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RFC 9253
Support for iCalendar Relationships

Abstract

This specification updates the iCalendar RELATED-TO property defined in RFC 5545 by adding new relation types and introduces new iCalendar properties (LINK, CONCEPT, and REFID) to allow better linking and grouping of iCalendar components and related data.

Status of This Memo

This is an Internet Standards Track document.

This document is a product of the Internet Engineering Task Force (IETF). It represents the consensus of the IETF community. It has received public review and has been approved for publication by the Internet Engineering Steering Group (IESG). Further information on Internet Standards is available in Section 2 of RFC 7841.

Information about the current status of this document, any errata, and how to provide feedback on it may be obtained at https://www.rfc-editor.org/info/rfc9253.

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1. Introduction

iCalendar entities defined in [RFC5545] often need to be related to each other or to associated metadata. The specifications below support relationships of the following forms:

Structured iCalendar: iCalendar entities can be related to each other in some structured way, for example, as parent, sibling, before, or after.

Grouped iCalendar: iCalendar entities can be related to each other as a group. CATEGORIES are often used for this purpose but are problematic for application developers due to their lack of consistency and use as a free-form tag.

Linked: Entities can be linked to other entities, such as vCards, through a URI and associated REL and FMTTYPE parameters.

1.1. Structured iCalendar Relationships

The iCalendar [RFC5545] RELATED-TO property has no support for temporal relationships as used by project management tools.

The RELTYPE parameter is extended to take new values defining temporal relationships, a GAP parameter is defined to provide lead and lag values, and RELATED-TO is extended to allow URI values. These changes allow the RELATED-TO property to define a richer set of relationships useful for project management.

1.2. Grouped iCalendar Relationships

This specification defines a new REFID property, which allows arbitrary groups of entities to be associated with the same key value.

REFID is used to identify a key allowing the association of components that are all related to the referring, aggregating component and the retrieval of components based on this key. For example, this may be used to identify the tasks associated with a given project without having to communicate the task structure of the project. A further example is the grouping of all sub-tasks associated with the delivery of a specific package in a package delivery system.

As such, the presence of a REFID property imparts no meaning to the component. It is merely a key to allow retrieval. This is distinct from categorization, which, while allowing grouping, also adds meaning to the component to which it is attached.

1.3. Concept Relationships

The name CONCEPT is used by the Simple Knowledge Organization System, as defined in [W3C.REC-skos-reference-20090818]. The term "concept" more accurately defines what we often mean by a category. It's not the text string that is important but the meaning attached to it. For example, the term "football" can mean very different sports.

The introduction of CONCEPT allows a more structured approach to categorization, with the possibility of namespaced and path-like values. Unlike REFID, the CONCEPT property imparts some meaning. It is assumed that the value of this property will reference a well-defined category.

The current CATEGORIES property defined in [RFC5545] is used as a free-form 'tagging' field. These values have some meaning to those who apply them but not necessarily to any consumer. As such, it is difficult to establish formal relationships between components based on their category.

Rather than attempt to add semantics to the CATEGORIES property, it seems best to continue its usage as an informal tag and establish a new CONCEPT property with more constraints.

1.4. Linked Relationships

The currently existing iCalendar standard [RFC5545] lacks a general purpose method for referencing additional, external information relating to calendar components.

This document proposes a method for referencing typed external information that can provide additional information about an iCalendar component. This new LINK property is closely aligned to [RFC8288], which defines the generic concept of Web Linking, as well as its expression in the HTTP LINK header field.

The LINK property defines a typed reference or relation to external metadata or related resources. By providing type and format information as parameters, clients and servers are able to discover interesting references and make use of them, perhaps for indexing or the presentation of interesting links for the user.

Calendar components are often grouped into collections to represent a calendar or a series of tasks, for example, Calendaring Extensions to WebDAV (CalDAV) calendar collections [RFC4791].

It is also often necessary to reference calendar components in other collections. For example, a VEVENT might refer to a VTODO from which it was derived. The PARENT, SIBLING, and CHILD relationships defined for the RELATED-TO property only allow for a unique identifier (UID), which is inadequate for many purposes. Allowing other value types for those relationships may help but would cause backward-compatibility issues. The LINK property can link components in different collections or even on different servers.

When publishing events, it is useful to be able to refer back to the source of that information. The actual event may have been consumed from a feed or an ics file on a website. A LINK property can provide a reference to the originator of the event.

Beyond the need to relate elements temporally, project management tools often need to be able to specify the relationships between the various events and tasks that make up a project. The LINK property provides such a mechanism.

The LINK property **MUST NOT** be treated as just another attachment. The ATTACH property defined in [RFC5545] has been extended by [RFC8607] to handle server-side management and stripping of inline data and to provide additional data about the attachment (size, filename, etc.).

Additionally, clients may choose to handle attachments differently from the LINK property, as attachments are often an integral part of the message, for example, the agenda.

1.5. Caching and Offline Use

In general, the calendar entity should be self explanatory without the need to download referenced metadata, such as a web page.

However, to facilitate offline display, the link type may identify important pieces of data that should be downloaded in advance.

1.6. Conventions Used in This Document

The key words "**MUST**", "**MUST NOT**", "**REQUIRED**", "**SHALL**", "**SHALL NOT**", "**SHOULD**", "**SHOULD NOT**", "**RECOMMENDED**", "**NOT RECOMMENDED**", "**MAY**", and "**OPTIONAL**" in this document are to be interpreted as described in BCP 14 [RFC2119] [RFC8174] when, and only when, they appear in all capitals, as shown here.

The notation used in this memo to (re-)define iCalendar elements is the ABNF notation of [RFC5234], as used by [RFC5545]. Any syntax elements shown below that are not explicitly defined in this specification come from iCalendar [RFC5545].

2. LINK Property Reference Types

The reference value in the LINK property defined below can take three forms specified by the VALUE parameter:

URI: This is a URI referring to the target.

UID: This allows for linking within a single collection of calendar components, and the value **MUST** refer to another component within the same collection.

XML-REFERENCE: In an XML environment, it may be necessary to refer to a fragment of an external XML artifact. This value is a URI with an XPointer anchor value. The XPointer is defined in [W3C.WD-xptr-xpointer-20021219], and its use as an anchor is defined in [W3C.REC-xptr-framework-20030325].

Note that UID references may need updating on import. An example is data to be imported from a file containing VTODO and VEVENT components, with a VTODO referring to VEVENT components by UID. When imported into a CalDAV system, the VTODO components are typically placed in a different collection from the VEVENT components. This would require the UID reference to be replaced with a URI.

3. Link Relation Types

Two forms of relation types are defined in [RFC8288]: registered and extension. Registered relation types are added to the "Link Relations" registry, as specified in Section 2.1.1 of [RFC8288]. Extension relation types, defined in Section 2.1.2 of [RFC8288], are specified as unique URIs that are not registered in the registry.

The relation types defined in Section 6.1 will be registered with IANA in accordance with the specifications in [RFC8288].

4. New Temporal RELTYPE Parameter Values

This section defines the usual temporal relationships for use with the RELTYPE parameter defined in Section 3.2.15 of [RFC5545]: FINISHTOSTART, FINISHTOFINISH, STARTTOFINISH, or STARTTOSTART.

The [RFC5545] RELATED-TO property with one or more of these temporal relationships will be present in the predecessor entity and will refer to the successor entity.

The GAP parameter (see Section 6.2) specifies the lead (a negative value) or lag (a positive value) time between the predecessor and the successor.

In the description of each temporal relationship below, we refer to Task-A, which contains and controls the relationship, and Task-B, which is the target of the relationship. This is indicated by the direction of the arrows in the diagrams below.

Also, each relationship may be modified by the addition of a GAP parameter to the relationship that applies to the targeted component.

RELTYPE=FINISHTOSTART: Task-B cannot start until Task-A finishes. For example, when painting is complete, carpet laying can begin.

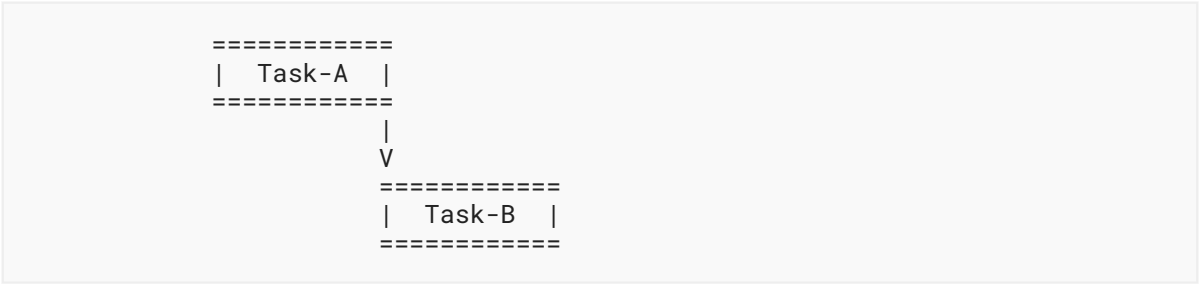

Figure 1: Finish-to-Start Relationship

RELTYPE=FINISHTOFINISH: Task-B can only be completed after Task-A is finished. The related tasks may run in parallel before completion.

For example, in the development of two related pieces of software (e.g., the API and the implementation), the design of the implementation (Task-B) cannot be completed until the design of the API (Task-A) has been completed.

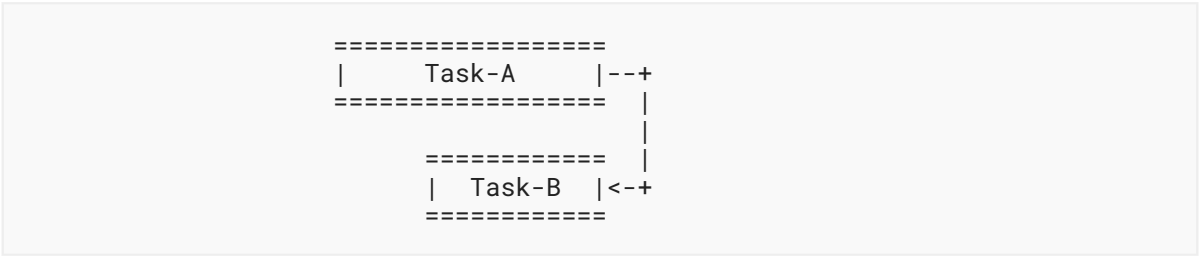

Figure 2: Finish-to-Finish Relationship

RELTYPE=STARTTOFINISH: The start of Task-A (which occurs after Task-B) controls the finish of Task-B. For example, ticket sales (Task-B) end after the game starts (Task-A).

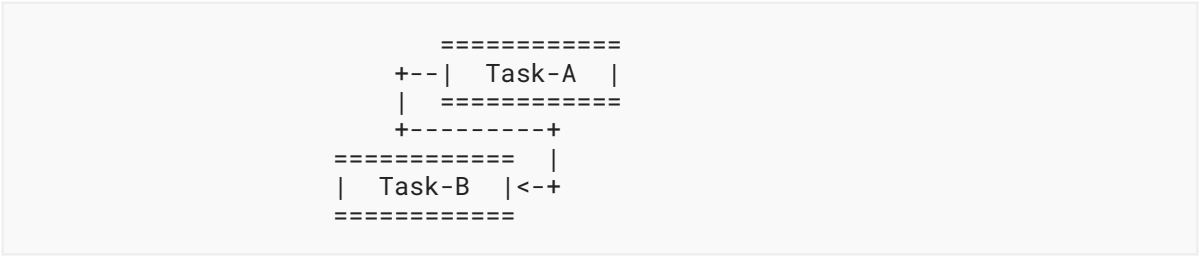

Figure 3: Start-to-Finish Relationship

RELTYPE=STARTTOSTART: The start of Task-A triggers the start of Task-B, that is, Task-B can start anytime after Task-A starts.

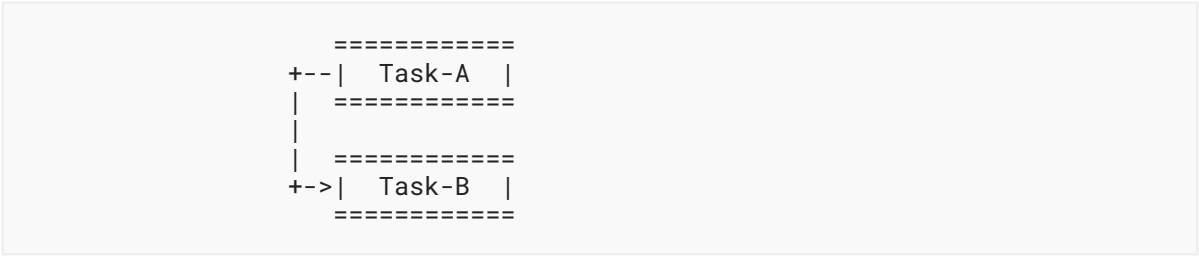

Figure 4: Start-to-Start Relationship

5. Additional New RELTYPE Parameter Values

This section defines the additional relationships below:

RELTYPE=FIRST: This indicates that the referenced calendar component is the first in a series the referencing calendar component is part of.

RELTYPE=NEXT: This indicates that the referenced calendar component is the next in a series the referencing calendar component is part of.

RELTYPE=DEPENDS-ON: This indicates that the current calendar component depends on the referenced calendar component in some manner. For example, a task may be blocked waiting on the other, referenced, task.

RELTYPE=REFID: This establishes a reference from the current component to components with a REFID property that matches the value given in the associated RELATED-TO property.

RELTYPE=CONCEPT: This establishes a reference from the current component to components with a CONCEPT property that matches the value given in the associated RELATED-TO property.

Note that the relationship types of PARENT, CHILD, and SIBLING establish a hierarchical relationship. The new types of FIRST and NEXT are an ordering relationship.

6. New Property Parameters

6.1. Link Relation

Parameter name: LINKREL

Purpose: This property specifies the relationship of data referenced by a LINK property.

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

```
linkrelparam = "LINKREL" "="
                (DQUOTE uri DQUOTE
               / iana-token)   ; Other IANA registered type
```

Description: This parameter **MUST** be specified on all LINK properties and define the type of reference. This allows programs consuming this data to automatically scan for references they support. There is no default relation type.

Any link relation in the link registry established by [RFC8288], or new link relations, may be used. It is expected that link relation types seeing significant usage in calendaring will have the calendaring usage described in an RFC.

LINKREL=latest-version: This identifies the latest version of the event information.

Registration: These relation types are registered in [RFC8288].

6.2. Gap

Parameter name: GAP

Purpose: This property specifies the length of the gap, positive or negative, between two components with a temporal relationship.

Format Definition: This parameter is defined by the following notation, where dur-value is defined in Section 3.3.6 of [RFC5545]. :

```
  gapparam      = "GAP" "=" dur-value
```

Description: This parameter **MAY** be specified on the RELATED-TO property and defines the duration of time between the predecessor and successor in an interval. When positive, it defines the lag time between a task and its logical successor. When negative, it defines the lead time.

An example of lag time might be if Task-A is "paint the room" and Task-B is "lay the carpets". Then, Task-A may be related to Task-B with RELTYPE=FINISHTOSTART with a gap of 1 day -- long enough for the paint to dry.

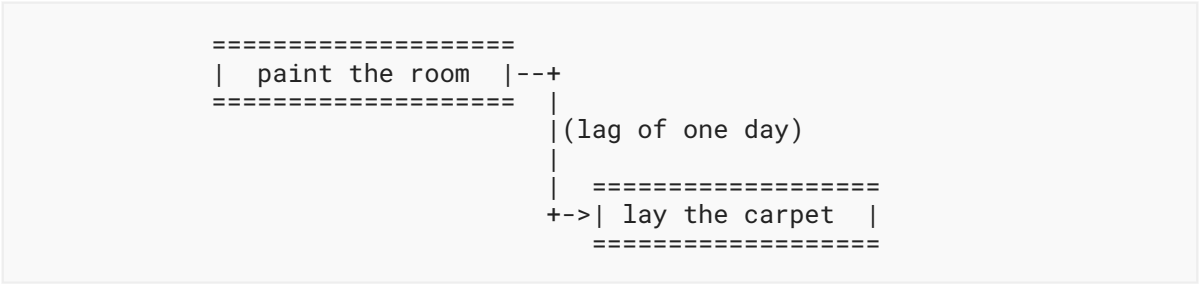

Figure 5: Finish-to-Start Relationship with Lag

For an example of lead time, in constructing a two-story building, the electrical work must be done before painting. However, the painter can move in to the first floor as the electricians move upstairs.

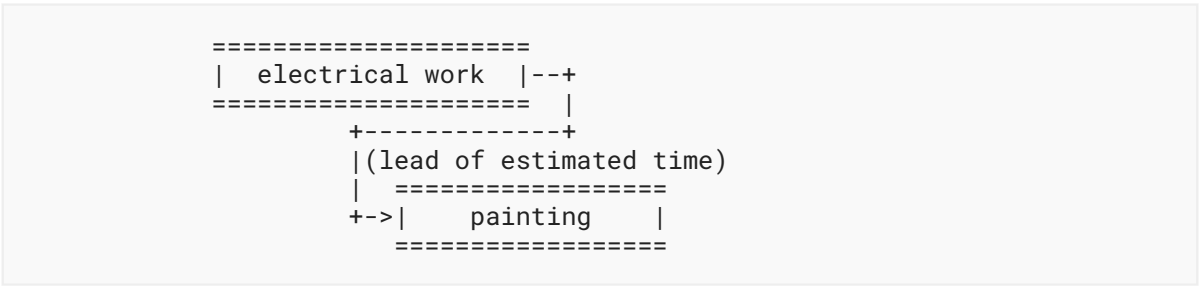

Figure 6: Finish-to-Start Relationship with Lead

7. New Value Data Types

This specification defines the following new value types to be used with the VALUE property parameter:

UID: VALUE=UID indicates that the associated value is the UID for a component.

XML-REFERENCE: VALUE=XML-REFERENCE indicates that the associated value references an associated XML artifact and is a URI with an XPointer anchor value. The XPointer is defined in [W3C.WD-xptr-xpointer-20021219], and its use as an anchor is defined in [W3C.REC-xptr-framework-20030325].

8. New Properties

8.1. Concept

Property name: CONCEPT

Purpose: This property defines the formal categories for a calendar component.

Value type: URI

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

Conformance: This property can be specified zero or more times in any iCalendar component.

Description: This property is used to specify formal categories or classifications of the calendar component. The values are useful in searching for a calendar component of a particular type and category.

This categorization is distinct from the more informal "tagging" of components provided by the existing CATEGORIES property. It is expected that the value of the CONCEPT property will reference an external resource that provides information about the categorization.

In addition, a structured URI value allows for hierarchical categorization of events.

Possible category resources are the various proprietary systems, for example, the Library of Congress, or an open source of categorization data.

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

```
concept        =  "CONCEPT" conceptparam ":"
                      uri CRLF

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

Example: The following is an example of this property. It points to a server acting as the source for the calendar object.

```
CONCEPT:https://example.com/event-types/arts/music
```

8.2. Link

Property name: LINK

Purpose: This property provides a reference to external information related to a component.

Value type: URI, UID, or XML-REFERENCE

Property Parameters: The VALUE parameter is required. Non-standard, link relation type, format type, label, and language parameters can also be specified on this property. The LABEL parameter is defined in [RFC7986].

Conformance: This property can be specified zero or more times in any iCalendar component.

Description: When used in a component, the value of this property points to additional information related to the component. For example, it may reference the originating web server.

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

```
link           = "LINK" linkparam ":"
                   ( uri /  ; for VALUE=XML-REFERENCE
                     uri /  ; for VALUE=URI
                     text ) ; for VALUE=UID
                 CRLF

linkparam      = (";" "VALUE" "=" ("XML-REFERENCE" /
                                   "URI" /
                                   "UID"))
                 1*(";" linkrelparam)
                 1*(";" fmttypeparam)
                 1*(";" labelparam)
                 1*(";" languageparam)
                 *(";" other-param)
                 ; the elements herein may appear in any order,
                 ; and the order is not significant.
```

This property is a serialization of the model in [RFC8288], where the link target is carried in the property value, the link context is the containing calendar entity, and the link relation type and any target attributes are carried in iCalendar property parameters.

The LINK property parameters map to [RFC8288] attributes as follows:

LABEL: This parameter maps to the "title" attribute defined in Section 3.4.1 of [RFC8288].

LANGUAGE: This parameter maps to the "hreflang" attribute defined in Section 3.4.1 of [RFC8288].

LINKREL: This parameter maps to the link relation type defined in Section 2.1 of [RFC8288].

FMTTYPE: This parameter maps to the "type" attribute defined in Section 3.4.1 of [RFC8288].

There is no mapping for "title*", "anchor", "rev", or "media" [RFC8288].

Example: The following is an example of this property, which provides a reference to the source for the calendar object.

```
LINK;LINKREL=SOURCE;LABEL=Venue;VALUE=URI:
 https://example.com/events
```

Example: The following is an example of this property, which provides a reference to an entity from which this one was derived. The link relation is a vendor-defined value.

```
LINK;LINKREL="https://example.com/linkrel/derivedFrom";
 VALUE=URI:
 https://example.com/tasks/01234567-abcd1234.ics
```

Example: The following is an example of this property, which provides a reference to a fragment of an XML document. The link relation is a vendor-defined value.

```
LINK;LINKREL="https://example.com/linkrel/costStructure";
 VALUE=XML-REFERENCE:
 https://example.com/xmlDocs/bidFramework.xml
 #xpointer(descendant::CostStruc/range-to(
 following::CostStrucEND[1]))
```

8.3. Refid

Property name: REFID

Purpose: This property value acts as a key for associated iCalendar entities.

Value type: TEXT

Property Parameters: Non-standard parameters can be specified on this property.

Conformance: This property can be specified zero or more times in any iCalendar component.

Description: The value of this property is free-form text that creates an identifier for associated components. All components that use the same REFID value are associated through that value and can be located or retrieved as a group. For example, all of the events in a travel itinerary would have the same REFID value, so as to be grouped together.

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

```
refid      = "REFID" refidparam ":" text CRLF

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

Example: The following is an example of this property.

```
REFID:itinerary-2014-11-17
```

9. Updates to RFC 5545

This specification updates the RELATED-TO property defined in Section 3.8.4.5 of [RFC5545]. The contents of Section 9.1 replace that section.

The RELTYPE parameter is extended to take new values defining temporal relationships, a GAP parameter is defined to provide lead and lag values, and RELATED-TO is extended to allow URI values. These changes allow the RELATED-TO property to define a richer set of relationships useful for project management.

9.1. RELATED-TO

Property name: RELATED-TO

Purpose: This property is used to represent a relationship or reference between one calendar component and another. The definition here extends the definition in Section 3.8.4.5 of [RFC5545] by allowing URI or UID values and a GAP parameter.

Value Type: URI, UID, or TEXT

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

Conformance: This property **MAY** be specified in any iCalendar component.

Description: By default or when VALUE=UID is specified, the property value consists of the persistent, globally unique identifier of another calendar component. This value would be represented in a calendar component by the UID property.

By default, the property value points to another calendar component that has a PARENT relationship to the referencing object. The RELTYPE property parameter is used to either explicitly state the default PARENT relationship type to the referenced calendar component or to override the default PARENT relationship type and specify either a CHILD or SIBLING relationship or a temporal relationship.

The PARENT relationship indicates that the calendar component is a subordinate of the referenced calendar component. The CHILD relationship indicates that the calendar component is a superior of the referenced calendar component. The SIBLING relationship indicates that the calendar component is a peer of the referenced calendar component.

To preserve backwards compatibility, the value type **MUST** be UID when the PARENT, SIBLING, or CHILD relationships are specified.

The FINISHTOSTART, FINISHTOFINISH, STARTTOFINISH, or STARTTOSTART relationships define temporal relationships, as specified in the RELTYPE parameter definition.

The FIRST and NEXT define ordering relationships between calendar components.

The DEPENDS-ON relationship indicates that the current calendar component depends on the referenced calendar component in some manner. For example, a task may be blocked waiting on the other, referenced, task.

The REFID and CONCEPT relationships establish a reference from the current component to the referenced component.

Changes to a calendar component referenced by this property can have an implicit impact on the related calendar component. For example, if a group event changes its start or end date or time, then the related, dependent events will need to have their start and end dates and times

changed in a corresponding way. Similarly, if a PARENT calendar component is canceled or deleted, then there is an implied impact to the related CHILD calendar components. This property is intended only to provide information on the relationship of calendar components.

Deletion of the target component, for example, the target of a FIRST, NEXT, or temporal relationship, can result in broken links.

It is up to the target calendar system to maintain any property implications of these relationships.

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

```
related    = "RELATED-TO" relparam ":"
                          ( text /  ; for VALUE=UID
                            uri /   ; for VALUE=URI
                            text ) ; for VALUE=TEXT or default
             CRLF

relparam   = ; the elements herein may appear in any order,
             ; and the order is not significant.
             [";" "VALUE" "=" ("UID" /
                               "URI" /
                               "TEXT")]
             [";" reltypeparam]
             [";" gapparam]
             *(";" other-param)
```

Example: The following are examples of this property.

```
RELATED-TO:jsmith.part7.19960817T083000.xyzMail@example.com

RELATED-TO:19960401-080045-4000F192713-0052@example.com

RELATED-TO;VALUE=URI;RELTYPE=STARTTOFINISH:
 https://example.com/caldav/user/jb/cal/
 19960401-080045-4000F192713.ics
```

10. Security Considerations

All of the security considerations of Section 7 of [RFC5545] apply to this specification.

Applications using the LINK property need to be aware of the risks entailed in using the URIs provided as values. See Section 7 of [RFC3986] for a discussion of the security considerations relating to URIs.

In particular, note Section 7.1 (Reliability and Consistency) of [RFC3986], which points out the lack of a stability guarantee for referenced resources.

When the value is an XML-REFERENCE type, the targeted data is an XML document or portion thereof. Consumers need to be aware of the security issues related to XML processing -- in particular, those related to XML entities. See Section 20.6 of [RFC4918]. Additionally, note that the reference may be invalid or become so over time.

The CONCEPT and redefined RELATED-TO properties have the same issues in that values may be URIs.

Extremely large values for the GAP parameter may lead to unexpected behavior.

11. IANA Considerations

11.1. iCalendar Property Registrations

The following iCalendar property names have been added to the iCalendar "Properties" registry defined in Section 8.3.2 of [RFC5545]. IANA has also added a reference to this document, where the properties originally defined in [RFC5545] have been updated by this document.

Property	Status	Reference
CONCEPT	Current	Section 8.1
LINK	Current	Section 8.2
REFID	Current	Section 8.3
RELATED-TO	Current	[RFC5545], Section 3.8.4.5; RFC 9253, Section 9.1

Table 1

11.2. iCalendar Property Parameter Registrations

The following iCalendar property parameter names have been added to the iCalendar "Parameters" registry defined in Section 8.3.3 of [RFC5545].

Parameter	Status	Reference
GAP	Current	Section 6.2
LINKREL	Current	Section 6.1

Table 2

11.3. iCalendar Value Data Type Registrations

The following iCalendar property parameter names have been added to the iCalendar "Value Data Types" registry defined in Section 8.3.4 of [RFC5545].

Value Data Type	Status	Reference
XML-REFERENCE	Current	Section 7
UID	Current	Section 7

Table 3

11.4. iCalendar RELTYPE Value Registrations

The following iCalendar "RELTYPE" values have been added to the iCalendar "Relationship Types" registry defined in Section 8.3.8 of [RFC5545].

Relationship Type	Status	Reference
CONCEPT	Current	Section 5
DEPENDS-ON	Current	Section 5
FINISHTOFINISH	Current	Section 4
FINISHTOSTART	Current	Section 4
FIRST	Current	Section 5
NEXT	Current	Section 5
REFID	Current	Section 5
STARTTOFINISH	Current	Section 4
STARTTOSTART	Current	Section 4

Table 4

12. References

12.1. Normative References

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12.2. Informative References

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