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JSCalendar: A JSON representation of calendar data
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Abstract

This specification defines a data model and JSON representation of calendar data that can be used for storage and data exchange in a calendaring and scheduling environment. It aims to be an alternative to the widely deployed iCalendar data format and to be unambiguous, extendable and simple to process.

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1. Introduction

This document defines a data model for calendar event and task objects, or groups of such objects, in electronic calendar applications and systems. It aims to be unambiguous, extendable and simple to process.

The key design considerations for this data model are as follows:

- The attributes of the calendar entry represented must be described as a simple key-value pair, reducing complexity of its representation.

- The data model should avoid all ambiguities and make it difficult to make mistakes during implementation.

- Most of the initial set of attributes should be taken from the iCalendar data format ([RFC5545], also see Section 1.1), but the specification should add new attributes or value types, or not support existing ones, where appropriate. Conversion between the data formats need not fully preserve semantic meaning.

- Extensions, such as new properties and components, MUST NOT lead to requiring an update to this document.

The representation of this data model is defined in the I-JSON format [RFC7493], which is a strict subset of the JavaScript Object Notation (JSON) Data Interchange Format [RFC8259]. Using JSON mostly is a pragmatic choice: its widespread use should help to speed up JSCalendar adoption and a wide range of production-ready JSON implementations allows to decrease interoperability issues.

1.1. Relation to the iCalendar format

The iCalendar data format [RFC5545], a widely deployed interchange format for calendaring and scheduling data, has served calendaring vendors for a long while, but contains some ambiguities and pitfalls that can not be overcome without backward-incompatible changes.

For example, iCalendar defines various formats for local times, UTC time and dates, which confuses new users. Other sources for errors are the requirement for custom time-zone definitions within a single calendar component, as well as the iCalendar format itself; the

latter causing interoperability issues due to misuse of CR LF terminated strings, line continuations and subtle differences between iCalendar parsers. Lastly, up until recently the iCalendar format did not allow to express the difference between two calendar components, which results in verbose exchanges during scheduling.

Some of these issues were addressed by the jCal [RFC7265] format, which is a direct mapping between iCalendar and JSON. However, it did not attempt to extend or update iCalendar semantics.

1.2. 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 underlying format used for this specification is JSON. Consequently, the terms "object" and "array" as well as the four primitive types (strings, numbers, booleans, and null) are to be interpreted as described in Section 1 of[RFC8259].

Some examples in this document contain "partial" JSON documents used for illustrative purposes. In these examples, three periods "..." are used to indicate a portion of the document that has been removed for compactness.

2. JSCalendar objects

This section describes the calendar object types specified by JSCalendar.

2.1. JSEvent

MIME type: "application/calendar+json;type=jsevent"

A JSEvent represents a scheduled amount of time on a calendar, typically a meeting, appointment, reminder or anniversary. Multiple participants may partake in the event at multiple locations.

The @type (Section 4.1.1) property value MUST be "jsevent".

2.2. JSTask

MIME type: "application/calendar+json;type=jstask"

A JSTask represents an action-item, assignment, to-do or work item .

The @type (Section 4.1.1) property value MUST be "jstask".

A JSTask may start and be due at certain points in time, may take some estimated time to complete and may recur; none of which is required. This notably differs from JSEvent (Section 2.1) which is required to start at a certain point in time and typically takes some non-zero duration to complete.

2.3. JSGroup

MIME type: "application/calendar+json;type=jsgroup"

A JSGroup is a collection of JSEvent (Section 2.1) and JSTask (Section 2.2) objects. Typically, objects are grouped by topic (e.g. by keywords) or calendar membership.

The @type (Section 4.1.1) property value MUST be "jsgroup".

3. Structure of JSCalendar objects

A JSCalendar object is a JSON object, which MUST be valid I-JSON (a stricter subset of JSON), as specified in [RFC8259]. Property names and values are case-sensitive.

The object has a collection of properties, as specified in the following sections. Unless otherwise specified, all properties are mandatory. Optional properties may have a default value, if explicitly specified in the property definition.

3.1. Type signatures

Types signatures are given for all JSON objects in this document. The following conventions are used:

- "Boolean|String": The value is either a JSON "Boolean" value, or a JSON "String" value.
- "Foo": Any name that is not a native JSON type means an object for which the properties (and their types) are defined elsewhere within this document.
- "Foo[]": An array of objects of type "Foo".
- "String[Foo]": A JSON "Object" being used as a map (associative array), where all the values are of type "Foo".

3.2. Data Types

In addition to the standard JSON data types, the following data types are used in this specification:

3.2.1. UTCDate

This is a string in [RFC3339] "date-time" format, with the further restrictions that any letters MUST be in upper-case, the time component MUST be included and the time MUST be in UTC. Fractional second values MUST NOT be included unless non-zero and MUST NOT have trailing zeros, to ensure there is only a single representation for each date-time.

For example "2010-10-10T10:10:10.003Z" is OK, but "2010-10-10T10:10:10.000Z" is invalid and MUST be encoded as "2010-10-10T10:10:10Z".

In common notation, it should be of the form "YYYY-MM-DDTHH:MM:SSZ".

3.2.2. LocalDate

This is a date-time string _with no time-zone/offset information_. It is otherwise in the same format as UTCDate: "YYYY-MM-DDTHH:MM:SS". The time-zone to associate the LocalDate with comes from an associated property, or if no time-zone is associated it defines _floating time_. Floating date-times are not tied to any specific time-zone. Instead, they occur in every timezone at the same _wall-clock_ time (as opposed to the same instant point in time).

3.2.3. Duration

A duration is represented by a subset of ISO8601 duration format, as specified by the following ABNF:

```
dur-secfrac = "." 1*DIGIT
dur-second  = 1*DIGIT [dur-secfrac] "S"
dur-minute  = 1*DIGIT "M" [dur-second]
dur-hour    = 1*DIGIT "H" [dur-minute]
dur-time    = "T" (dur-hour / dur-minute / dur-second)
dur-day     = 1*DIGIT "D"
dur-week    = 1*DIGIT "W"

duration    = "P" (dur-day [dur-time] / dur-time / dur-week)
```

In addition, the duration MUST NOT include fractional second values unless the fraction is non-zero.

3.2.4. PatchObject

A *PatchObject* is of type "String[*|null]", and represents an unordered set of patches on a JSON object. The keys are a path in a subset of [RFC6901] JSON pointer format, with an implicit leading "/" (i.e. prefix each key with "/" before applying the JSON pointer evaluation algorithm).

A patch within a PatchObject is only valid, if all of the following conditions apply:

1. The pointer MUST NOT reference inside an array (i.e. it MUST NOT insert/delete from an array; the array MUST be replaced in its entirety instead).

2. When evaluating a path, all parts prior to the last (i.e. the value after the final slash) MUST exist.

3. There MUST NOT be two patches in the PatchObject where the pointer of one is the prefix of the pointer of the other, e.g. "alerts/foo/offset" and "alerts".

The value associated with each pointer is either:

- "null": Remove the property from the patched object. If not present in the parent, this a no-op.

- Anything else: The value to replace the inherited property on the patch object with (if present) or add to the property (if not present).

Implementations MUST reject a PatchObject if any of its patches are invalid.

3.2.5. Identifiers

If not noted otherwise, properties that define identifiers MUST be string values, MUST be at least 1 character in length and maximum 256 octets in size, and MUST only contain characters from the "URL and Filename safe" Base 64 Alphabet, as defined in section 5 of [RFC4648]. This is the ASCII alphanumeric characters (A-Za-z0-9), hyphen (-), and underscore (_).

3.2.6. Normalization and equivalence

JSCalendar aims to provide unambiguous definitions for value types and properties, but does not define a general normalization or equivalence method for JSCalendar objects and types. This is because

the notion of equivalence might range from byte-level equivalence to semantic equivalence, depending on the respective use case (for example, the CalDAV protocol [RFC4791] requires octet equivalence of the encoded calendar object to determine ETag equivalence).

Normalization of JSCalendar objects is hindered because of the following reasons:

- Custom JSCalendar properties may contain arbitrary JSON values, including arrays. However, equivalence of arrays might or might not depend on the order of elements, depending on the respective property definition.

- Several JSCalendar property values are defined as URIs and MIME types, but normalization of these types is inherently protocol and scheme-specific, depending on the use-case of the equivalence definition (see section 6 of [RFC3986]).

Considering this, the definition of equivalence and normalization is left to client and server implementations and to be negotiated by a calendar exchange protocol or defined by another RFC.

3.3. Custom property extensions and values

Vendors MAY add additional properties to the calendar object to support their custom features. The names of these properties MUST be prefixed with a domain name controlled by the vendor to avoid conflict, e.g. "example.com/customprop".

Some JSCalendar properties allow vendor-specific value extensions. If so, vendor specific values MUST be prefixed with a domain name controlled by the vendor, e.g. "example.com/customrel", unless otherwise noted.

4. Common JSCalendar properties

This section describes the properties that are common to the various JSCalendar object types. Specific JSCalendar object types may only support a subset of these properties. The object type definitions in Section 5 describe the set of supported properties per type.

4.1. Metadata properties

4.1.1. @type

Type: "String"

Specifies the type which this object represents. This MUST be one of the following values, registered in a future RFC, or a vendor-specific value:

- "jsevent": a JSCalendar event (Section 2.1).
- "jstask": a JSCalendar task (Section 2.2).
- "jsgroup": a JSCalendar group (Section 2.3).

A valid JSCalendar object MUST include this property.

4.1.2. uid

Type: "String"

A globally unique identifier, used to associate the object as the same across different systems, calendars and views. The value of this property MUST be unique across _all_ JSCalendar objects, even if they are of different type. [RFC4122] describes a range of established algorithms to generate universally unique identifiers (UUID), and the random or pseudo-random version is recommended to use.

For compatibility with [RFC5545] UIDs, implementations MUST be able to receive and persist values of at least 255 octets for this property, but they MUST NOT truncate values in the middle of a UTF-8 multi-octet sequence.

A valid JSCalendar object MUST include this property.

4.1.3. relatedTo

Type: "String[Relation]" (optional)

Relates the object to other JSCalendar objects. This is represented as a map of the uids of the related objects to information about the relation.

A *Relation* object has the following properties:

- *relation*: "String[]" Describes how the linked object is related to this object.

  The strings in the array MUST each be at most one of the following values, registered in a future RFC, or a vendor-specific value:

* "first": The linked object is the first in the series this object is part of.

* "next": The linked object is the next in the series this object is part of.

* "child": The linked object is a subpart of this object.

* "parent": This object is part of the overall linked object.

If an object is split to make a "this and future" change to a recurrence, the original object MUST be truncated to end at the previous occurrence before this split, and a new object created to represent all the objects after the split. A "relation=["next"]" relatedTo property MUST be set on the original object with the uid of the new object. A "relation=["first"]" relatedTo property with the UID of the first object in the series MUST be set on the new object. Clients can then follow these UIDs to get the complete set of objects if the user wishes to modify them all at once.

4.1.4. prodId

Type: "String" (optional)

The identifier for the product that created the JSCalendar object.

The vendor of the implementation SHOULD ensure that this is a globally unique identifier, using some technique such as an FPI value, as defined in [ISO.9070.1991]. It MUST only use characters of an iCalendar TEXT data value (see section 3.3.11 in [RFC5545]).

This property SHOULD NOT be used to alter the interpretation of an JSCalendar object beyond the semantics specified in this document. For example, it is not to be used to further the understanding of non-standard properties.

4.1.5. created

Type: "UTCDate" (optional)

The date and time this object was initially created.

4.1.6. updated

Type: "UTCDate"

The date and time the data in this object was last modified.

4.1.7. sequence

Type: "Number" (optional, default:"0")

Initially zero, this MUST be a non-negative integer that is monotonically incremented each time a change is made to the object.

4.1.8. method

Type: "String" (optional)

The iTIP ([RFC5546]) method, in lower-case. Used for scheduling.

4.2. What and where properties

4.2.1. title

Type: "String" (optional, default:"")

A short summary of the object.

4.2.2. description

Type: "String" (optional, default:"")

A longer-form text description of the object. The content is formatted according to the *descriptionContentType* property.

4.2.3. descriptionContentType

Type: "String" (optional, default:"text/plain")

Describes the media type ([RFC6838]) of the contents of the "description" property. Media types MUST be sub-types of type "text", and SHOULD be "text/plain" or "text/html" ([MIME]). They MAY define parameters and the "charset" parameter MUST be "utf-8", if specified. Descriptions of type "text/html" MAY contain "cid" URLs ([RFC2392]) to reference links in the calendar object by use of the *cid* property of the *Link* object.

4.2.4. locations

Type: "String[Location]" (optional)

A map of location ids to Location objects, representing locations associated with the object. A location id may be any valid [RFC6901] JSON pointer and need only be unique to this object; a UUID is a practical choice.

A *Location* object has the following properties. It must define at least one other property than *rel*.

- *name*: "String" (optional, default:"") The human-readable name of the location.

- *description*: "String" (optional) Human-readable, plain-text instructions for accessing this location. This may be an address, set of directions, door access code, etc.

- *rel*: "String" (optional) The relation type of this location to the JSCalendar object.

  This MUST be either one of the following values, registered in a future RFC, or a vendor-specific value. Any value the client or server doesn't understand should be treated the same as if this property is omitted.

  * "start": The JSCalendar object starts at this location.

  * "end": The JSCalendar object ends at this location.

- *timeZone*: "String" (optional) A time-zone for this location.

  If omitted, the *timeZone* from the JSCalendar object MUST be presumed when a time-zone is needed in relation to this location.

- *coordinates*: "String" (optional) An [RFC5870] "geo:" URI for the location.

- *linkIds*: "String[]" (optional) A list of ids for links to alternate representations of this location.

  For example, an alternative representation could be in vCard format.

4.2.5. virtualLocations

Type: "String[VirtualLocation]" (optional)

A map of ids to VirtualLocation objects, representing virtual locations, such as video conferences or chat rooms, associated with the object. A virtual location id may be any valid [RFC6901] JSON pointer and need only be unique to this object; a UUID is a practical choice.

A *VirtualLocation* object has the following properties.

- *name*: "String" (optional, default:"") The human-readable name of the virtual location.

- *description*: "String" (optional) Human-readable plain-text instructions for accessing this location. This may be an address, set of directions, door access code, etc.

- *uri*: "String" A URI that represents how to connect to this virtual location.

  This may be a telephone number (represented as "tel:+1-555-555-555") for a teleconference, a web address for online chat, or any custom URI.

4.2.6. links

Type: "String[Link]" (optional)

A map of link ids to Link objects, representing external resources associated with the object. A link id may be any valid [RFC6901] JSON pointer and need only be unique to this object; the href or a UUID are practical choices.

A *Link* object has the following properties:

- *href*: "String" A URI from which the resource may be fetched.

  This MAY be a "data:" URL, but it is recommended that the file be hosted on a server to avoid embedding arbitrarily large data in JSCalendar object instances.

- *cid* "String" (optional) This MUST be a valid "content-id" value according to the definition of section 2 in [RFC2392]. The identifier MUST be unique within this JSCalendar object but has no meaning beyond that. Specifically, it MAY be different from the link identifier in the enclosing *links* property.

- *type*: "String" (optional) The content-type [RFC6838] of the resource, if known.

- *size*: "Number" (optional) The size, in bytes, of the resource when fully decoded (i.e. the number of bytes in the file the user would download), if known.

- *rel*: "String" (optional) Identifies the relation of the linked resource to the object. If set, the value MUST be a registered relation type (see [RFC8288] and IANA Link Relations [1]).

Links with a rel of "enclosure" SHOULD be considered by the client as attachments for download.

Links with a rel of "describedby" SHOULD be considered by the client to be an alternate representation of the description.

Links with a rel of "icon" SHOULD be considered by the client to be an image that it MAY use when presenting the calendar data to a user. The *display* property MAY be set to indicate the purpose of this image.

- *display*: "String" (optional) Describes the intended purpose of a link to an image. If set, the *rel* property MUST be set to "icon". The value MUST be either one of the following values, registered in a future RFC, or a vendor-specific value:
  - "badge": an image inline with the title of the object
  - "graphic": a full image replacement for the object itself
  - "fullsize": an image that is used to enhance the object
  - "thumbnail": a smaller variant of "fullsize " to be used when space for the image is constrained
- *title*: "String" (optional) A human-readable plain-text description of the resource.

4.2.7. locale

Type: "String" (optional)

The [RFC5646] language tag that best describes the locale used for the calendar object, if known.

4.2.8. keywords

Type: "String[Boolean]" (optional)

A set of keywords or tags that relate to the object. The set is represented as a map, with the keys being the keywords. The value for each key in the map MUST be "true".

4.2.9. categories

Type: "String[Boolean]" (optional)

A set of categories that relate to the calendar object. The set is represented as a map, with the keys being the categories specified as URIs. The value for each key in the map MUST be "true".

In contrast to *keywords*, categories typically are structured. For example, a vendor owning the domain "example.com" might define the categories "http://example.com/categories/sports/american-football"" and "http://example.com/categories/music/r-b".

4.2.10. color

Type: "String" (optional)

Specifies a color clients MAY use when displaying this calendar object. The value is a case-insensitive color name taken from the CSS3 set of names, defined in Section 4.3 of W3C.REC-css3-color-20110607 [2] or a CSS3 RGB color hex value.

4.3. Recurrence properties

4.3.1. recurrenceRule

Type: "Recurrence"

Defines a recurrence rule (repeating pattern) for recurring calendar objects.

A *Recurrence* object is a JSON object mapping of a RECUR value type in iCalendar, see [RFC5545] and[RFC7529]. A JSEvent recurs by applying the recurrence rule (and *recurrenceOverrides*) to the *start* date/time. A JSTask recurs by applying the recurrence rule (and *recurrenceOverrides*) to its *start* date/time, if defined. If the task does not define a start date-time, it recurs by its *due* date-time. If it neither defines a start or due date-time, it MUST NOT define a *recurrenceRule*.

A Recurrence object has the following properties:

o *frequency*: "String" This MUST be one of the following values:

  * "yearly"

  * "monthly"

  * "weekly"

  * "daily"

  * "hourly"

  * "minutely"

  * "secondly"

  To convert from iCalendar, simply lower-case the FREQ part.

- *interval*: "Number"(optional, default:"1") The INTERVAL part from iCal. If included, it MUST be an integer "x >= 1".

- *rscale*: "String"(optional, default:""gregorian"") The RSCALE part from iCalendar RSCALE [RFC7529], converted to lower-case.

- *skip*: "String"(optional, default:""omit"") The SKIP part from iCalendar RSCALE [RFC7529], converted to lower-case.

- *firstDayOfWeek*: "String"(optional, default:""mo"") The WKST part from iCalendar, represented as a lower-case abbreviated two-letter English day of the week. If included, it MUST be one of the following values: ""mo"|"tu"|"we"|"th"|"fr"|"sa"|"su"".

- *byDay*: "NDay[]" (optional) An *NDay* object has the following properties:

  * *day*: "String" The day-of-the-week part of the BYDAY value in iCalendar, lower-cased. MUST be one of the following values: ""mo"|"tu"|"we"|"th"|"fr"|"sa"|"su"".

  * *nthOfPeriod*: "Number" (optional) The ordinal part of the BYDAY value in iCalendar (e.g. ""+1"" or ""-3""). If present, rather than representing every occurrence of the weekday defined in the *day* property of this *NDay*, it represents only a specific instance within the recurrence period. The value can be positive or negative, but MUST NOT be zero. A negative integer means nth-last of period.

- *byMonthDay*: "Number[]" (optional) The BYMONTHDAY part from iCalendar. The array MUST have at least one entry if included.

- *byMonth*: "String[]" (optional) The BYMONTH part from iCalendar. Each entry is a string representation of a number, starting from "1" for the first month in the calendar (e.g. ""1" " means ""January"" with Gregorian calendar), with an optional ""L"" suffix (see [RFC7529]) for leap months (this MUST be upper-case, e.g. ""3L""). The array MUST have at least one entry if included.

- *byYearDay*: "Number[]"(optional) The BYYEARDAY part from iCalendar. The array MUST have at least one entry if included.

- *byWeekNo*: "Number[]"(optional) The BYWEEKNO part from iCalendar. The array MUST have at least one entry if included.

- *byHour*: "Number[]"(optional) The BYHOUR part from iCalendar. The array MUST have at least one entry if included.

- *byMinute*: "Number[]"(optional) The BYMINUTE part from iCalendar. The array MUST have at least one entry if included.

- *bySecond*: "Number[]"(optional) The BYSECOND part from iCalendar. The array MUST have at least one entry if included.

- *bySetPosition*: "Number[]"(optional) The BYSETPOS part from iCalendar. The array MUST have at least one entry if included.

- *count*: "Number"(optional) The COUNT part from iCalendar. This MUST NOT be included if an *until* property is specified.

- *until*: "LocalDate"(optional) The UNTIL part from iCalendar. This MUST NOT be included if a *count* property is specified. Note, as in iCalendar, this date is presumed to be in the time-zone specified in *timeZone*. It is not a UTC time.

A recurrence rule specifies a set of set of date-times for recurring calendar objects. A recurrence rule has the following semantics:

1. A set of candidates is generated. This is every second within a period defined by the frequency property:

    * *yearly*: every second from midnight on the 1st January (inclusive) to midnight the following 1st January (exclusive)

    * *monthly*: every second from midnight on the 1st of a month (inclusive) to midnight on the 1st of the following month (exclusive)

    * *weekly*: every second from midnight (inclusive) on the first day of the week (as defined by the firstDayOfWeek property, or Monday if omitted), to midnight 7 days later (exclusive).

    * *daily*: every second from midnight at the start of the day (inclusive) to midnight at the end of the day (exclusive).

    * *hourly*: every second from the beginning of the hour (inclusive) to the beginning of the next hour (exclusive).

   * *minutely*: every second from the beginning of the minute (inclusive) to the beginning of the next minute (exclusive).

   * *secondly*: the second itself, only.

2. Each date-time candidate is compared against all of the byX properties of the rule except bySetPosition. If any property in the rule does not match the date-time, it is eliminated. Each byX property is an array; the date-time matches the property if it matches any of the values in the array. The properties have the following semantics:

   * *byMonth*: the date-time is in the given month.

   * *byMonthDay*: the date-time is on the given day of the month. Negative numbers mean the nth last day of the month.

   * *byDay*: the date-time is on the given day of the week. If the day is prefixed by a number, it is the nth occurrence of that day of the week within the month (if frequency is monthly) or year (if frequency is yearly). Negative numbers means nth last occurrence within that period.

   * *byYearDay*: the date-time is on the nth day of year. Negative numbers mean the nth last day of the year.

   * *byWeekNo*: the date-time is in the nth week of the year. Negative numbers mean the nth last week of the year. This corresponds to weeks according to week numbering as defined in ISO.8601.2004, with a week defined as a seven day period, starting on the firstDayOfWeek property value or Monday if omitted. Week number one of the calendar year is the first week that contains at least four days in that calendar year.

   * *byHour*: the date-time has the given hour value.

   * *byMinute*: the date-time has the given minute value.

   * *bySecond*: the date-time has the given second value.

3. If a bySetPosition property is included, this is now applied to the ordered list of remaining dates (this property specifies the indexes of date-times to keep; all others should be eliminated. Negative numbers are indexes from the end of the list, with -1 being the list item).

4. Any date-times before the start date of the event are eliminated (see below for why this might be needed).

5. If further dates are required (we have not reached the until date, or count limit) skip the next (interval - 1) sets of candidates, then continue from step 1.

When determining the set of occurrence dates for an event or task, the following extra rules must be applied:

1. The start date-time is always the first occurrence in the expansion (and is counted if the recurrence is limited by a "count" property), even if it would normally not match the rule.

2. The first set of candidates to consider is that which would contain the start date-time. This means the first set may include candidates before the start; such candidates are eliminated from the results in step (4) as outlined before.

3. The following properties MUST be implicitly added to the rule under the given conditions:

   * If frequency > "secondly" and no bySecond property: Add a bySecond property with the sole value being the seconds value of the start date-time.

   * If frequency > "minutely" and no byMinute property: Add a byMinute property with the sole value being the minutes value of the start date-time.

   * If frequency > "hourly" and no byHour property: Add a byHour property with the sole value being the hours value of the start date-time.

   * If frequency is "weekly" and no byDay property: Add a byDay property with the sole value being the day-of-the-week of the start date-time.

   * If frequency is "monthly" and no byDay property and no byMonthDay property: Add a byMonthDay property with the sole value being the day-of-the-month of the start date-time.

   * If frequency is "yearly" and no byYearDay property:

     + if there are no byMonth or byWeekNo properties, and either there is a byMonthDay property or there is no byDay property: Add a byMonth property with the sole value being the month of the start date-time.

+ if there is no byMonthDay, byWeekNo or byDay properties: Add a byMonthDay property with the sole value being the day-of-the-month of the start date-time.

+ if there is a byWeekNo property and no byMonthDay or byDay properties: Add a byDay property with the sole value being the day-of-the-week of the start date-time.

4.3.2. recurrenceOverrides

Type: "LocalDate[PatchObject]" (optional)

A map of the recurrence-ids (the date-time of the start of the occurrence) to an object of patches to apply to the generated occurrence object.

If the recurrence-id does not match an expanded start date from a recurrence rule, it is to be treated as an additional occurrence (like an RDATE from iCalendar). The patch object may often be empty in this case.

If the patch object defines the *excluded* property to be "true", then the recurring calendar object does not occur at the recurrence-id date-time (like an EXDATE from iCalendar). Such a patch object MUST NOT patch any other property.

By default, an occurrence inherits all properties from the main object except the start (or due) date-time, which is shifted to the new start time of the LocalDate key. However, individual properties of the occurrence can be modified by a patch, or multiple patches. It is valid to patch the start property value, and this patch takes precedence over the LocalDate key. Both the LocalDate key as well as the patched start date-time may occur before the original JSCalendar object's start or due date.

A pointer in the PatchObject MUST NOT start with one of the following prefixes; any patch with such a key MUST be ignored:

o @type

o uid

o relatedTo

o prodId

o method

- isAllDay
- recurrenceRule
- recurrenceOverrides
- replyTo

4.3.3. excluded

Type: "Boolean" (optional, default:"false")

Defines if this object is an overridden, excluded instance of a recurring JSCalendar object (also see Section 4.3.2). If this property value is "true", this calendar object instance MUST be treated as if not existent.

4.4. Sharing and scheduling properties

4.4.1. priority

Type: "Number" (optional, default:"0")

Specifies a priority for the calendar object. This may be used as part of scheduling systems to help resolve conflicts for a time period.

The priority is specified as an integer in the range 0 to 9. A value of 0 specifies an undefined priority. A value of 1 is the highest priority. A value of 2 is the second highest priority. Subsequent numbers specify a decreasing ordinal priority. A value of 9 is the lowest priority. Other integer values are reserved for future use.

4.4.2. freeBusyStatus

Type: "String"(optional, default:"busy")

Specifies how this property should be treated when calculating free-busy state. The value MUST be one of:

- ""free"": The object should be ignored when calculating whether the user is busy.
- ""busy"": The object should be included when calculating whether the user is busy.

4.4.3. privacy

Type: "String"(optional, default:"public")

Calendar objects are normally collected together and may be shared with other users. The privacy property allows the object owner to indicate that it should not be shared, or should only have the time information shared but the details withheld. Enforcement of the restrictions indicated by this property are up to the implementations.

This property MUST NOT affect the information sent to scheduled participants; it is only interpreted when the object is shared as part of a shared calendar.

The value MUST be either one of the following values, registered in a future RFC, or a vendor-specific value. Vendor specific values MUST be prefixed with a domain name controlled by the vendor, e.g. "example.com/topsecret". Any value the client or server doesn't understand should be preserved but treated as equivalent to "private".

- "public": The full details of the object are visible to those whom the object's calendar is shared with.

- "private": The details of the object are hidden; only the basic time and metadata is shared. Implementations MUST ensure the following properties are stripped when the object is accessed by a sharee:

  * title

  * description

  * locations

  * links

  * locale

  * localizations

  * participants

  * replyTo

  In addition, any patches in "recurrenceOverrides" whose key is prefixed with one of the above properties MUST be stripped.

- "secret": The object is hidden completely (as though it did not exist) when the calendar is shared.

4.4.4. replyTo

Type: "String[String]" (optional)

Represents methods by which participants may submit their RSVP response to the organizer of the calendar object. The keys in the property value are the available methods. The value is a URI to use that method. Future methods may be defined in future specifications; a calendar client MUST ignore any method it does not understand.

The following methods are defined:

- "imip": The organizer accepts an iMIP [RFC6047] response. The value MUST be a "mailto:" URI.

- "web": There is a web page where the user may submit the RSVP response using a browser. The value MUST be a "https:" URI Template ([RFC6570]) in level 1 format. The template MAY contain variables that MUST be expanded from the JSCalendar object as defined in table Table 1. Calendar clients SHOULD be prepared to handle authentication requests from the respective web page and for the participant email, but this specification does not mandate any specific mechanism.

Variable	Expand to
email	The *email* property value of the replying *Participant* object.
uid	The *uid* property value of the JSCalendar object.
sequence	The *sequence* property value of the JSCalendar object.
recurrenceId	The recurrence-id when replying for a single occurrence of a recurring JSCalendar object. The LocalDate-typed value is the recurrence-id of a non-overridden recurrence, or the key of a recurrenceOverride of this JSCalendar object.

Table 1: replyTo URI Template variables

4.4.5. participants

Type: "String[Participant]" (optional)

A map of participant ids to participants, describing their participation in the calendar object. A participant id may be any valid [RFC6901] JSON pointer and need only be unique to this calendar object; the email address of the participant is a good choice.

A *Participant* object has the following properties:

- *name*: "String" The display name of the participant (e.g. "Joe Bloggs").

- *email*: "String" The email address for the participant.

- *kind*: "String" (optional) What kind of entity this participant is, if known.

  This MUST be either one of the following values, registered in a future RFC, or a vendor-specific value. Any value the client or server doesn't understand should be treated the same as if this property is omitted.

  * "individual": a single person

  * "group": a collection of people invited as a whole

  * "resource": a non-human resource, e.g. a projector

  * "location": a physical location involved in the calendar object that needs to be scheduled, e.g. a conference room.

- *roles*: "String[]" A list of roles that this participant fulfills.

  At least one value MUST be specified for the participant. This MUST be either one of the following values, registered in a future RFC, or a vendor-specific value. Any value the client or server doesn't understand should be preserved but ignored.

  * "owner": The participant is an owner of the object.

  * "attendee": The participant is an attendee of the calendar object.

  * "chair": The participant is in charge of the calendar object when it occurs.

- *locationId*: "String" (optional) The location at which this participant is expected to be attending.

  If the value does not correspond to any location id in the *locations* property of the instance, this MUST be treated the same as if the participant's locationId were omitted.

- *rsvpResponse*: "String"(optional, default:"needs-action") The RSVP response, if any, of this participant.

  The value MUST be either one of the following values, registered in a future RFC, or a vendor-specific value:

  * "needs-action": No status yet set by the participant.

  * "accepted": The invited participant will participate.

  * "declined": The invited participant will not participate.

  * "tentative": The invited participant may participate.

- *participation*: "String"(optional, default:"required") The required participation of this participant.

  The value MUST be either one of the following values, registered in a future RFC, or a vendor-specific value. Any value the client or server doesn't understand should be treated the same as "required".

  * "non-participant": Indicates a participant who is copied for information purposes only.

  * "optional": Indicates a participant whose participation is optional.

  * "required": Indicates a participant whose participation is required.

- *rsvpWanted*: "Boolean"(optional, default:"false") If true, the organizer is expecting the participant to notify them of their status.

- *scheduleSequence*: "Number"(optional, default:"0") The sequence number of the last response from the participant. If defined, this MUST be a non-negative integer.

  This can be used to determine whether the participant has sent a new RSVP following significant changes to the calendar object, and

to determine if future responses are responding to a current or older view of the data.

- *scheduleUpdated*: "UTCDate" (optional) The *updated* property of the last iMIP response from the participant.

  This can be compared to the *updated* timestamp in future iMIP responses to determine if the response is older or newer than the current data.

- *invitedBy*: "String" (optional) The participant id of the participant who invited this one, if known.

- *delegatedTo*: "String[]" (optional) A list of participant ids of participants that this participant has delegated their participation to. This MUST be omitted if none (rather than an empty array).

- *delegatedFrom*: "String[]" (optional) A list of participant ids that this participant is acting as a delegate for. This MUST be omitted if none (rather than an empty array).

- *memberOf*: "String[]" (optional) A list of group participants that were invited to this calendar object, which caused this participant to be invited due to their membership of the group(s). This MUST be omitted if none (rather than an empty array).

- *linkIds*: "String[]" (optional) Links to more information about this participant, for example in vCard format.

4.5. Alerts properties

4.5.1. useDefaultAlerts

Type: "Boolean" (optional, default:"false")

If "true", use the user's default alerts and ignore the value of the *alerts* property. Fetching user defaults is dependent on the API from which this JSCalendar object is being fetched, and is not defined in this specification. If an implementation cannot determine the user's default alerts, or none are set, it MUST process the alerts property as if useDefaultAlerts is set to "false".

4.5.2. alerts

Type: "String[Alert]" (optional)

A map of alert ids to Alert objects, representing alerts/reminders to display or send the user for this calendar object. An alert id may be any valid [RFC6901] JSON pointer and need only be unique to this calendar object; a globally unique id is a practical choice (also see Section 4.1.2)).

An *Alert* Object has the following properties:

- *relativeTo*: "String" (optional, default:"before-start")
  Specifies where the offset is relative to for the alarm to trigger. The value MUST be one of:

  - "before-start"
  - "after-start"
  - "before-end"
  - "after-end"

- *offset*: "Duration" The offset from the start and end/due of the calendar object to fire the alert. If the calendar object does not define a time-zone, the user's default time-zone SHOULD be used when determining the offset, if known. Otherwise, the time-zone to use is implementation specific.

- *acknowledged*: "UTCDate" (optional)

  When the user has permanently dismissed the alert the client MUST set this to the current time in UTC. Other clients which sync this property can then automatically dismiss or suppress duplicate alerts (alerts with the same alert id that triggered on or before this date-time).

  For a recurring calendar object, the *acknowledged* property of the parent object MUST be updated, unless the alert is already overridden in *recurrenceOverrides*.

- *snoozed*: "UTCDate" (optional)

  If the user temporarily dismisses the alert, this is the UTC date-time after which it should trigger again. Setting this property on an instance of a recurring calendar object MUST update the alarm on the master object, unless the respective instance already is defined in "recurrenceOverrides". It MUST NOT generate an override for the sole use of snoozing an alarm.

- *action*: "String" (optional, default:"display") Describes how to alert the user.

  The value MUST be at most one of the following values, registered in a future RFC, or a vendor-specific value:

  * "display": The alert should be displayed as appropriate for the current device and user context.

  * "email": The alert should trigger an email sent out to the user, notifying about the alert. This action is typically only appropriate for server implementations.

4.6. Multilingual properties

4.6.1. localizations

Type: "String[PatchObject]" (optional)

A map of [RFC5646] language tags to patch objects, which localize the calendar object into the locale of the respective language tag.

See the description of PatchObject (Section 3.2.4) for the structure of the PatchObject. The patches are applied to the top-level object. In addition to all the restrictions on patches specified there, the pointer also MUST NOT start with one of the following prefixes; any patch with a such a key MUST be ignored:

- @type
- due
- duration
- freeBusyStatus
- localization
- method
- participants
- prodId
- progress
- relatedTo

- sequence
- start
- status
- timeZone
- uid
- useDefaultAlerts

Note that this specification does not define how to maintain validity of localized content. For example, a client application changing a JSCalendar object's title property might also need to update any localizations of this property. Client implementations SHOULD provide the means to manage localizations, but how to achieve this is specific to the application's workflow and requirements.

5. Type-specific JSCalendar properties

5.1. JSEvent properties

In addition to the common JSCalendar object properties (Section 4) a JSEvent has the following properties:

5.1.1. start

Type: "LocalDate" e.g. "2015-09-02T00:00:00"

The date/time the event would start in the event's time-zone.

A valid JSEvent MUST include this property.

5.1.2. timeZone

Type: "String|null" (optional, default:"null")

The IANA Time Zone Database [3] name for the time-zone the event is scheduled in, or "null" for floating time. If omitted, this MUST be presumed to be "null" (i.e. floating time).

5.1.3. duration

Type: "Duration", e.g. "P2DT3H" (optional, default: "P0D")

The zero or positive duration of the event in absolute time (i.e. in UTC time; ignoring DST shifts). To get the end date in the event

time-zone, convert start into UTC, then add the duration, then convert the result into the appropriate time-zone.

A JSEvent MAY be end in a different time-zone (e.g. a plane flight crossing time-zones). In this case, the JSEvent MUST specify the end time-zone in a *location* property value that defines its *rel* to be "end" and the end time-zone in its *timeZone* property.

5.1.4. isAllDay

Type: "Boolean" (optional, default:"false")

Specifies if the event an all day event, such as a birthday or public holiday.

If *isAllDay* is true, then the following restrictions apply:

- the *start* property MUST have a time component of "T00:00:00".
- the *duration* property MUST only include a day component.

Note that all-day events MAY be bound to a specific time-zone, as defined by the *timeZone* property.

5.1.5. status

Type: "String" (optional, default:"confirmed")

The scheduling status (Section 4.4) of a JSEvent. If set, it MUST be one of:

- "confirmed": Indicates the event is definite.
- "cancelled": Indicates the event is cancelled.
- "tentative": Indicates the event is tentative.

5.2. JSTask properties

In addition to the common JSCalendar object properties (Section 4) a JSTask has the following properties:

5.2.1. due

Type: "LocalDate" (optional) e.g. "2015-09-02T00:00:00"

The date/time the task is due in the task's time-zone.

5.2.2. start

Type: "LocalDate" (optional) e.g. "2015-09-02T00:00:00"

The date/time the task should start in the task's time-zone.

5.2.3. timeZone

Type: "String|null" (optional, default:"null")

The IANA Time Zone Database name for the time-zone the task is scheduled in, or "null" for floating time. If omitted, this MUST be presumed to be "null" (i.e. floating time).

5.2.4. estimatedDuration

Type: "Duration" (optional), e.g. "P2DT3H"

Specifies the estimated positive duration of time the task takes to complete.

5.2.5. statusUpdatedAt

Type: "UTCDate" (optional), e.g. "2016-06-13T12:00:00Z"

Specifies the date/time the task status properties was last updated.

If the task is recurring and has future instances, a client may want to keep track of the last status update timestamp of a specific task recurrence, but leave other instances unchanged. One way to achieve this is by overriding the statusUpdatedAt property in the task *recurrenceOverrides*. However, this could produce a long list of timestamps for regularly recurring tasks. An alternative approach is to split the JSTask into a current, single instance of JSTask with this instance status update time and a future recurring instance. Also see the definition of the *relatedTo* on splitting.

5.2.6. isAllDay

Type: "Boolean" (optional, default:"false")

Specifies if the task is an all day task.

If *isAllDay* is true, then the *start* and *due* properties MUST have a time component of "T00:00:00". Note that the *estimatedDuration* property MAY contain a non-zero time duration. All-day tasks MAY be bound to a specific time-zone, as defined by the *timeZone* property.

5.2.7. progress

In addition to the common properties of a *Participant* object (Section 4.4.5), a Participant within a JSTask supports the following property:

- *progress*: "ParticipantProgress" (optional) The progress of the participant for this task, if known. This property MUST NOT be set if the *rsvpResponse* of this participant is any other value but "accepted".

A *ParticipantProgress* object has the following properties:

- *status*: "String" Describes the completion status of the participant's progress.

  The value MUST be at most one of the following values, registered in a future RFC, or a vendor-specific value:

  * "completed": The participant completed their progress.

  * "in-process": The participant processes this task.

  * "failed": The participant failed to complete their progress.

- *timestamp*: "UTCDate" Describes the last time when the participant progress got updated.

5.2.8. status

Type: "String"

Defines the overall status of this task. If omitted, the default status (Section 4.4) of a JSTask is defined as follows (in order of evaluation):

- "completed": if all the *ParticipantProgress* status of the task participants is "completed".

- "failed": if at least one *ParticipantProgress* status of the task participants is "failed".

- "in-process": if at least one *ParticipantProgress* status of the task participants is "in-process".

- "needs-action": If none of the other criteria match.

If set, it MUST be one of:

- "needs-action": Indicates the task needs action.
- "completed": Indicates the task is completed.
- "in-process": Indicates the task is in process.
- "cancelled": Indicates the task is cancelled.
- "pending": Indicates the task has been created and accepted for processing, but not yet started.
- "failed": Indicates the task failed.

5.3. JSGroup properties

JSGroup supports the following JSCalendar properties (Section 4):

- @type
- uid
- created
- updated
- categories
- keywords
- name
- description
- color
- links

as well as the following JSGroup-specific properties:

5.3.1. entries

Type: "String[JSTask|JSEvent]"

A collection of group members. This is represented as a map of the *uid* property value to the JSCalendar object member having that uid. Implementations MUST ignore entries of unknown type.

5.3.2. source

Type: "String" (optional)

The source from which updated versions of this group may be retrieved from. The value MUST be a URI.

6. Conversion from and to iCalendar

This section specifies which JSCalendar properties can be mapped from and to iCalendar format. Implementations SHOULD follow these conversion guidelines. Still, JSCalendar does not restrict itself to iCalendar and conversion between these two formats MAY be lossy.

6.1. JSEvent

The iCalendar counterpart to *JSEvent* is the VEVENT component type [RFC5545]. A VEVENT component that is a direct child of a VCALENDAR component is equivalent to a standalone JSEvent. A VEVENT component *within* a VEVENT maps to the entries of the JSEvent *recurrenceOverrides* property.

Property	iCalendar counterpart
isAllDay	True, if the type of the DTSTART property in iCalendar is DATE. When translating from JSCalendar the iCalendar DTSTART property is of DATE value type, if the *isAllDay* property is set to true and the *timeZone* property is null.
start	Corresponds to the DTSTART property in iCalendar. Note that time-zone information is stored separately in JSEvent.
timeZone	Corresponds to the TZID part of the DTSTART property in iCalendar. If the event has a different end time-zone to start time-zone, this should be added as a JSCalendar *location* with just a *timeZone* property and "rel="end"".
duration	Corresponds to the DURATION or DSTART+DTEND properties in iCalendar.

Table 2: Translation between JSEvent and iCalendar

6.2. JSTask

The iCalendar counterpart to *JSTask* is the VTODO component type [RFC5545]. A VTODO component that is a direct child of a VCALENDAR component is equivalent to a standalone JSTask. A VTODO component *within* a master VTODO maps to the entries of the JSTask *recurrenceOverrides* property.

Property	iCalendar counterpart
isAllDay	True, if the type of the DTSTART property in iCalendar is DATE. When translating from JSCalendar the iCalendar DTSTART property is of DATE value type, if the *isAllDay* property is set to true and the *timeZone* property is null.
due	Corresponds to the DUE and DTSTART+DURATION properties in iCalendar. When mapping iCalendar VTODOs with DTSTART+DURATION, the due date is the result of adding DURATION to DTSTART in the DTSTART time-zone.
start	Corresponds to the DTSTART property in iCalendar.
timeZone	Corresponds to the TZID part of the DTSTART/DUE properties in iCalendar. If the task has a different end time-zone to start or due time-zone, this should be added as a JSCalendar *location* with just a *timeZone* property and "rel="end"".
estimatedDuration	Corresponds to the ESTIMATED-DURATION iCalendar property in the RFC draft [draft-apthorp-ical-tasks].
statusUpdatedAt	Maps to the COMPLETED iCalendar property. The JSTask status property MUST have value "completed".
progress	Corresponds to the PARTSTAT and COMPLETED properties in iCalendar, including the definitions in the RFC draft [draft-apthorp-ical-tasks].
status	Corresponds to the STATUS property in iCalendar, including the definitions in the RFC draft [draft-apthorp-ical-tasks].

Table 3: Translation between JSTask and iCalendar

6.3. JSGroup

A JSGroup converts to a iCalendar VCALENDAR containing VEVENT or VTODO components.

Property	iCalendar counterpart
entries	The VEVENT and VTODO components within a top-level VCALENDAR component.
source	Corresponds to the SOURCE property in iCalendar.

Table 4: Translation between JSGroup and iCalendar

6.4. Common properties

Property	iCalendar counterpart
alerts	An *Alert* corresponds to the VALARM component in iCalendar, where the *action* is determined by the iCalendar ACTION property value (e.g., both "DISPLAY" and "AUDIO" actions map to a JSCalendar *display* action, and similarly for "EMAIL"). The *relativeTo* and *offset* properties corresponds to the iCalendar TRIGGER property.
categories	Corresponds to the CONCEPT property in iCalendar, see in the RFC draft [draft-ietf-calext-ical-relations].
color	Corresponds to the COLOR property in iCalendar, as specified in [RFC7986].
created	Corresponds to the CREATED property in iCalendar.
description	Corresponds to the DESCRIPTION property and its ALTREP parameters in iCalendar.
descriptionContentType	Implementation-specific.
freeBusyStatus	Corresponds to the TRANSP property in

	iCalendar.
keywords	Corresponds to the CATEGORIES property in iCalendar, as specified in [RFC7986].
links	Corresponds to the ATTACH ([RFC5545]) or IMAGE ([RFC7986]) properties with a URI value type set to the link "href". ([RFC7986]). The *type* property corresponds to the FMTTYPE parameter, the *size* property to the SIZE parameter. Mapping all other properties is implementation-specific.
locale	Corresponds to the LANGUAGE parameter in iCalendar, which is added to individual properties. When converting from iCalendar, one language must be picked as the main locale for the object, and all properties in other languages moved to the localizations JSEvent property.
localizations	Implementation-specific.
locations	See Section 6.5.
method	Corresponds to the METHOD property of the embedding VCALENDAR in iCalendar.
participants	See Section 6.5.
priority	Corresponds to the PRIORITY property in iCalendar.
privacy	Corresponds to the CLASS property in iCalendar.
prodId	Corresponds to the PRODID property in iCalendar.
recurrenceOverrides	Corresponds to the RDATE and EXDATE properties in iCalendar, plus VEVENT (for JSEvent) or VTODO (for JSTask) instances with a recurrence-id.
recurrenceRule	Corresponds to the RRULE property in iCalendar. See the property definition at section Section 4.3.1 how to map a

	RRULE value.	
relatedTo	Corresponds to the RELATED-TO property in iCalendar.	
replyTo	An iCalendar ORGANIZER with one of the mapped URIs as value. If URIs are defined for both the "imip" and "web" type, it is recommended to map the "imip" value to the calendar address value of the ORGANIZER.	
sequence	Corresponds to the SEQUENCE property in iCalendar.	
status	Corresponds to the STATUS property in iCalendar (converted to lower-case).	
title	Corresponds to the SUMMARY property in iCalendar.	
uid	Corresponds to the UID property in iCalendar.	
updated	Corresponds to the DTSTAMP and LAST-MODIFIED properties in iCalendar. (These are only different in the iTIP case, and the difference is not actually useful.)	

Table 5: Translation between JSCalendar and iCalendar

6.5. Locations and participants

Both JSCalendar participants and locations have counterparts in iCalendar but provide richer representation.

The following table outlines translation of JSCalendar participants. Where iCalendar has distinct properties for ORGANIZER and ATTENDEE, these are merged in JSCalendar into the Participant object type.

Property	iCalendar counterpart
delegatedFrom	the DELEGATED-FROM parameter

delegatedTo	email
the value of the ORGANIZER or ATTENDEE property	kind
the CUTYPE parameter	linkIds
Implementation-specific.	locationId
Implementation-specific. When mapping from iCalendar to JSCalendar this may be the JSCalendar identifier of a CONFERENCE property that has the MODERATOR feature defined in its FEATURE parameter values. If multiple such CONFERENCE properties are defined in iCalendar, then the one with the most interactive features is chosen.	memberOf
the MEMBER parameter	name
the CN parameter	participation
Maps to the standard iCalendar ROLE parameter values REQ-PARTICIPANT, OPT-PARTICIPANT and NON-PARTICIPANT.	roles
The "chair" role maps to the standard iCalendar ROLE parameter value "chair", with an implicit participant of value "required". The mapping of non-required chairs and other roles is implementation-specific, but using "x-name" parameter values is recommended.	rsvpResponse
the PARTSTAT parameter	the DELEGATED-TO parameter
scheduleSequence	the SEQUENCE property of the participant's latest iMIP message
scheduleUpdated	the DTSTAMP property of the participant's latest iMIP message

Table 6: Translation of Participant between JSCalendar and iCalendar

The iCalendar counterpart for JSCalendar Location objects is the iCalendar [RFC5545] LOCATION property, or implementation-specific.

Property	iCalendar counterpart
name	Corresponds to the LOCATION property value.
description	Implementation-specific.
rel	Implementation-specific.
timeZone	Implementation-specific.
coordinates	Implementation-specific. Consider using a GEO iCalendar property, along with one LOCATION.
uri	Corresponds to the LOCATION ALTREP parameter.
linkIds	Implementation-specific.

Table 7: Translation of Location between JSCalendar and iCalendar

The iCalendar counterpart for JSCalendar VirtualLocation objects is the iCalendar [RFC7986] CONFERENCE property, or implementation-specific.

Property	iCalendar counterpart
name	Corresponds to the CONFERENCE LABEL parameter.
description	Implementation-specific.
uri	Corresponds to the CONFERENCE property value.

Table 8: Translation of VirtualLocation between JSCalendar and iCalendar

6.6. Unknown properties

Both JSCalendar and iCalendar calendar objects may contain properties that are not expressible in the other format. This specification does not mandate how to preserve these properties. Instead, it leaves negotiation on how to treat unknown properties to client and server implementations and their protocol used to exchange calendar objects.

Two notable options to represent and preserve arbitrary iCalendar object properties in JSCalendar are:

- *JCal*: Define iCalendar properties in JCal format ([RFC7265]) in a vendor-specific property of the JCalendar object. The JCal-formatted value may either only contain iCalendar properties that were not mapped to JSCalendar properties, or contain the complete iCalendar object representation.

- *Alternate link*: Define an alternate link (Section 4.2.6) value pointing to the iCalendar representation of the JSCalendar object. E.g. the alternative representation of a VEVENT would be represented as a link with rel "alternate" and type "text/calendar;component=VEVENT".

7. JSCalendar object examples

The following examples illustrate several aspects of the JSCalendar data model and format. The examples may omit mandatory or additional properties, which is indicated by a placeholder property with key "...". While most of the examples use calendar event objects, they are also illustrative for tasks.

7.1. Simple event

This example illustrates a simple one-time event. It specifies a one-time event that begins on January 15, 2018 at 1pm New York local time and ends after 1 hour.

```
{
  "@type": "jsevent",
  "uid": "2a358cee-6489-4f14-a57f-c104db4dc2f1",
  "updated": "2018-01-15T18:00:00Z",
  "title": "Some event",
  "start": "2018-01-15T13:00:00",
  "timeZone": "America/New_York",
  "duration": "PT1H"
}
```

7.2. Simple task

This example illustrates a simple task for a plain to-do item.

```
{
  "@type": "jstask",
  "uid": "2a358cee-6489-4f14-a57f-c104db4dc2f2",
  "updated": "2018-01-15T18:00:00Z",
  "title": "Do something"
}
```

7.3. Simple group

This example illustrates a simple calendar object group that contains an event and a task.

```
{
  "@type": "jsgroup",
  "uid": "2a358cee-6489-4f14-a57f-c104db4dc343",
  "updated": "2018-01-15T18:00:00Z",
  "name": "A simple group",
  "entries": [
    {
      "@type": "jsevent",
      "uid": "2a358cee-6489-4f14-a57f-c104db4dc2f1",
      "updated": "2018-01-15T18:00:00Z",
      "title": "Some event",
      "start": "2018-01-15T13:00:00",
      "timeZone": "America/New_York",
      "duration": "PT1H"
    },
    {
      "@type": "jstask",
      "uid": "2a358cee-6489-4f14-a57f-c104db4dc2f2",
      "updated": "2018-01-15T18:00:00Z",
      "title": "Do something"
    }
  ]
}
```

7.4. All-day event

This example illustrates an event for an international holiday. It specifies an all-day event on April 1 that occurs every year since the year 1900.

```
{
  "...": "",
  "title": "April Fool's Day",
  "isAllDay": true,
  "start": "1900-04-01T00:00:00",
  "duration": "P1D",
  "recurrenceRule": {
    "frequency": "yearly"
  }
}
```

7.5. Task with a due date

This example illustrates a task with a due date. It is a reminder to buy groceries before 6pm Vienna local time on January 19, 2018. The calendar user expects to need 1 hour for shopping.

```
{
  "...": "",
  "title": "Buy groceries",
  "due": "2018-01-19T18:00:00",
  "timeZone": "Europe/Vienna",
  "estimatedDuration": "PT1H"
}
```

7.6. Event with end time-zone

This example illustrates the use of end time-zones by use of an international flight. The flight starts on April 1, 2018 at 9am in Berlin local time. The duration of the flight is scheduled at 10 hours 30 minutes. The time at the flights destination is in the same time-zone as Tokyo. Calendar clients could use the end time-zone to display the arrival time in Tokyo local time and highlight the time-zone difference of the flight.

```
{
  "...": "",
  "title": "Flight XY51 from FRA to NRT",
  "start": "2018-04-01T09:00:00",
  "timeZone": "Europe/Berlin",
  "duration": "PT10H30M",
  "locations": {
    "2a358cee-6489-4f14-a57f-c104db4dc2f1": {
      "rel": "end",
      "timeZone": "Asia/Tokyo"
    }
  }
}
```

7.7. Floating-time event (with recurrence)

This example illustrates the use of floating-time. Since January 1, 2018, a calendar user blocks 30 minutes every day to practice Yoga at 7am local time, in whatever time-zone the user is located on that date.

```
{
  "...": "",
  "title": "Yoga",
  "start": "2018-01-01T07:00:00",
  "duration": "PT30M",
  "recurrenceRule": {
    "frequency": "daily"
  }
}
```

7.8. Event with multiple locations and localization

This example illustrates an event that happens at both a physical and a virtual location. Fans can see a live convert on premises or online. The event title and descriptions are localized. (Note: the localization of the event description contains an UTF-8 encoded German Umlaut. This character may have been replaced with ASCII characters in the plain-text rendering of this RFC document)

```
{
  "...": "",
  "title": "Live from Music Bowl: The Band",
  "description": "Go see the biggest music event ever!",
  "locale": "en",
  "start": "2018-07-04T17:00:00",
  "timeZone": "America/New_York",
  "duration": "PT3H",
  "locations": {
    "c0503d30-8c50-4372-87b5-7657e8e0fedd": {
      "name": "The Music Bowl",
      "description": "Music Bowl, Central Park, New York",
      "coordinates": "geo:40.7829,73.9654"
    }
  },
  "virtualLocations": {
    "6f3696c6-1e07-47d0-9ce1-f50014b0041a": {
      "name": "Free live Stream from Music Bowl",
      "uri": "https://stream.example.com/the_band_2018"
    }
  },
  "localizations": {
    "de": {
      "title": "Live von der Music Bowl: The Band!",
      "description": "Schau dir das groesste Musikereignis an!",
      "virtualLocations/6f3696c6-1e07-47d0-9ce1-f50014b0041a/name":
                              "Gratis Live-Stream aus der Music Bowl"
    }
  }
}
```

7.9. Recurring event with overrides

This example illustrates the use of recurrence overrides. A math course at a University is held for the first time on January 8, 2018 at 9am London time and occurs every week until June 25, 2018. Each lecture lasts for one hour and 30 minutes and is located at the Mathematics department. This event has exceptional occurrences: at the last occurrence of the course is an exam, which lasts for 2 hours and starts at 10am. Also, the location of the exam differs from the usual location. On April 2 no course is held. On January 5 at 2pm is an optional introduction course, that occurs before the first regular lecture.

```
{
  "...": "",
  "title": "Calculus I",
  "start": "2018-01-08T09:00:00",
  "timeZone": "Europe/London",
  "duration": "PT1H30M",
  "locations": {
    "2a358cee-6489-4f14-a57f-c104db4dc2f1": {
      "title": "Math lab room 1",
      "description": "Math Lab I, Department of Mathematics"
    }
  },
  "recurrenceRule": {
    "frequency": "weekly",
    "until": "2018-06-25T09:00:00"
  },
  "recurrenceOverrides": {
    "2018-01-05T14:00:00": {
      "title": "Introduction to Calculus I (optional)"
    },
    "2018-04-02T09:00:00": {
      "excluded": "true"
    },
    "2018-06-25T09:00:00": {
      "title": "Calculus I Exam",
      "start": "2018-06-25T10:00:00",
      "duration": "PT2H",
      "locations": {
        "2a358cee-6489-4f14-a57f-c104db4dc2f1": {
          "title": "Big Auditorium",
          "description": "Big Auditorium, Other Road"
        }
      }
    }
  }
}
```

7.10. Recurring event with participants

This example illustrates scheduled events. A team meeting occurs every week since January 8, 2018 at 9am Johannesburg time. The event owner also chairs the event. Participants meet in a virtual meeting room. An attendee has accepted the invitation, but on March 8, 2018 he is unavailable and declined participation for this occurrence.

```
{
  "...": "",
  "title": "FooBar team meeting",
```

```
    "start": "2018-01-08T09:00:00",
    "timeZone": "Africa/Johannesburg",
    "duration": "PT1H",
    "locations": {
      "2a358cee-6489-4f14-a57f-c104db4dc2f1": {
        "title": "ChatMe meeting room",
        "rel": "virtual",
        "features": [
          "audio",
          "chat",
          "video"
        ],
        "uri": "https://chatme.example.com?id=1234567"
      }
    },
    "recurrenceRule": {
      "frequency": "weekly"
    },
    "replyTo": {
      "imip": "zoe@foobar.example.com"
    },
    "participants": {
      "tom@foobar.example.com": {
        "name": "Tom Tool",
        "email": "tom@foobar.example.com",
        "rsvpResponse": "accepted",
        "roles": [
          "attendee"
        ]
      },
      "zoe@foobar.example.com": {
        "name": "Zoe Zelda",
        "email": "zoe@foobar.example.com",
        "rsvpResponse": "accepted",
        "roles": [
          "owner",
          "chair"
        ]
      },
      "...": ""
    },
    "recurrenceOverrides": {
      "2018-03-08T09:00:00": {
        "participants/tom@foobar.example.com/rsvpResponse": "declined"
      }
    }
  }
```

8. Security Considerations

The use of JSON as a format does have its own inherent security risks as discussed in Section 12 of [RFC8259]. Even though JSON is considered a safe subset of JavaScript, it should be kept in mind that a flaw in the parser processing JSON could still impose a threat, which doesn't arise with conventional iCalendar data.

With this in mind, a parser for JSON data aware of the security implications should be used for the format described in this document. For example, the use of JavaScript's "eval()" function is considered an unacceptable security risk, as described in Section 12 of[RFC8259]. A native parser with full awareness of the JSON format should be preferred.

9. IANA Considerations

This document amends the "application/calendar" MIME media type defined in [RFC7265].

New optional parameter: "type" with value being one of "jsevent", "jstask", "jsgroup". The parameter MUST NOT occur more than once.

10. Acknowledgments

The authors would like to thank the members of CalConnect for their valuable contributions. This specification originated from the work of the API technical committee of CalConnect, the Calendaring and Scheduling Consortium.

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