always uses UTC date-time values for query parameters, and always returns UTC date-time onset values (<https://tools.ietf.org/wg/tzdist/trac/ticket/21>).

Changes for -00

1. Initial WG draft derived from [draft-douglass-timezone-service-11](#), with some terminology changes to match WG name.
2. Updated references.
3. "timezone" -> "time zone" (<https://tools.ietf.org/wg/tzdist/trac/ticket/6>).
4. Glossary tweak (first part of <https://tools.ietf.org/wg/tzdist/trac/ticket/13>).
5. Fix iCalendar property names: UTC-OFFSET-* -> TZOFFSET*.
6. Fix invalid-truncate error code description.

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