DataCite - International Data Citation

DataCite Metadata Schema Documentation for the Publication and Citation of Research Data

Citation:

> DataCite Metadata Working Group. (2017). DataCite Metadata Schema Documentation for the Publication and Citation of Research Data. Version 4.1. DataCite e.V. 10.5438/0014.

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Introduction

The DataCite Consortium

Scholarly research is producing ever-increasing amounts of digital research data, and it depends on data to verify research findings, create new research, and share findings. In this context, what has been missing until recently, is a *persistent* approach to access, identification, sharing, and re-use of datasets. To address this need, the DataCite[1] international consortium was founded in late 2009 with these three fundamental goals:

- establish easier access to scientific research data on the Internet,
- increase acceptance of research data as legitimate, citable contributions to the scientific record, and
- support data archiving that will permit results to be verified and re-purposed for future study.

Since its founding in 2009, DataCite has grown and now spans the globe from Europe and North America to Asia and Australia. The aim of DataCite is to provide domain agnostic services to benefit scholars in a wide range of disciplines.

Key to DataCite service is the concept of a long-term or *persistent* identifier. A persistent identifier is an association between a character string and a resource. Resources can be files, parts of files, persons, organisations, abstractions, etc. DataCite uses *Digital Object Identifiers* (DOIs).[2]

DataCite Community Participation

The Metadata Working Group would like to acknowledge the contributions to our work of many colleagues in our institutions who provided assistance of all kinds. Their help has been greatly appreciated. In addition, we are indebted to numerous individuals and organisations in the broader scholarly community who have taken an interest in this work. Because data citation and data management are evolving areas of concern, we look forward to continued interest. With this in mind, the Working Group provides an interactive discussion mechanism for DataCite members and clients to discuss the DataCite Metadata Schema and issues connected with metadata submitted to DataCite, as appropriate[3].

[1] http://schema.datacite.org/

[2] DOIs are administered by the International DOI Foundation, http://www.doi.org/

[3] Join the discussion here: schema.datacite.org.

The Metadata Schema

The DataCite Metadata Schema is a list of core metadata properties chosen for an accurate and consistent identification of a resource for citation and retrieval purposes, along with recommended use instructions. The resource that is being identified can be of any kind, but it is typically a dataset. We use the term 'dataset' in its broadest sense. We mean it to include not only numerical data, but any other research objects in keeping with DataCite's mission. The metadata schema properties are presented and described in detail in DataCite Metadata Properties.

If this release of the metadata schema has a theme, it is support for software citation. The Working Group undertook this in response to increasing interest within the community, including the publication of the Force11 Software Citation Principles[4] as well as a set of guidelines[5] prepared by the UK Science and Technology Facilities Council for working with the DataCite schema. As we reviewed schema version 4.0, we found that very few actual schema changes were required, but substantial modifications needed to be made to the documentation to assist those registering DOIs for software. While the DataCite metadata schema now supports software registration, and provides properties to include version information for items being registered, it is not to be used as a version control or source code control system. There are many tools widely available that are ideally suited for that purpose. Instead, DataCite facilitates software discovery, sharing and citation.

A complete list of all changes in support of software citation is available as a special reference in Appendix 4. In addition, we are providing a mapping of the Force11 Software Citation Principles' metadata requirements to DataCite's metadata schema. This is available as Appendix 5.

The remainder of the Version 4.1 changes is in response to requests from DataCite community members, people like you that have used the metadata schema and have imagined ways in which it might work better for their particular use case. We are indebted to everyone who has provided us with their feedback, allowing us to improve our service for the broader DataCite community.

For a list of all changes, see Version 4.1 Updates.

Lastly, we continue to support openness and the future extensibility of the schema by collaborating with the Dublin Core Metadata Initiative (DCMI) Science and Metadata Community (SAM)[6] to maintain a Dublin Core Application Profile for the schema.

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[4] Smith AM, Katz DS, Niemeyer KE, FORCE11 Software Citation Working Group. (2016) Software citation principles. PeerJ Computer Science 2:e86 https://doi.org/10.7717/peerj-cs.86

[5] Gent, I., Jones, C., & Matthews, B. (2015). Guidelines for persistently identifying software using DataCite. Retrieved July 19, 2017, from http://purl.org/net/epubs/work/24058274

[6] For more information on DCMI SAM, see http://wiki.dublincore.org/index.php/DCMI_Science_And_Metadata.

Version 4.1 Update

Version 4.1 of the schema includes these changes:

- Allowing multiple polygons per GeoLocation
- Addition of new optional subproperties for polygon
    - inPolygonPoint
- Addition of new dateType “Other”
- Addition of new subproperty for Date
    - dateInformation
- Addition of a new resourceType "DataPaper"
- Addition of three new relationType pairs:
    - IsDescribedBy and Describes
    - HasVersion and IsVersionOf
    - IsRequiredBy and Requires
- Addition of a new optional attribute for creatorName and ContributorName:
    - nameType. Controlled list: personal, organizational
- Addition of a new optional attribute for relatedIdentifier
    - resourceTypeGeneral. Controlled list is identical to existing resourceTypeGeneral attribute
- Addition of optional lang attribute to Rights property

Version 4.1 of the documentation includes these changes:

- Change to the definition of Collection to encompass collections of one resourceType as well as those of mixed types.
- Inclusion of a reference to the Research Data Alliance (RDA)-recommended dynamic data citation approach in documentation in section 2.2, Citation.
- Change to the definition and examples of Size property to include duration as well as extent.
- Correction of the hierarchy of elements for Creator and Contributor.
- To enhance support for software citation, addition of 2 new appendices: one with a list of all the changes and explanatory notes; and one with Force11 mappings

- Changes and additions to these definitions, in support of software citation:
    - Identifier
    - Title
    - Publisher
    - Contributor
    - PublicationYear
    - resourceTypeGeneral (Service, Software)
    - relationType pairs (IsPartOf, HasPart, IsDocumentedBy, Documents, IsVariantFormOf, IsOriginalFormOf)
    - Version
    - Rights
    - Description (TechnicalInfo)

DataCite Metadata Properties

Overview

The properties of the DataCite Metadata Schema are presented in this section. More detailed descriptions of the properties, and their related sub-properties, are provided in the DataCite Properties section.

There are three different levels of obligation for the metadata properties:

- **Mandatory (M)** properties *must* be provided,
- **Recommended (R)** properties are optional, but strongly recommended for interoperability and
- **Optional (O)** properties are optional and provide richer description.

Those clients who wish to enhance the prospects that their metadata will be found, cited and linked to original research are strongly encouraged to submit the Recommended as well as Mandatory set of properties. Together, the Mandatory and Recommended set of properties and their sub-properties are especially valuable to information seekers and added-service providers, such as indexers. The Metadata Working Group members strongly urge the inclusion of metadata identified as Recommended for the purpose of achieving greater exposure for the resource's metadata record, and therefore, the underlying research itself.

The properties listed in Table 1 have the obligation level Mandatory, and *must be* supplied when submitting DataCite metadata. The properties listed in Table 2 have one of the obligation levels Recommended or Optional, and *may be* supplied when submitting DataCite metadata.

The prospect that a resource's metadata will be found, cited and linked is enhanced by using the combined Mandatory and Recommended "super set" of properties and sub-properties. These are highlighted in Tables 1 and 2, as shown in the example below.

Example of shading

ID	***DataCite-Property***	***Occ***	***Definition***	***Allowed values, examples, other constraints***
6	Subject	0-n	Subject, keyword, classification code, or key phrase describing the resource.	Free text.

Of the Recommended set of properties, the most important to use is the **`Description`** property, together with the Recommended sub-properties `descriptionType` =”`Abstract`” (see DataCite Properties and property 17). Appendix 1 includes detailed descriptions of controlled list values, using the same shading to indicate those values that are especially important for information seekers and added-service providers. It cannot be emphasized enough how valuable an Abstract is to other scholars in finding the resource and then determining whether or not the resource, once found, is worth investigating further, re-using or validating.

Table 1: DataCite Mandatory Properties

ID	***Property***	***Obligation***
1	Identifier (with mandatory type sub-property)	M
2	Creator (with optional given name, family name, name identifier and affiliation sub-properties)	M
3	Title (with optional type sub-properties)	M
4	Publisher	M
5	PublicationYear	M
10	ResourceType (with mandatory general type description sub-property)	M

Table 2: DataCite Recommended and Optional Properties

ID	*Property*	*Obligation*
6	Subject (with scheme sub-property)	R
7	Contributor (with optional given name, family name, name identifier and affiliation sub-properties)	R
8	Date (with type sub-property)	R
9	Language	O
11	AlternateIdentifier (with type sub-property)	O
12	RelatedIdentifier (with type and relation type sub-properties)	R
13	Size	O
14	Format	O
15	Version	O
16	Rights	O
17	Description (with type sub-property)	R
18	GeoLocation (with point, box and polygon sub-properties)	R
19	FundingReference (with name, identifier, and award related sub-properties)	O

Citation

Because many users of this schema are members of a variety of academic disciplines, DataCite remains discipline-agnostic concerning matters pertaining to academic style sheet requirements. Therefore, DataCite encourages rather than requires a particular citation format[7]. In keeping with this approach, the following is the *preferred* format for rendering a DataCite citation for human readers using the mandatory properties of the schema:

> Creator (PublicationYear): Title. Publisher. (resourceTypeGeneral). Identifier

It may also be desirable to include information from optional properties, such as Version. This is particularly important to include when citing software. For example:

> Creator (PublicationYear): Title. Version. Publisher. (resourceTypeGeneral). Identifier

For citation purposes, DataCite prefers that DOI names are displayed as linkable, permanent URLs. The Identifier may appear in its original format. If the original format is chosen, be sure to include the characters “doi:" pre-pended to the Identifier as in “doi:10.1234/abc.”

For resources that do not have a standard publication year value, DataCite suggests that PublicationYear should include the date that is preferred for use in a citation.

Here are several examples:

- Irino, T; Tada, R (2009): Chemical and mineral compositions of sediments from ODP Site 127-797. V. 2.1. Geological Institute, University of Tokyo. (dataset). https://doi.org/10.1594/PANGAEA.726855
- Geofon operator (2009): GEFON event gfz2009kciu (NW Balkan Region). GeoForschungsZentrum Potsdam (GFZ). (dataset). https://doi.org/10.1594/GFZ.GEOFON.gfz2009kciu
- Denhard, Michael (2009): dphase_mpeps: MicroPEPS LAF-Ensemble run by DWD for the MAP D-PHASE project. World Data Center for Climate. (dataset.) https://doi.org/10.1594/WDCC/dphase_mpeps

[7] In collaboration with CrossRef, DataCite has created a DOI Citation Formatter Service available at http://crosscite.org/citeproc/. The user can choose from more than 500 different citation formats in 45 different languages.

A special note regarding citation of dynamic datasets:

For datasets that are continuously and rapidly updated, there are special challenges both in citation and preservation. For citation, four approaches are possible:

a) Cite a specific slice[8] or subset (the set of updates to the dataset made during a particular period of time or to a particular area of the dataset); Example:
Data Request T.Jansen; SAHFOS; Work published 2014 via SAHFOS ; Area Def: 54-65°N, 0-45°W. Temporal Def: 1980-2012 (April-August) Taxonomic Def: All zooplankton; (dataset). https://doi.org/10.7487/2014.15.1.1

b) Cite a specific snap-shot[6] (a copy of the entire dataset made at a specific time); Example:
König-Langlo, G., & Sieger, R. (2010). BSRN snapshot 2010-01 as ISO image file (3.75 GB) [Data set]. PANGAEA - Data Publisher for Earth & Environmental Science. (dataset). https://doi.org/10.1594/pangaea.833424

c) Cite the continuously updated dataset[6], but add an Access Date and Time to the citation. Example: Doe, J. and R. Roe. 2001. The FOO Data Set. Version 2.3. The FOO Data Center. (dataset). https://doi.org/10.xxxx/notfoo.547983. Accessed 1 May 2011.

d) Cite a query[9], time-stamped for re-execution against a versioned database. The RDA recommended citation for this approach is:
R. Roe. 2017. "The Moo Data Query" created at 2017-07-21 10:25:30 PID https://doi.org/10.xxxx/notmoo.857988. Subset of Moo Database (dataset). PID https://doi.org/10.xxxx/bigmoo.360873.

Notes:

The “slice,” “snap-shot” and "query" options require unique identifiers. Be aware that the third option (c) necessarily means that following the citation does not result in access to the resource as cited. This limits reproducibility of the work that uses this form of citation.
In addition, please note that access date and time may be combined with the first (a), second (b) and fourth (d) options, but it must be used with the third option (c).

The fourth option (d) may shift more work onto repositories to store database versions for all the queries, so not all repositories will be able to support this alternative.

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[8] Ball, A. & Duke, M. (2015, July 30). ‘How to Cite Datasets and Link to Publications’. DCC How-to Guides. Edinburgh : Digital Curation Centre. Retrieved April 13, 2017, from: http://www.dcc.ac.uk/resources/how-guides/cite-datasets#sec:versions

[9] Rauber, A., Uytvanck, D. V., Asmi, A., & Proll, S. (2016, February 09). Identification of Reproducible Subsets for Data Citation, Sharing and Re-Use. Retrieved April 13, 2017, from https://www.rd-alliance.org/system/files/documents/TCDL-RDA-Guidelines_160411.pdf

DataCite Properties

Table 3 provides a detailed description of the mandatory properties, which *must* be supplied with any initial metadata submission to DataCite, together with their sub-properties. **If one of the required properties is unavailable**, please use one of the standard (machine-recognizable) codes listed in Appendix 3, Table 11. In Table 4, the Recommended and Optional properties are described in detail. For an example of how to make a submission in XML format, please see the XML Examples provided on the DataCite Metadata Schema Repository[10] website.

Throughout this document, a naming convention has been used for all properties and sub-properties as follows: properties begin with a capital letter, whereas sub-properties begin with a lower case letter. If the name is a compound of more than one word, subsequent words begin with capital letters.[11]

As with Tables 1 and 2, Tables 3 and 4 use shading to identify the combined Mandatory and Recommended "super set" of properties and sub-properties that enhance the prospect that the resource's metadata will be found, cited and linked.

The third column, Occurrence (Occ), indicates cardinality/quantity constraints for the properties as follows:

0-n = optional and repeatable
0-1 = optional, but not repeatable
1-n = required and repeatable
1 = required, but not repeatable

NOTE:
XML provides an xml:lang attribute[12] that can be used on the properties `Title`, `Subject`, `Rights`, and `Description`. This provides a way to describe the language used for the content of the specified properties. The schema provides a `Language` property to be used to describe the language of the resource.

[10] http://schema.datacite.org/

[11] This convention is known as "camelCase." https://en.wikipedia.org/wiki/CamelCase

[12] Allowed values IETF BCP 47, ISO 639-1 language codes, e.g. en, de, fr

Table 3: Expanded DataCite Mandatory Properties

ID	DataCite-Property	Occ	Definition	Allowed values, examples, other constraints
1	Identifier	1	The Identifier is a unique string that identifies a resource. For software, determine whether the identifier is for a specific version of a piece of software, (per the Force11 Software Citation Principles[13]), or for all versions.	DOI (Digital Object Identifier) registered by a DataCite member. Format should be "10.1234/foo"
1.1	identifierType	1	The type of Identifier.	*Controlled List Value:* DOI
2	Creator	1-n	The main researchers involved in producing the data, or the authors of the publication, in priority order. To supply multiple creators, repeat this property.	May be a corporate/institutional or personal name. Note: DataCite infrastructure supports up to 8000-10000 names. For name lists above that size, consider attribution via linking to the related metadata.
2.1	creatorName	1	The full name of the creator.	Examples: Charpy, Antoine; Foo Data Center Note: The personal name, format should be: given, family. Non-roman names may be transliterated according to the ALA-LC schemas[14].
2.1.1	nameType	0-1	The type of name	*Controlled List Values:* Organizational Personal

[13] Smith AM, Katz DS, Niemeyer KE, FORCE11 Software Citation Working Group. (2016) Software citation principles. PeerJ Computer Science 2:e86 https://doi.org/10.7717/peerj-cs.86

[14] http://www.loc.gov/catdir/cpso/roman.html

ID	DataCite-Property	Occ	Definition	Allowed values, examples, other constraints
2.2	givenName	0-1	The personal or first name of the creator.	Examples based on the 2.1 names: Antoine
2.3	familyName	0-1	The surname or last name of the creator.	Examples based on the 2.1 names: Charpy
2.4	nameIdentifier	0-n	Uniquely identifies an individual or legal entity, according to various schemas.	The format is dependent upon schema.
2.4.1	nameIdentifierScheme	1	The name of the name identifier schema.	If nameIdentifier is used, nameIdentifierScheme is mandatory. Examples: ORCID[15], ISNI[16]
2.4.2	schemeURI	0-1	The URI of the name identifier schema.	Examples: http://www.isni.org http://orcid.org
2.5	affiliation	0-n	The organizational or institutional affiliation of the creator.	Free text.
3	Title	1-n	A name or title by which a resource is known. May be the title of a dataset or the name of a piece of software.	Free text.
3.1	titleType	0-1	The type of Title.	*Controlled List Values:* AlternativeTitle Subtitle TranslatedTitle Other

[15] http://orcid.org/. When entering an ORCID, follow these style guidelines: http://support.orcid.org/knowledgebase/articles/116780-structure-of-the-orcid-identifier

[16] http://www.isni.org/

ID	DataCite-Property	Occ	Definition	Allowed values, examples, other constraints
4	Publisher	1	The name of the entity that holds, archives, publishes prints, distributes, releases, issues, or produces the resource. This property will be used to formulate the citation, so consider the prominence of the role. For software, use Publisher for the code repository. If there is an entity other than a code repository, that "holds, archives, publishes, prints, distributes, releases, issues, or produces" the code, use the property Contributor/contributorType/ hostingInstitution for the code repository.	Examples: World Data Center for Climate (WDCC); GeoForschungsZentrum Potsdam (GFZ); Geological Institute, University of Tokyo, GitHub
5	PublicationYear	1	The year when the data was or will be made publicly available. In the case of resources such as software or dynamic data where there may be multiple releases in one year, include the Date/dateType/ dateInformation property and sub-properties to provide more information about the publication or release date details.	YYYY *** If an embargo period has been in effect, use the date when the embargo period ends. In the case of datasets, "publish" is understood to mean making the data available on a specific date to the community of researchers. If there is no standard publication year value, use the date that would be preferred from a citation perspective.

ID	DataCite-Property	Occ	Definition	Allowed values, examples, other constraints
10	ResourceType	1	A description of the resource.	The format is open, but the preferred format is a single term of some detail so that a pair can be formed with the sub-property. Text formats can be free-text OR terms from the CASRAI Publications resource type list.[17] *** Examples: Dataset/Census Data, where 'Dataset' is resourceTypeGeneral value and 'Census Data' is ResourceType value. Text/Conference Abstract, where 'Text' is resourceTypeGeneral value and 'Conference Abstract' is resourceType value aligned with CASRAI Publications term.

[17] http://dictionary.casrai.org/Output_Types

ID	DataCite-Property	Occ	Definition	Allowed values, examples, other constraints
10.1	resourceTypeGeneral	1	The general type of a resource.	*Controlled List Values:* Audiovisual Collection DataPaper Dataset Event Image InteractiveResource Model PhysicalObject Service Software Sound Text[18] Workflow Other See Appendix for definitions and examples.

PublicationYear—Additional guidance

PublicationYear : the year when the data was or will be made publicly available. In the case of datasets, "publish" is understood to mean making the data available on a specific date to the community of researchers.

- If that date cannot be determined, use the date of registration.
- If an embargo period has been in effect, use the date when the embargo period ends.
- If there is no standard publication year value, use the date that would be preferred from a citation perspective.

- In the case of resources such as software or dynamic data where there may be multiple releases in one year, include the Date/dateType/dateInformation property and sub-properties to provide more information about the publication or release date details.

[18]Combine "Text" with free-text or terms from the CASRAI Publications resource type list found here: http://dictionary.casrai.org/Output_Types

In the case of a digitised version of a physical object

If the DOI is being used to identify a digitised version of an original item, the recommended approach is to supply the PublicationYear for the digital version and not the original object.

The Title field may be used to convey the approximate or known date of the original object. Other metadata properties available for additional date information about the object include: Subject and Description. However, only Title will be part of the citation.

Here are two examples of citations using dates or date information in the titles.

Schmidt, S., Andersen, V., Belviso, S., & Marty, J.-C. (2002). Dissolved and particulate thorium 234 concentration at time series station DYFAMED from date 1995-05-07 (Data set). PANGAEA - Data Publisher for Earth & Environmental Science. https://doi.org/10.1594/pangaea.183607

Tape, K. D. (2015). Aerial Images of Alaska's Arctic Coastal Plain; 1948-1949. U.S. Geological Survey. (Image). https://doi.org/10.5066/f79021tb

Guidance for handling missing mandatory property values

If providing values for any of the mandatory properties presents a difficulty, use of standard machine-recognizable codes is strongly advised. A set of the codes is provided in Appendix 3, Table 11. However, we recommend that you consider the resulting effect on the citation created from the metadata provided.

Here is an example of a citation that uses machine-readable substitutions for all but one of the required metadata properties. Obviously the more metadata that is supplied, the more information is conveyed. Note that this is a demonstration DOI and not an actual identifier, so the link will not work.

(:unkn)(9999):(:none).(:null).Dataset. https://doi.org/10.5072/FK2JW8C992

Table 4: Expanded DataCite Recommended and Optional Properties

ID	***DataCite-Property***	***Occ***	***Definition***	***Allowed values, examples, other constraints***
6	Subject	0-n	Subject, keyword, classification code, or key phrase describing the resource.	Free text.

ID	DataCite-Property	Occ	Definition	Allowed values, examples, other constraints
6.1	subjectScheme	0-1	The name of the subject scheme or classification code or authority if one is used.	Free text.
6.2	schemeURI	0-1	The URI of the subject identifier scheme.	Examples: http://id.loc.gov/authorities/subjects http://udcdata.info/
6.3	valueURI	0-1	The URI of the subject term.	Example(s) http://id.loc.gov/authorities/subjects/sh85026196 http://udcdata.info/037278
7	Contributor	0-n	The institution or person responsible for collecting, managing, distributing, or otherwise contributing to the development of the resource. To supply multiple contributors, repeat this property. For software, if there is an alternate entity that "holds, archives, publishes, prints, distributes, releases, issues, or produces" the code, use the contributorType "hostingInstitution" for the code repository.	Note: DataCite infrastructure supports up to between 8000-10000 names. For name lists above that size, consider attribution via linking to the related metadata. Examples: Charpy, Antoine; Foo Data Center

ID	DataCite-Property	Occ	Definition	Allowed values, examples, other constraints
7.1	contributorType	1	The type of contributor of the resource.	If Contributor is used, then contributorType is mandatory. *Controlled List Values:* ContactPerson DataCollector DataCurator DataManager Distributor Editor HostingInstitution Producer ProjectLeader ProjectManager ProjectMember RegistrationAgency RegistrationAuthority RelatedPerson Researcher ResearchGroup RightsHolder Sponsor Supervisor WorkPackageLeader Other See Appendix for definitions.

ID	DataCite-Property	Occ	Definition	Allowed values, examples, other constraints
7.2	contributorName	1	The full name of the contributor.	If Contributor is used, then contributorName is mandatory. Examples: Patel, Emily; ABC Foundation The personal name format may be: given, family. Non-roman names should be transliterated according to the ALA-LC schemas[19].
7.2.1	nameType	0-1	The type of name	*Controlled List Values:* Organizational Personal (default)
7.3	givenName	0-1	The personal or first name of the contributor.	Examples based on the 7.2 names: Emily
7.4	familyName	0-1	The surname or last name of the contributor.	Examples based on the 7.2 names: Patel
7.5	nameIdentifier	0-n	Uniquely identifies an individual or legal entity, according to various schemes.	The format is dependent upon scheme.
7.5.1	nameIdentifierScheme	1	The name of the name identifier scheme.	If nameIdentifier is used, nameIdentifierScheme is mandatory. Examples:ORCID[20], ISNI[21]

[19] http://www.loc.gov/catdir/cpso/roman.html

[20] http://orcid.org/ When entering an ORCID, follow these style guidelines: http://support.orcid.org/knowledgebase/articles/116780-structure-of-the-orcid-identifier

[21] http://www.isni.org/

ID	DataCite-Property	Occ	Definition	Allowed values, examples, other constraints
7.5.2	schemeURI	0-1	The URI of the name identifier scheme.	Examples: http://www.isni.org http://orcid.org http://www.crossref.org/fundref/
7.6	affiliation	0-n	The organizational or institutional affiliation of the contributor.	Free text.
8	Date	0-n	Different dates relevant to the work.	YYYY,YYYY-MM-DD, YYYY-MM-DDThh:mm:ssTZD or any other format or level of granularity described in W3CDTF.[22] Use RKMS-ISO8601[23] standard for depicting date ranges. Example: 2004-03-02/2005-06-02
8.1	dateType	1	The type of date.	If Date is used, dateType is mandatory. *Controlled List Values:* Accepted Available Copyrighted Collected Created Issued Submitted Updated Valid Other See Appendix for definitions and recommendations.

[22] http://www.w3.org/TR/NOTE-datetime

[23] The standard is documented here: http://www.ukoln.ac.uk/metadata/dcmi/collection-RKMS-ISO8601/

ID	DataCite-Property	Occ	Definition	Allowed values, examples, other constraints
8.2	dateInformation	0-1	Specific information about the date, if appropriate.	Free text May be used to provide more information about the publication, release or collection date details, for example.
9	Language	0-1	The primary language of the resource.	Allowed values are taken from IETF BCP 47, ISO 639-1 language codes. Examples: en, de, fr
11	AlternateIdentifier	0-n	An identifier or identifiers other than the primary Identifier applied to the resource being registered. This may be any alphanumeric string which is unique within its domain of issue. May be used for local identifiers. AlternateIdentifier should be used for another identifier of the same instance (same location, same file).	Free text. *** Example: E-GEOD-34814
11.1	alternateIdentifierType	1	The type of the AlternateIdentifier.	Free text. *** If AlternateIdentifier is used, alternateIdentifierType is mandatory. For the above example, the alternateIdentifierType would be “A local accession number”

ID	DataCite-Property	Occ	Definition	Allowed values, examples, other constraints
12	RelatedIdentifier	0-n	Identifiers of related resources. These must be globally unique identifiers.	Free text. *** Use this property to indicate subsets of properties, as appropriate.
12.1	relatedIdentifierType	1	The type of the RelatedIdentifier	If RelatedIdentifier is used, relatedIdentifierType is mandatory. *Controlled List Values:* ARK arXiv bibcode DOI EAN13 EISSN Handle IGSN ISBN ISSN ISTC LISSN LSID PMID PURL UPC URL URN See Appendix for full names and examples.

ID	DataCite-Property	Occ	Definition	Allowed values, examples, other constraints
12.2	relationType	1	Description of the relationship of the resource being registered (A) and the related resource (B).	If RelatedIdentifier is used, relationType is mandatory. *Controlled List Values:* IsCitedBy Cites IsSupplementTo IsSupplementedBy IsContinuedBy Continues IsDescribedBy Describes HasMetadata IsMetadataFor HasVersion IsVersionOf IsNewVersionOf IsPreviousVersionOf IsPartOf HasPart IsReferencedBy References IsDocumentedBy Documents IsCompiledBy Compiles IsVariantFormOf IsOriginalFormOf IsIdenticalTo IsReviewedBy Reviews IsDerivedFrom IsSourceOf IsRequiredBy Requires See Appendix for definitions, examples and usage notes.

ID	DataCite-Property	Occ	Definition	Allowed values, examples, other constraints
12.3	relatedMetadataScheme	0-1	The name of the scheme.	Use only with this relation pair: (HasMetadata/ IsMetadataFor) See Appendix for example.
12.4	schemeURI	0-1	The URI of the relatedMetadataScheme.	Use only with this relation pair: (HasMetadata/ IsMetadataFor) See Appendix for example
12.5	schemeType	0-1	The type of the relatedMetadataScheme, linked with the schemeURI.	Use only with this relation pair: (HasMetadata/ IsMetadataFor) Examples: XSD, DDT, Turtle
12.6	resourceTypeGeneral	0-1	The general type of a resource.	*Controlled List Values:* Audiovisual Collection DataPaper Dataset Event Image InteractiveResource Model PhysicalObject Service Software Sound

ID	DataCite-Property	Occ	Definition	Allowed values, examples, other constraints
				Text[24] Workflow Other See Appendix for definitions and examples.
13	Size	0-n	Size (e.g. bytes, pages, inches, etc.) or duration (extent), e.g. hours, minutes, days, etc., of a resource.	Free text. *** Examples: "15 pages", "6 MB", “45 minutes”
14	Format	0-n	Technical format of the resource.	Free text. *** Use file extension or MIME type where possible, e.g., PDF, XML, MPG or application/pdf, text/xml, video/mpeg.
15	Version	0-1	The version number of the resource.	Suggested practice: track major_version.minor_version. Register a new identifier for a major version change. Individual stewards need to determine which are major vs. minor versions[25]. Software engineering practice follows this approach of tracking changes and giving new version numbers.

[24]Combine “Text” with free-text or terms from the CASRAI Publications resource type list found here: http://dictionary.casrai.org/Output_Types

[25] Based on the work of the Earth Science Information Partners (ESIP). For more guidance, see: http://wiki.esipfed.org/index.php/Interagency_Data_Stewardship/Citations/provider_guidelines#Note_on_Versioning_and_Locators

ID	DataCite-Property	Occ	Definition	Allowed values, examples, other constraints
				May be used in conjunction with properties 11 and 12 (AlternateIdentifier and RelatedIdentifier) to indicate various information updates. May be used in conjunction with property 17 (Description) to indicate the nature and file/record range of version.
16	Rights	0-n	Any rights information for this resource. The property may be repeated to record complex rights characteristics.	Free text. *** Provide a rights management statement for the resource or reference a service providing such information. Include embargo information if applicable. Use the complete title of a license and include version information if applicable. May be used for software licenses. Examples: Creative Commons Attribution 3.0 Germany License Apache License, Version 2.0[26]

[26] http://www.apache.org/licenses/

ID	DataCite-Property	Occ	Definition	Allowed values, examples, other constraints
16.1	rightsURI	0-1	The URI of the license.	Example: http://creativecommons.org/licenses/by/3.0/de/deed.en
17	Description	0-n	All additional information that does not fit in any of the other categories. May be used for technical information.	Free text. *** It is a best practice to supply a description.
17.1	descriptionType	1	The type of the Description.	If Description is used, descriptionType is mandatory. *Controlled List Values:* Abstract Methods SeriesInformation TableOfContents TechnicalInfo Other See Appendix for definitions.
18	GeoLocation	0-n	Spatial region or named place where the data was gathered or about which the data is focused.	Repeat this property to indicate several different locations.
18.1	geoLocationPoint	0-1	A point location in space.	A point contains a single longitude-latitude pair.

ID	DataCite-Property	Occ	Definition	Allowed values, examples, other constraints
18.1.1	pointLongitude	1	Longitudinal dimension of point.	If geolocationPoint[27] is used, pointLongitude is mandatory. Longitude of the geographic point expressed in decimal degrees (positive east). Example: -67.302 Domain: -180 <= pointLongitude <= 180
18.1.2	pointLatitude	1	Latitudinal dimension of point.	If geolocationPoint[27] is used, pointLatitude is mandatory. Latitude of the geographic point expressed in decimal degrees (positive north) Example: 31.233 Domain: -90<= pointLatitude <= 90
18.2	geoLocationBox	0-1	The spatial limits of a box.	A box is defined by two geographic points. Left low corner and right upper corner. Each point is defined by its longitude and latitude.
18.2.1	westBoundLongitude	1	Western longitudinal dimension of box.	If geolocationBox[27] is used westBoundLongitude is mandatory. Longitude of the geographic point expressed in decimal degrees (positive east). Domain: -180.00 ≤ westBoundLongitude ≤ 180.00

[27] Use WGS 84 (World Geodetic System) coordinates. Use only decimal numbers for coordinates. Longitudes are -180 to 180 (0 is Greenwich, negative numbers are west, positive numbers are east), Latitudes are -90 to 90 (0 is the equator; negative numbers are south, positive numbers north).

ID	DataCite-Property	Occ	Definition	Allowed values, examples, other constraints
18.2.2	eastBoundLongitude	1	Eastern longitudinal dimension of box.	If geolocationBox[27] is used eastBoundLongitude is mandatory. Longitude of the geographic point expressed in decimal degrees (positive east) Domain: -180.00 ≤ eastBoundLongitude ≤ 180.00
18.2.3	southBoundLatitude	1	Southern latitudinal dimension of box.	If geolocationBox[27] is used southBoundLatitude is mandatory. Latitude of the geographic point expressed in decimal degrees (positive north). Domain: -90.00 ≤ southBoundingLatitude ≤ 90.00
18.2.4	northBoundLatitude	1	Northern latitudinal dimension of box.	If geolocationBox[27] is used northBoundLatitude is mandatory. Latitude of the geographic point expressed in decimal degrees (positive north). Domain: -90.00 ≤ northBoundingLatitude ≤ 90.00
18.3	geoLocationPlace	0-1	Description of a geographic location	Free text. Use to describe a geographic location.
18.4	geoLocationPolygon	0-n	A drawn polygon area, defined by a set of points and lines connecting the points in a closed chain.	A polygon is delimited by geographic points. Each point is defined by a longitude-latitude pair. The last point should be the same as the first point.

ID	DataCite-Property	Occ	Definition	Allowed values, examples, other constraints
18.4.1	polygonPoint	4-n	A point location in a polygon.	If geoLocationPolygon[27] is used, polygonPoint must be used as well. There must be at least 4 non-aligned points to make a closed curve, with the last point described the same as the first point.
18.4.1.1	pointLongitude	1	Longitudinal dimension of point.	If polygonPoint is used pointLongitude is mandatory. Longitude of the geographic point expressed in decimal degrees (positive east). Domain: -180 <= pointLongitude <= 180
18.4.1.2	pointLatitude	1	Latitudinal dimension of point.	If polygonPoint is used pointLatitude is mandatory. Latitude of the geographic point expressed in decimal degrees (positive north). Domain: -90<= pointLatitude <= 90
18.4.2	inPolygonPoint[28]	0-1	For any bound area that is larger than half the earth, define a (random) point inside.	inPolygonPoint is only necessary to indicate the "inside" of the polygon if the polygon is larger than half the earth. Otherwise the smallest of the two areas bounded by the polygon will be used.
18.4.2.1	pointLongitude	1	Longitudinal dimension of point.	If inPolygonPoint[28] is used pointLongitude is mandatory. Longitude of the geographic point expressed in decimal degrees (positive east).

[28] A polygon that crosses the anti-meridian (i.e. the 180th meridian) can be represented by cutting it into two polygons such that neither crosses the anti-meridian.

ID	DataCite-Property	Occ	Definition	Allowed values, examples, other constraints
18.4.2.2	pointLatitude	1	Latitudinal dimension of point.	If inPolygonPoint is used, pointLatitude is mandatory. Latitude of the geographic point expressed in decimal degrees (positive north).
19	FundingReference	0-n	Information about financial support (funding) for the resource being registered.	It is a best practice to supply funding information when financial support has been received.
19.1	funderName	1	Name of the funding provider.	Example: Gordon and Betty Moore Foundation
19.2	funderIdentifier	0-1	Uniquely identifies a funding entity, according to various types.	Example: https://doi.org/10.13039/100000936
19.2.1	funderIdentifierType	0-1	The type of the funderIdentifier.	*Controlled List Values:* ISNI GRID Crossref Funder[29] Other
19.3	awardNumber	0-1	The code assigned by the funder to a sponsored award (grant).	Example: GBMF3859.01
19.3.1	awardURI	0-1	The URI leading to a page provided by the funder for more information about the award (grant).	Example: https://www.moore.org/grants/list/GBMF3859.01
19.4	awardTitle	0-1	The human readable title or name of the award (grant).	Example: Socioenvironmental Monitoring of the Amazon Basin and Xingu

[29] The FundRef service is now called "Open Funder Registry" (http://fundref.org/fundingdata/registry.html) and Crossref Funder ID is the new name for a Fundref identifier.

XML Examples

Examples for various resource types and special cases can be found at http://schema.datacite.org/meta/kernel-4.1/index.html.

XML Schema

The XML Schema is available here:

http://schema.datacite.org/meta/kernel-4.1/metadata.xsd

Citation:

> DataCite Metadata Working Group; (2017): DataCite Metadata Schema for the Publication and Citation of Research Data v4.0; DataCite e.V.. https://doi.org/10.5438/0015

Note that the schema and this documentation will always have the same version number.

Each subsequent version of the schema will be at this same location using an address composed in the same manner, that is: http://schema.datacite.org/meta/kernel-versionnumber/metadata.xsd.

Earlier versions will continue to be available at their previous locations for backward compatibility.

Other DataCite Services

For information about other DataCite services that pertain to DataCite metadata records, including the Metadata Store, Metadata Search and Content Negotiation, please see DataCite.

Appendices

Appendix 1: Controlled List Definitions

In Appendix 1, as in Sections 2.1 and 2.3 above, controlled list values that enhance the prospect that the resource's metadata will be found, cited and linked are indicated by shading.

`contributorType`

Table 5: Description of contributorType

Option	*Description*	*Usage Notes*
ContactPerson	Person with knowledge of how to access, troubleshoot, or otherwise field issues related to the resource	May also be "Point of Contact" in organisation that controls access to the resource, if that organisation is different from Publisher, Distributor, Data Manager
DataCollector	Person/institution responsible for finding, gathering/collecting data under the guidelines of the author(s) or Principal Investigator (PI)	May also use when crediting survey conductors, interviewers, event or condition observers, person responsible for monitoring key instrument data.

Option	*Description*	*Usage Notes*
DataCurator	Person tasked with reviewing, enhancing, cleaning, or standardizing metadata and the associated data submitted for storage, use, and maintenance within a data centre or repository	While the "DataManager" is concerned with digital maintenance, the DataCurator's role encompasses quality assurance focused on content and metadata. This includes checking whether the submitted dataset is complete, with all files and components as described by submitter, whether the metadata is standardized to appropriate systems and schema, whether specialized metadata is needed to add value and ensure access across disciplines, and determining how the metadata might map to search engines, database products, and automated feeds.
DataManager	Person (or organisation with a staff of data managers, such as a data centre) responsible for maintaining the finished resource.	The work done by this person or organisation ensures that the resource is periodically "refreshed" in terms of software/hardware support, is kept available or is protected from unauthorized access, is stored in accordance with industry standards, and is handled in accordance with the records management requirements applicable to it.
Distributor	Institution tasked with responsibility to generate/disseminate copies of the resource in either electronic or print form.	Works stored in more than one archive/repository may credit each as a distributor.

Option	*Description*	*Usage Notes*
Editor	A person who oversees the details related to the publication format of the resource.	Note: if the Editor is to be credited in place of multiple creators, the Editor's name may be supplied as Creator, with "(Ed.)" appended to the name.
HostingInstitution	Typically, the organisation allowing the resource to be available on the internet through the provision of its hardware/software/operating support.	May also be used for an organisation that stores the data offline. Often a data centre (if that data centre is not the "publisher" of the resource.)
Producer	Typically a person or organisation responsible for the artistry and form of a media product.	In the data industry, this may be a company "producing" DVDs that package data for future dissemination by a distributor.
ProjectLeader	Person officially designated as head of project team or sub-project team instrumental in the work necessary to development of the resource.	The Project Leader is not "removed" from the work that resulted in the resource; he or she remains intimately involved throughout the life of the particular project team.
ProjectManager	Person officially designated as manager of a project. Project may consist of one or many project teams and sub-teams.	The manager of a project normally has more administrative responsibility than actual work involvement.
ProjectMember	Person on the membership list of a designated project/project team.	This vocabulary may or may not indicate the quality, quantity, or substance of the person's involvement.

Option	*Description*	*Usage Notes*
RegistrationAgency	Institution/organisation officially appointed by a Registration Authority to handle specific tasks within a defined area of responsibility.	DataCite is a Registration Agency for the International DOI Foundation (IDF). One of DataCite's tasks is to assign DOI prefixes to the allocating agents who then assign the full, specific character string to data clients, provide metadata back to the DataCite registry, etc.
RegistrationAuthority	A standards-setting body from which Registration Agencies obtain official recognition and guidance.	The IDF serves as the Registration Authority for the International Standards Organisation (ISO) in the area/domain of Digital Object Identifiers.
RelatedPerson	A person without a specifically defined role in the development of the resource, but who is someone the author wishes to recognize.	This person could be an author's intellectual mentor, a person providing intellectual leadership in the discipline or subject domain, etc.
Researcher	A person involved in analyzing data or the results of an experiment or formal study. May indicate an intern or assistant to one of the authors who helped with research but who was not so "key" as to be listed as an author.	Should be a person, not an institution. Note that a person involved in the gathering of data would fall under the contributorType "DataCollector." The researcher may find additional data online and correlate it to the data collected for the experiment or study, for example.
ResearchGroup	Typically refers to a group of individuals with a lab, department, or division; the group has a particular, defined focus of activity.	May operate at a narrower level of scope; may or may not hold less administrative responsibility than a project team.

Option	*Description*	*Usage Notes*
RightsHolder	Person or institution owning or managing property rights, including intellectual property rights over the resource.	
Sponsor	Person or organisation that issued a contract or under the auspices of which a work has been written, printed, published, developed, etc.	Includes organisations that provide in-kind support, through donation, provision of people or a facility or instrumentation necessary for the development of the resource, etc.
Supervisor	Designated administrator over one or more groups/teams working to produce a resource or over one or more steps of a development process.	
WorkPackageLeader	A Work Package is a recognized data product, not all of which is included in publication. The package, instead, may include notes, discarded documents, etc. The Work Package Leader is responsible for ensuring the comprehensive contents, versioning, and availability of the Work Package during the development of the resource.	
Other	Any person or institution making a significant contribution to the development and/or maintenance of the resource, but whose contribution does not “fit” other controlled vocabulary for contributorType.	Could be a photographer, artist, or writer whose contribution helped to publicize the resource (as opposed to creating it), a reviewer of the resource, someone providing administrative services to the author (such as depositing updates into an online repository, analysing usage, etc.), or one of many other roles.

dateType

NOTE: To indicate a date range, follow the RKMS-ISO8601 standard for depicting date ranges.

For example:

<date dateType="created">2012-03-01/2012-03-05</date>

Table 6: Description of dateType

Option	*Description*	*Usage Notes*
Accepted	The date that the publisher accepted the resource into their system.	To indicate the start of an embargo period, use Submitted or Accepted, as appropriate.
Available	The date the resource is made publicly available. May be a range.	To indicate the end of an embargo period, use Available.
Copyrighted	The specific, documented date at which the resource receives a copyrighted status, if applicable.	
Collected	The date or date range in which the resource content was collected.	To indicate precise or particular timeframes in which research was conducted.
Created	The date the resource itself was put together; this could be a date range or a single date for a final component, e.g., the finalised file with all of the data.	Recommended for discovery.
Issued	The date that the resource is published or distributed e.g. to a data centre	
Submitted	The date the creator submits the resource to the publisher. This could be different from Accepted if the publisher then applies a selection process.	Recommended for discovery. To indicate the start of an embargo period, use Submitted or Accepted, as appropriate.

Option	*Description*	*Usage Notes*
Updated	The date of the last update to the resource, when the resource is being added to. May be a range.	
Valid	The date or date range during which the dataset or resource is accurate.	

resourceTypeGeneral

Table 7: Description of resourceTypeGeneral

Option	*Description*[30]	*Examples and Usage Notes*	*Suggested Dublin Core Mapping*
Audiovisual	A series of visual representations imparting an impression of motion when shown in succession. May or may not include sound.	May be used for films, video, etc, Ex: https://data.datacite.org/application/vnd.datacite.datacite+xml/10.17608/K6.AUCKLAND.4620790.V1	MovingImage
Collection	An aggregation of resources, which may encompass collections of one resourceType as well as those of mixed types. A collection is described as a group; its parts may also be separately described.	A collection of samples, or various files making up a report. Ex: https://data.datacite.org/application/vnd.datacite.datacite+xml/10.5284/1001038	Collection
DataPaper	A factual and objective publication with a focused intent to identify and describe specific data, sets of data, or data collections to facilitate discoverability.	A data paper describes data provenance and methodologies used in the gathering, processing, organizing, and representing the data. Ex: https://data.datacite.org/application/vnd.datacite.datacite+xml/10.15470/5a5kni	Text
Dataset	Data encoded in a defined structure.	Data file or files. Ex: https://data.datacite.org/application/vnd.datacite.datacite+xml/10.1594/PANGAEA.804876	Dataset

[30]Where there is direct correspondence with the Dublin Core Metadata, DataCite definitions have borrowed liberally from the DCMI definitions. See: http://dublincore.org/documents/dcmi-terms/index.shtml

Option	*Description*[30]	*Examples and Usage Notes*	*Suggested Dublin Core Mapping*
Event	A non-persistent, time-based occurrence.	Descriptive information and/or content that is the basis for discovery of the purpose, location, duration, and responsible agents associated with an event such as a webcast or convention. Ex: https://data.datacite.org/application/vnd.datacite.datacite+xml/10.7269/P3RN35SZ	Event
Image	A visual representation other than text.	Digitised or born digital images, drawings or photographs. Ex: https://data.datacite.org/application/vnd.datacite.datacite+xml/10.6083/M4QN65C5	Image, StillImage
InteractiveResource	A resource requiring interaction from the user to be understood, executed, or experienced	Training modules, files that require use of a viewer (e.g., Flash), or query/response portals. Ex: https://data.datacite.org/application/vnd.datacite.datacite+xml/10.7269/P3TB14TR	InteractiveResource
Model	An abstract, conceptual, graphical, mathematical or visualization model that represents empirical objects, phenomena, or physical processes.	Modelled descriptions of, for example, different aspects of languages or a molecular biology reaction chain. Ex: https://data.datacite.org/application/vnd.datacite.datacite+xml/10.5285/4D866CD2-C907-4CE2-B070-084CA9779DC2	N/A

Option	*Description*[30]	*Examples and Usage Notes*	*Suggested Dublin Core Mapping*
PhysicalObject	An inanimate, three-dimensional object or substance.	Artifacts, specimens. Ex: https://data.datacite.org/application/vnd.datacite.datacite+xml/10.7299/X78052RB	PhysicalObject
Service	An organized system of apparatus, appliances, staff, etc., for supplying some function(s) required by end users.	Data management service, or long-term preservation service. Ex.: https://data.datacite.org/application/vnd.datacite.datacite+xml/10.21938/3I01ISNUCODNH1ZJBCVUWA	Service
Software	A computer program in source code (text) or compiled form. Use this type for all software components supporting scholarly research.	Software supporting scholarly research. Ex: https://data.datacite.org/application/vnd.datacite.datacite+xml/10.4225/03/5954F738EE5AA	Software
Sound	A resource primarily intended to be heard.	Audio recording. Ex: https://data.datacite.org/application/vnd.datacite.datacite+xml/10.7282/T3J67F05	Sound
Text	A resource consisting primarily of words for reading.	Grey literature, lab notes, accompanying materials. Ex: https://data.datacite.org/application/vnd.datacite.datacite+xml/10.5682/9786065914018	Text

Option	*Description*[30]	*Examples and Usage Notes*	*Suggested Dublin Core Mapping*
Workflow	A structured series of steps which can be executed to produce a final outcome, allowing users a means to specify and enact their work in a more reproducible manner.	Computational workflows involving sequential operations made on data by wrapped software and may be specified in a format belonging to a workflow management system, such as Taverna (http://www.taverna.org.uk/). More.[31]	N/A
Other	If selected, supply a value for ResourceType.		

[31] An education module on workflows prepared by DataONE is available at http://www.dataone.org/sites/all/documents/L10_AnalysisWorkflows.pptx

relatedIdentifierType

Table 8: Description of relatedIdentifierType

Option	*Full Name*	*Example*
ARK	Archival Resource Key; URL designed to support long-term access to information objects. In general, ARK syntax is of the form (brackets indicate [optional] elements: [http://*NMA/*]ark:*/NAAN/Name [Qualifier*]	<relatedIdentifier relatedIdentifierType="ARK" relationType="IsCitedBy">ark:/13030/tqb3kh97gh8w </relatedIdentifier>
arXiv	arXiv identifier; arXiv.org is a repository of preprints of scientific papers in the fields of mathematics, physics, astronomy, computer science, quantitative biology, statistics, and quantitative finance.	<relatedIdentifier relatedIdentifierType=”arXiv” relationType=”IsCitedBy”>arXiv:0706.0001 </relatedIdentifier>
bibcode	Astrophysics Data System bibliographic codes; a standardized 19 character identifier according to the syntax yyyyjjjjjvvvvmppppa. See http://info-uri.info/registry/OAIHandler?verb=GetRecord&metadataPrefix=reg&identifier=info:bibcode/	<relatedIdentifier relatedIdentifierType="bibcode" relationType="IsCitedBy"> 2014Wthr…69…72C </relatedIdentifier> Note: bibcodes can be resolved via http://adsabs.harvard.edu/abs/bibcode
DOI	Digital Object Identifier; a character string used to uniquely identify an object. A DOI name is divided into two parts, a prefix and a suffix, separated by a slash.	<relatedIdentifier relatedIdentifierType="DOI" relationType=”IsSupplementTo”> 10.1016/j.epsl.2011.11.037 </relatedIdentifier>

Option	*Full Name*	*Example*
EAN13	European Article Number, now renamed International Article Number, but retaining the original acronym, is a 13-digit barcoding standard which is a superset of the original 12-digit Universal Product Code (UPC) system.	<relatedIdentifier relatedIdentifierType="EAN13" relationType="Cites">9783468111242 </relatedIdentifier>
EISSN	Electronic International Standard Serial Number; ISSN used to identify periodicals in electronic form (eISSN or e-ISSN).	<relatedIdentifier relatedIdentifierType="eISSN" relationType="Cites">1562-6865 </relatedIdenfifier>
Handle	A handle is an abstract reference to a resource.	<relatedIdentifier relatedIdentifierType="Handle" relationType="References">10013/epic.10033 </relatedIdentifier>
IGSN	International Geo Sample Number; a 9-digit alphanumeric code that uniquely identifies samples from our natural environment and related sampling features.	<relatedIdentifier relatedIdentifierType="IGSN" relationType="References">IECUR0097 </relatedIdentifier>
ISBN	International Standard Book Number; a unique numeric book identifier. There are 2 formats: a 10-digit ISBN format and a 13-digit ISBN.	<relatedIdentifier><relatedIdentifier relatedIdentifierType="ISBN" relationType="IsPartOf">978-3-905673-82-1 </relatedIdentifier>
ISSN	International Standard Serial Number; a unique 8-digit number used to identify a print or electronic periodical publication.	<relatedIdentifier relatedIdentifierType="ISSN" relationType="IsPartOf">0077-5606 </relatedIdentifier>

Option	*Full Name*	*Example*
ISTC	International Standard Text Code; a unique "number" assigned to a textual work. An ISTC consists of 16 numbers and/or letters.	<relatedIdentifier relatedIdentifierType="ISTC" relationType="Cites">0A9 2002 12B4A105 7 </relatedIdentifier>
LISSN	The linking ISSN or ISSN-L enables collocation or linking among different media versions of a continuing resource.	<relatedIdentifier relatedIdentifierType="LISSN" relationType="Cites">1188-1534</relatedIdentifier>
LSID	Life Science Identifiers; a unique identifier for data in the Life Science domain. Format: urn:lsid:authority:namespace:identifier:revision	<relatedIdentifier relatedIdentifierType="LSID" relationType="Cites"> urn:lsid:ubio.org:namebank:11815</relatedIdentifier>
PMID	PubMed identifier; a unique number assigned to each PubMed record.	<relatedIdentifier relatedIdentifierType="PMID" relationType="IsReferencedBy">12082125</relatedIdentifier>
PURL	Persistent Uniform Resource Locator. A PURL has three parts: (1) a *protocol*, (2) a *resolver address*, and (3) a *name*.	<relatedIdentifier relatedIdentifierType="PURL" relationType="Cites"> http://purl.oclc.org/foo/bar</relatedIdentifier>
UPC	Universal Product Code is a barcode symbology used for tracking trade items in stores. Its most common form, the UPC-A, consists of 12 numerical digits.	<relatedIdentifier relatedIdentifierType="UPC" relationType="Cites"> 123456789999</relatedIdentifier>

Option	*Full Name*	*Example*
URL	Uniform Resource Locator, also known as web address, is a specific character string that constitutes a reference to a resource. The syntax is: schema://domain:port/path?query_string#fragment_id	<relatedIdentifier relatedIdentifierType="URL" relationType="IsCitedBy">http://www.heatflow.und.edu/index2.html</relatedIdentifier>
URN	Uniform Resource Name; is a unique and persistent identifier of an electronic document. The syntax is: urn:< NID>:<NSS> The leading urn : sequence is case-insensitive, <NID> is the namespace identifier, <NSS> is the namespace-specific string.	<relatedIdentifier relatedIdentifierType="URN" relationType="IsSupplementTo">urn:nbn:de:101:1-201102033592</relatedIdentifier>

relationType

Description of the relationship of the resource being registered (A) and the related resource (B).

Table 9: Description of relationType

Option	*Definition*	*Example and Usage Notes*
IsCitedBy	indicates that B includes A in a citation	Recommended for discovery. <relatedIdentifier relatedIdentifierType="DOI"relationType="IsCitedBy">10.4232/10.ASEAS-5.2-1</relatedIdentifier>
Cites	indicates that A includes B in a citation	Recommended for discovery. <relatedIdentifier relatedIdentifierType="ISBN" relationType="Cites“>0761964312</relatedIdentifier>
IsSupplementTo	indicates that A is a supplement to B	Recommended for discovery. <relatedIdentifier relatedIdentifierType="URN" relationType="IsSupplementTo">urn:nbn:de:0168-ssoar-13172</relatedIdentifier>
IsSupplementedBy	indicates that B is a supplement to A	Recommended for discovery. <relatedIdentifier relatedIdentifierType="PMID" relationType="IsSupplementedBy">16911322/</relatedIdentifier>
IsContinuedBy	indicates A is continued by the work B	<relatedIdentifier relatedIdentifierType="URN" relationType="IsContinuedBy">urn:nbn:de:bsz:21-opus-4967</relatedIdentifier>
Continues	indicates A is a continuation of the work B	<relatedIdentifier relatedIdentifierType="URN" relationType="Continues">urn:nbn:de:bsz:21-opus-4966</relatedIdentifier>

Option	*Definition*	*Example and Usage Notes*
Describes	indicates A describes B	<relatedIdentifier relatedIdentifierType="DOI" relationType="Describes">10.6084/m9.figshare.c.3288407</relatedIdentifier>
IsDescribedBy	indicates A is described by B	<relatedIdentifier relatedIdentifierType="DOI" relationType="IsDescribedBy">10.1038/sdata.2016.123</relatedIdentifier>
HasMetadata	indicates resource A has additional metadata B	<relatedIdentifier relatedIdentifierType="DOI" relationType="HasMetadata" relatedMetadataSchema="DDI-L" schemeURI="http://www.ddialliance.org/Specification/DDI-Lifecycle/3.1/XMLSchema/instance.xsd">10.1234/567890</relatedIdentifier>
IsMetadataFor	indicates additional metadata A for a resource B	<relatedIdentifier relatedIdentifierType="DOI" relationType="IsMetadataFor "relatedMetadataSchema="DDI-L" schemeURI="http://www.ddialliance.org/Specification/DDI-Lifecycle/3.1/XMLSchema/instance.xsd">10.1234/567891</relatedIdentifier>
HasVersion	indicates A has a version (B)	The registered resource such as a software package or code repository has a versioned instance (indicates A has the instance B) e.g. it may be used to relate an un-versioned code repository to one of its specific software versions. <relatedIdentifier relatedIdentifierType="DOI" relationType="HasVersion">10.5281/ZENODO.832053 </relatedIdentifier>
IsVersionOf	indicates A is a version of B	The registered resource is an instance of a target resource (indicates that A is an instance of B) e.g. it may be used to relate a specific version of a software package to its software code repository. <relatedIdentifier relatedIdentifierType="DOI" relationType="IsVersionOf">10.5281/ZENODO.832054 </relatedIdentifier>

Option	*Definition*	*Example and Usage Notes*
IsNewVersionOf	indicates A is a new edition of B, where the new edition has been modified or updated	<relatedIdentifier relatedIdentifierType="DOI" relationType="IsNewVersionOf">10.5438/0005 </relatedIdentifier>
IsPreviousVersion Of	indicates A is a previous edition of B	<relatedIdentifier relatedIdentifierType="DOI" relationType="IsPreviousVersionOf">10.5438/0007 </relatedIdentifier>
IsPartOf	indicates A is a portion of B; may be used for elements of a series	Primarily this relation is applied to container-contained type relationships. Note: May be used for individual software modules; note that code repository-to-version relationships should be modeled using IsVersionOf and HasVersion Recommended for discovery. <relatedIdentifier relatedIdentifierType="DOI" relationType="IsPartOf">10.5281/zenodo.754312 </relatedIdentifier>
HasPart	indicates A includes the part B	Primarily this relation is applied to container-contained type relationships. Note: May be used for individual software modules; note that code repository-to-version relationships should be modeled using IsVersionOf and HasVersion Recommended for discovery. <relatedIdentifier relatedIdentifierType="URL" relationType="HasPart">https://zenodo.org/record/16564/files/dune-stuff-LSSC_15.zip</relatedIdentifier>
IsReferencedBy	indicates A is used as a source of information by B	<relatedIdentifier relatedIdentifierType="URL" relationType="IsReferencedBy">http://www.testpubl.de </relatedIdentifier>

Option	*Definition*	*Example and Usage Notes*
References	indicates B is used as a source of information for A	<relatedIdentifier relatedIdentifierType="URN" relationType="References">urn:nbn:de:bsz:21-opus-963</relatedIdentifier>
IsDocumentedBy	indicates B is documentation about/ explaining A; e.g. points to software documentation	<relatedIdentifier relatedIdentifierType="URL" relationType="IsDocumentedBy">http://tobias-lib.uni-tuebingen.de/volltexte/2000/96/ </relatedIdentifier>
Documents	indicates A is documentation about/B; e.g. points to software documentation	<relatedIdentifier relatedIdentifierType="DOI" relationType="Documents">10.1234/7836 </relatedIdentifier>
IsCompiledBy	indicates B is used to compile or create A	<relatedIdentifier relatedIdentifierType="URL" relationType="isCompiledBy">http://d-nb.info/gnd/4513749-3 </relatedIdentifier>
Compiles	indicates B is the result of a compile or creation event using A	<relatedIdentifier relatedIdentifierType="URN" relationType="Compiles">urn:nbn:de:bsz:21-opus-963 </relatedIdentifier>
IsVariantFormOf	indicates A is a variant or different form of B	<relatedIdentifier relatedIdentifierType="DOI" relationType="IsVariantFormOf">10.1234/8675 </relatedIdentifier> Use for a different form of one thing. May be used for different software operating systems or compiler formats, for example.

Option	*Definition*	*Example and Usage Notes*
IsOriginalFormOf	indicates A is the original form of B	<relatedIdentifier relatedIdentifierType="DOI" relationType="IsOriginalFormOf">10.1234/9035 </relatedIdentifier> May be used for different software operating systems or compiler formats, for example.
IsIdenticalTo	indicates that A is identical to B, for use when there is a need to register two separate instances of the same resource	<relatedIdentifier relatedIdentifierType="URL" relationType="IsIdenticalTo">http://oac.cdlib.org/findaid/ark:/13030/c8r78fzq </relatedIdentifier> IsIdenticalTo should be used for a resource that is the same as the registered resource but is saved on another location, maybe another institution.
IsReviewedBy	indicates that A is reviewed by B	<relatedIdentifier relatedIdentifierType="DOI" relationType="IsReviewedBy">10.5256/F1000RESEARCH.4288.R4745 </relatedIdentifier>
Reviews	indicates that A is a review of B	<relatedIdentifier relatedIdentifierType="DOI" relationType="Reviews">10.12688/f1000research.4001.1 </relatedIdentifier>
IsDerivedFrom	indicates B is a source upon which A is based	<relatedIdentifier relatedIdentifierType="DOI" relationType="IsDerivedFrom">10.6078/M7DZ067C </relatedIdentifier> IsDerivedFrom should be used for a resource that is a derivative of an original resource. In this example, the dataset is derived from a larger dataset and data values have been manipulated from their original state.

Option	*Definition*	*Example and Usage Notes*
IsSourceOf	indicates A is a source upon which B is based	<relatedIdentifier relatedIdentifierType="URL" relationType="IsSourceOf"> http://opencontext.org/projects/81204AF8-127C-4686-E9B0-1202C3A47959 </relatedIdentifier> IsSourceOf is the original resource from which a derivative resource was created. In this example, this is the original dataset without value manipulation, and the source of the derived dataset.
IsRequiredBy	Indicates A is required by B	<relatedIdentifier relatedIdentifierType="DOI" relationType="IsRequiredBy">10.1234/8675 </relatedIdentifier> Note: May be used to indicate software dependencies.
Requires	Indicates A requires B	<relatedIdentifier relatedIdentifierType="DOI" relationType="Requires">10.1234/8675 </relatedIdentifier> Note: May be used to indicate software dependencies.

descriptionType

Table 10: Description of descriptionType

Option	*Definition*	*Usage Notes*
Abstract	A brief description of the resource and the context in which the resource was created.	Recommended for discovery. Use " " to indicate a line break for improved rendering of multiple paragraphs, but otherwise no html markup. Example: https://data.datacite.org/application/vnd.datacite.datacite+xml/10.1594/PANGAEA.771774
Methods	The methodology employed for the study or research.	Recommended for discovery. Example: https://data.datacite.org/application/vnd.datacite.datacite+xml/10.6078/D1K01X
SeriesInformation	Information about a repeating series, such as volume, issue, number.	For use with grey literature. If providing an ISSN, use property 12 (RelatedIdentifier), relatedIdentifierType=ISSN. For dataset series, use property 12 (RelatedIdentifier) and describe the relationships with isPartOf or HasPart. Example: https://data.datacite.org/application/vnd.datacite.datacite+xml/10.4229/23RDEUPVSEC2008-5CO.8.3
TableOfContents	A listing of the Table of Contents.	Use " " to indicate a line break for improved rendering of multiple paragraphs, but otherwise no html markup. Example: https://data.datacite.org/application/vnd.datacite.datacite+xml/10.5678/LCRS/FOR816.CIT.1031

Option	*Definition*	*Usage Notes*
TechnicalInfo	Detailed information that may be associated with design, implementation, operation, use, and/or maintenance of a process or system.	For software description, this may include the contents of a readme.txt, and necessary environmental information (hardware, operational software, applications/programs with version information, a human-readable synopsis of software purpose) that cannot be described using other properties (e.g. Language (software)). For other uses, this can include specific and detailed information as necessary and appropriate.
Other	Other description information that does not fit into an existing category.	Use for any other description type.

Appendix 2: Earlier Version Update Notes

Appendix 2 provides the update contents of earlier versions of the schema.

Version 4.0 Update

Version 4.0 of the schema includes these changes:

- Allowing more than one nameIdentifier per creator or contributor
- Addition of new optional subproperties for creatorName and contributorName
    - givenName
    - familyName
- Addition of new titleType “Other”

Addition of new subproperty for subjectScheme

    - subjectScheme
        - valueURI
- Changing resourceTypeGeneral from optional to mandatory
- Addition of a new relatedIdentifierType option “IGSN”
- Addition of a new descriptionType "TechnicalInfo"
- Addition of a new subproperty for GeoLocation “geoLocationPolygon”
- Changing the definition of the existing GeoLocation sub properties (geoLocationPoint, and geoLocationBox)
- Addition of a new property: FundingReference, with subproperties
    - funderName
    - funderIdentifier
        - funderIdentifierType
    - awardNumber
    - awardURI
    - awardTitle
- Deprecation of contributorType “funder” (as a result of adding the new property “FundingReference”)

Version 4.0 of the documentation includes these changes:

- Provision of a link to guidelines for how to write the ORCID ID (See properties 2.2.1 and 7.3.1 nameIdentifierScheme)
- Adjustment of the instructions for resourceTypeGeneral option “collection” (See Appendix 1, Table 7)

Note that, while the property resourceType has been relocated in the documentation to the mandatory property section, it retains its original numbering (10).

Version 3.1 Update

Version 3.1 of the schema includes these changes:

- New affiliation attribute for Creator and Contributor
- New relationType pairs
    - IsReviewedBy and Reviews
    - IsDerivedFrom and IsSourceOf
- New contributorType: DataCurator
- New relatedIdentifierTypes:
    - arXiv
    - bibcode

Version 3.1 of the documentation includes these changes:

- Documentation for the new affiliation attributes for Creator and Contributor
- Special notes about support for long lists of names (Creator and Contributor)
- Additional guidance for:
    - Recording Publication Year
    - Handling the digitised version of physical object
    - Handling missing mandatory property values, including standard values table
- Documentation for the new contributorType: DataCurator
- Documentation for the two new relatedIdentifierTypes:
    - arXiv
    - bibcode
- Documentation, including examples, for the new relationType pairs:
    - IsReviewedBy and Reviews
    - IsDerivedFrom and IsSourceOf
- Correction of link errors in 3.0 documentation

Version 3.0 Update

Version 3.0 of the DataCite Metadata Schema included these changes[32]:

- Correction of a problem with our way of depicting dates by
  - implementing RKMS-ISO8601[33] standard for depicting date ranges, so that a range is indicated as follows: 2004-03-02/2005-06-02
  - deleting `startDate` and `endDate` date types, and derogating these from earlier versions
- Addition of a new `GeoLocation` property, with the sub-properties `geoLocationPoint`, `geoLocationBox`, `geoLocationPlace` supporting a simple depiction of geospatial information, as well as a free text description.
- Addition of new values to controlled lists:
  - `contributorType`: ResearchGroup and Other
  - `dateType`: Collected
  - `resourceTypeGeneral`: Audiovisual, Workflow, and Other and derogation of Film
  - `relatedIdentifierType`: PMID
  - `relationType`: IsIdenticalTo (indicates that A is identical to B, for use when there is a need to register two separate instances of the same resource)
  - `relationType`: HasMetadata, (indicates resource A has additional metadata B and indicates), IsMetadataFor (indicates additional metadata A for resource B)
  - `descriptionType`: Methods
- Deletion of the derogated `resourceType`: film
- new sub-properties for `relationType`: `relatedMetadataSchema`, `schemeURI` and `schemaType`, to be used only for the new `relationType` pair of `HasMetadata`, `IsMetadataFor`
- Addition of `schemeURI` sub-property to the `nameIdentifierScheme` associated with `CreatorName`, `ContributorName` and `Subject`
- Addition of the `rightsURI` sub-property to `Rights`; `Rights` is now repeatable (within wrapper element `rightsList`).
- Implementation of the xml:lang attribute[34] that can be used on the properties `Title`, `Subject` and `Description`.
- Removal of two system-generated administrative metadata fields: `LastMetadataUpdate` and `MetadataVersionNumber` because both values are tracked in another way now.

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[32] Two additional schema code level changes are the allowance of keeping optional wrapper elements empty and the allowance of arbitrary ordering of elements (by removal of <xs:sequence>).

[33] The standard is documented here: http://www.ukoln.ac.uk/metadata/dcmi/collection-RKMS-ISO8601/

[34] Allowed values IETF BCP 47, ISO 639-1 language codes, e.g. en, de, fr

Version 3.0 of the DataCite Metadata Schema documentation included these changes:

- Updates to the introductory information
- Provision of greater detail, explanatory material and definitions for controlled lists
- Indication of recommended metadata, in addition to mandatory and optional
- Addition of more and more varied XML examples on the Metadata Schema website
- Removal from documentation of information about administrative metadata (which cannot be edited by contributors).

Version 2.2 Update

Version 2.2 of the DataCite Metadata Schema introduced several changes, as noted below:

- Addition of "URL" to list of allowed values for `relatedIdentifierType`
- Addition of the following values to list of allowed values for `contributorType`: Producer, Distributor, RelatedPerson, Supervisor, Sponsor, Funder, RightsHolder
- Addition of "SeriesInformation" to list of allowed values for `descriptionType`
- Addition of "Model" to list of allowed values for `resourceTypeGeneral`

Version 2.2 of the DataCite Metadata Schema documentation included these changes:

- Provision of more examples of xml for different types of resources
- Explanation of the `PublicationYear` property in consideration of the requirements of citation. A change to the definition of the Publisher property, which now reads, "The name of the entity that holds, archives, publishes, prints, distributes, releases, issues, or produces the resource. This property will be used to formulate the citation, so consider the prominence of the role."

Version 2.1 Update

Version 2.1 of the DataCite Metadata Schema introduced several changes, as noted below:

- Addition of a namespace (http://schema.datacite.org/namespace) to the schema in order to support OAI PMH compatibility
- Enforcement of content for mandatory properties
- New type for the `Date` property to conform with the specification that it handles both YYYY and YYYY-MM-DD values

Version 2.1 of the DataCite Metadata Schema documentation included these changes:

- Addition of a column to the Mandatory and Optional Properties tables providing an indicator of whether the property being described is an attribute or a child of the corresponding property that has preceded it
- Revision of the allowed values description for the attribute 12.2 `relationType`. These have been reviewed and rewritten for increased clarity. In several cases, corrections to the definitions occurred.

Appendix 3: Standard values for unknown information

Appendix 3 provides a set of standard values that may be used when mandatory property values are not available for various reasons.

Table 11: Standard values for unknown information

Code	***Definition***
(:unac)	temporarily inaccessible
(:unal)	unallowed, suppressed intentionally
(:unap)	not applicable, makes no sense
(:unas)	value unassigned (e.g., Untitled)
(:unav)	value unavailable, possibly unknown
(:unkn)	known to be unknown (e.g., Anonymous, Inconnue)
(:none)	never had a value, never will
(:null)	explicitly and meaningfully empty
(:tba)	to be assigned or announced later
(:etal)	too numerous to list (et alia)

Appendix 4: Version 4.1 Changes in support of software citation

Appendix 4 provides a quick reference guide for all the 4.1 version changes in support of software citation.

Documentation updates:

Property	***Change to the documentation***
Identifier	Add: "For software, a decision may need to be made about whether the ID is for a specific version of a piece of software (recommended by Force11 Software Citation Principles*), for a piece of software i.e. all versions or for the latest version."*
Title	Add:"May be the title of a dataset or the name of a piece of software."
Publisher	Add: "For software, use Publisher for Code Repository, following the data model. If there is an alternate entity that "holds, archives, publishes, prints, distributes, releases, issues, or produces" the code, use the contributorType "hostingInstitution" for the code repository**."**
Contributor	Add: "For software, if there is an alternate entity that "holds, archives, publishes, prints, distributes, releases, issues, or produces" the code, use the contributorType "hostingInstitution" for the code repository**."**
PublicationYear	Add: "In the case of resources such as software where there may be multiple releases in one year, other DataCite metadata or information such as the landing page should enable users to identify the newest one."

Property	***Change to the documentation***
resourceTypeGeneral	New definition for Service: "An organized system of apparatus, appliances, staff, etc., for supplying some function(s) required by end users." New example language for Service: "Data management service, or *long-term preservation service."* New definition for Software: "A computer program in source code (text) or compiled form*. Use this type for all software components supporting scholarly research."* New example language for Software: "Software supporting *scholarly* research."
relationType	Changes to Example and Usage Notes in the relationType Appendix: IsPartOf and HasPart: may be used for individual software modules; note that code repository-to-*version* relationships should be modeled using IsVersionOf and HasVersion IsDocumentedBy and Documents: e.g. points to software documentation IsVariantFormOf and IsOriginalFormOf: May be used for different software operating systems or compiler formats, for example.
Version	Add to Example: "Software engineering practice follows this approach of tracking changes and giving new version numbers."
Rights	Add: "May be used for software licenses."
Description	Change definition of TechnicalInfo: "For software description, this may include a readme.txt, and necessary environmental *information (hardware, operational software, applications/programs with version information, a human-readable synopsis of software purpose) that cannot be described using other properties (e.g. Language (software)).* For other uses, this can include specific and detailed information as necessary and appropriate."

Changes to the schema

- new relationType pair (HasVersion, IsVersionOf)
    - HasVersion The registered resource such as a software package or code repository has a versioned instance (indicates A has the instance B) e.g. it may be used to relate an un-versioned code repository to one of its specific software versions.
    - IsVersionOf The registered resource is an instance of a target resource (indicates that A is an instance of B) e.g. it may be used to relate a specific version of a software package to its software code repository.
- New relationType pair (IsRequiredBy, Requires)
    - The registered resource such as a software package (A) is required by an identified external resource (B). This may be used to indicate software dependencies.
    - The registered resource such as a software package (A) requires an identified external resource (B). This may be used to indicate software dependencies.

Appendix 5: FORCE11 Software Citation Principles[35] Mapping

FORCE11 requirements	*DataCite v 4.1*	*Comments*
Unique identifier – recommend a DOI	Identifier with identifierType 'DOI'	For software a decision may need to be made about whether the ID is for a specific version of a piece of software (recommended by Force11 Software Citation Principles), for a piece of software i.e. all versions or for the latest version.
Software name	Title	May be the title of a dataset or the name of a piece of software.
Author	Creator	May include those responsible for software creation.
Contributor	Contributor	For software, if there is an alternate entity that "holds, archives, publishes, prints, distributes, releases, issues, or produces the code, use the contributorType "HostingInstitution" for the code repository.
Contributor role	contributorType	See Definition in contributorType Appendix: Distributor: Includes distribution of software. See Example for HostingInstitution: Includes software or run code repositories.

[35] Smith AM, Katz DS, Niemeyer KE, FORCE11 Software Citation Working Group. (2016) Software citation principles. PeerJ Computer Science 2:e86 https://doi.org/10.7717/peerj-cs.86

FORCE11 requirements	*DataCite v 4.1*	*Comments*
Version number	Version	See Version example: Software engineering practice follows this approach of tracking changes and giving new version numbers.
Release date	PublicationYear	See definition: In the case of resources such as software where there may be multiple releases in one year, other DataCite metadata or information such as the landing page should enable users to identify the newest one.
Location/repository	Publisher or Contributor/contributorType 'HostingInstitution'	For software, use Publisher for Code Repository, following the data model. If there is an alternate entity that "holds, archives, publishes, prints, distributes, releases, issues, or produces" the code, use the contributorType "hostingInstitution" for the code repository."
Indexed citations (and links between software versions)	relationType +	RelationTypes of use for software.

FORCE11 requirements	*DataCite v 4.1*	*Comments*
	HasVersion, IsVersionOf	HasVersion - The registered resource such as a software package or code repository has a versioned instance (indicates A has the instance B) e.g. it may be used to relate an un-versioned code repository to one of its specific software versions. IsVersionOf - The registered resource is an instance of a target resource (indicates that A is an instance of B) e.g. it may be used to relate a specific version of a software package to its software code repository.
	IsNewVersionOf, IsPreviousVersionOf	IsNewVersionOf: can be used for “edition or software release etc.” IsPreviousVersionOf: can be used for “edition or software release etc.”
	IsDerivedFrom, IsSourceOf	IsDerivedFrom and IsSourceOf: Can be used to denote software that is a fork of other software or is the origin of a fork.
	IsPartOf,HasPart	IsPartOf and HasPart: may be used for individual software modules
	IsDocumentedBy, Documents	IsDocumentedBy and Documents: e.g. points to software documentation

FORCE11 requirements	*DataCite v 4.1*	*Comments*
	IsVariantFormOf, IsOriginalFormOf	IsVariantFormOf and IsOriginalFormOf: May be used for different software operating systems or compiler formats, for example. Indicates that A is a variant or different form or packaging of B.
	IsRequiredBy, Requires	IsRequiredBy: the registered resource A is called by or is required by software resource B. Requires: the registered resource A calls or requires software resource B.
Software licenses	Rights	See example: May be used for software licenses.
Description	Description Description with descriptionType 'TechnicalInfo' Description with descriptionType 'Abstra'	TechnicalInfo: for software description, this may include a readme.text, and necessary environmental information (hardware, operational software, applications/programs) that cannot be described using other properties such as 'Format/version' or 'Description/summary'
Keywords	Subject	Existing guidance applies: Subject, keyword, classification code, or key phrase describing the resource.