



GROUP REPORT

Context Information Management (CIM); Handling of data catalogues and data services with NGSI-LD

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Contents

Intellectual Property Rights	5
Foreword.....	5
Modal verbs terminology.....	5
Introduction	5
1 Scope	6
2 References	6
2.1 Normative references	6
2.2 Informative references.....	6
3 Definition of terms, symbols and abbreviations.....	6
3.1 Terms.....	6
3.2 Symbols.....	6
3.3 Abbreviations	6
4 DCAT-AP model for describing datasets and data services.....	7
4.0 Introduction	7
4.1 Prefixes and namespace.....	8
5 DCAT-AP concepts to NGSI-LD mapping.....	8
5.0 Foreword	8
5.1 DCAT-AP main classes.....	9
5.1.0 Foreword.....	9
5.1.1 Catalogue	9
5.1.2 Dataset	13
5.1.3 Dataset Series.....	18
5.1.4 Distribution	21
5.1.5 Data Service.....	26
5.1.6 Agent	29
5.1.7 Location	30
5.1.8 Catalogue Record.....	32
5.1.9 Catalogued Resource	34
5.1.10 Checksum	34
6 NGSI-LD handling of DCAT-AP Location entities.....	35
7 NGSI-LD handling of DCAT-AP based entities.....	36
7.0 Foreword	36
7.1 Creation of Data Services, Datasets and Dataset Series	36
7.1.0 Foreword.....	36
7.1.1 Data Services	38
7.1.2 Datasets.....	41
7.1.3 Dataset Series.....	44
7.2 Data Services creation upon Context Source registration	48
7.3 Handling temporal data	50
Annex A: Mapping examples	56
A.0 Foreword	56
A.1 Catalogue entity.....	56
A.2 Dataset entity.....	59
A.3 Distribution entity	63
A.4 Data Service entity	65
A.5 Dataset Series entity	67
A.6 Location entity.....	68

A.7	Catalogue Record entity	69
A.8	@context files for DCAT-AP NGSI-LD entities	70
Annex B:	DCAT-AP Entities JSON Schemas	74
B.0	Foreword	74
B.1	Catalogue entity JSON Schema	74
B.2	Dataset entity JSON Schema.....	82
B.3	Dataset Series entity JSON Schema	97
B.4	Distribution entity JSON Schema	102
B.5	Data Service entity JSON Schema	111
B.6	Agent entity JSON Schema.....	117
B.7	Location entity JSON Schema	119
B.8	Catalogue Record entity JSON Schema	120
B.9	Checksum entity JSON Schema.....	125
Annex C:	Change history	127
	History	128

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Foreword

This Group Report (GR) has been produced by ETSI Industry Specification Group (ISG) cross-cutting Context Information Management (CIM).

Modal verbs terminology

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Introduction

The DCAT Application Profile (DCAT-AP) is a specification based on World Wide Web Consortium's Data Catalog vocabulary (DCAT) for describing public sector and other open datasets in Europe. Its basic use case is to enable a cross-data portal search for datasets and make public sector data better searchable across borders and sectors. The present document proposes a mapping to enrich NGSI-LD datasets with metadata aligned with DCAT/DCAT-AP definitions.

1 Scope

The present document aims at recommending an approach to encode dataset and data services metadata within an NGSI-LD format using Data Catalog Vocabulary (DCAT) and its Application Profile (DCAT-AP) representation.

2 References

2.1 Normative references

Normative references are not applicable in the present document.

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the referenced document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long-term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] [W3C® Recommendation 22 August 2024](#): "Data Catalog Vocabulary (DCAT) - Version 3".

[i.2] [SEMIC community](#): "DCAT-AP 3.0", 14 June 2024.

NOTE: See also <https://joinup.ec.europa.eu/collection/semic-support-centre/solution/dcat-application-profile-data-portals-europe/release/300>.

[i.3] [ETSI GS CIM 009 \(V1.8.1\)](#): "Context Information Management (CIM); NGSI-LD API".

3 Definition of terms, symbols and abbreviations

3.1 Terms

Void.

3.2 Symbols

Void.

3.3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

API	Application Programming Interface
DCAT	Data CATalog vocabulary
DCAT-AP	DCAT - Application Profile
DOI	Digital Object Identifier
ELI	European Legislation Identifier
ETSI	European Telecommunications Standards Institute
EU	European Union

EZID	Identifiers made easy
HTTP	HyperText Transfer Protocol
IANA	Internet Assigned Numbers Authority
IRI	Internationalized Resource Identifier
ISG CIM	Industry Specification Group on cross-cutting Context Information Management
JSON	JavaScript Object Notation
LD	Linked Data
MAST	Mikulski Archive for Space Telescopes
NAL	Named Authority Lists
NGSI	Next Generation Service Interfaces
NGSI-LD	Next Generation Service Interface - Linked Data
ODRL	Open Digital Rights Language
OGC	Open Geospatial Consortium
PROV-O	The PROV Ontology
RDF	Resource Description Framework
TB	Technical Board
URI	Uniform Resource Identifier
URL	Uniform Resource Locator
W3ID	W3C [®] Permanent Identifier
WFS	Web Feature Service
XML	eXtensible Markup Language

4 DCAT-AP model for describing datasets and data services

4.0 Introduction

The exponential number of published datasets creates an ever-increasing and more complex data environment for a user to navigate. Data on its own, without contextual information or links to other similar sources, often proves difficult to analyse or interpret.

In Europe, a developing open government data ecosystem is employing various technologies and platforms to foster both data publication and data usability. A common metadata standard, the DCAT-AP specification, serves as the universal language amidst this otherwise fragmented environment. This standard-based approach fosters the subsidiarity principle, empowering open data portal owners to select platforms and internal structures tailored to their needs. Nevertheless, these owners are required to furnish DCAT-AP compliant metadata exports for their stored datasets.

"Data Catalog Vocabulary (DCAT) is a Resource Description Framework (RDF) vocabulary designed to facilitate interoperability between data catalogs published on the Web" [i.1]. DCAT is meant for the description of datasets and data services using a standard model and vocabulary. DCAT provides RDF classes and properties to allow datasets and data services to be described and included in a catalogue. This can increase the discoverability of datasets and data services. It also enables having a decentralized approach to publishing and discovering data catalogues.

Furthermore, the DCAT vocabulary can be extended by adding classes and properties for metadata fields not covered in the DCAT specification. Each of these new specifications constitutes a DCAT profile, i.e. a named set of constraints based on DCAT. In fact, there are already a number of profiles that have been created to extend it for application in data catalogues in different domains.

"DCAT-AP is a DCAT profile for sharing information about catalogues containing datasets and data services descriptions in Europe" [i.2]. This Application Profile provides a minimal common basis within Europe to share datasets and data services cross-border and cross-domain.

In this respect, an important clarification that has to be done to correctly understand the scope of DCAT-AP is that data described in a catalogue can come in many formats, ranging from spreadsheets, through XML and RDF to various specialized formats. DCAT does not make any assumptions about these serialization formats of the datasets but it does distinguish between the abstract dataset and its different manifestations or distributions. Thus, it is important to differentiate between the dataset (i.e. the entities containing the context information, for example, temperature, humidity, etc.) and the dataset description (i.e. the entities containing the metadata that describes which entities compose the dataset, for example, Catalogue, Dataset, DataService, Distribution, etc.). DCAT-AP's scope is on the dataset description (i.e. the metadata associated to the actual data).

Thus, the main classes in DCAT-AP are thus the classes Catalogue, Dataset, Distribution and Data Service, which can be combined for the description of each catalogue as necessary, usually as a mixture of datasets and data services. In the most recent version of the DCAT-AP specification, dataset series are introduced to further organise the datasets within a catalogue. DCAT-AP provides a plethora of properties, vocabularies and guidelines to extensively express information about Open Data.

In this sense, it is important to highlight that within the DCAT-AP specification the term Entities is actually employed to define the classes that can be leveraged to describe a catalogue and the datasets and/or data services contained in it. However, the present document is referring to them using the term Classes in order to not conflict with the concept of Entity that is used in the ETSI ISG CIM NGSI-LD standard [i.3] when specifying the mapping between DCAT-AP Entities (also known as DCAT-AP Classes) and the respective NGSI-LD Entities.

4.1 Prefixes and namespace

For the purposes of the present document, the following prefixes apply:

adms	http://www.w3.org/ns/adms#
dcat	http://www.w3.org/ns/dcat#
dcatap	http://data.europa.eu/r5r/
dct	http://purl.org/dc/terms/
foaf	http://xmlns.com/foaf/0.1/
locn	http://www.w3.org/ns/locn#
odrl	http://www.w3.org/ns/odrl/2/
owl	http://www.w3.org/2002/07/owl#
prov	http://www.w3.org/ns/prov#
rdfs	http://www.w3.org/2000/01/rdf-schema#
skos	http://www.w3.org/2004/02/skos/core#
spdx	http://spdx.org/rdf/terms#
vcard	http://www.w3.org/2006/vcard/ns#

5 DCAT-AP concepts to NGSI-LD mapping

5.0 Foreword

This clause introduces the rules for describing DCAT-AP classes using NGSI-LD.

The objective is to be able to describe the metadata related to NGSI-LD datasets (i.e. context information available through an NGSI-LD Context Broker) using the conceptual classes defined in the DCAT-AP model.

5.1 DCAT-AP main classes

5.1.0 Foreword

First the key classes from the DCAT-AP model are mapped into an NGSI-LD data model.

5.1.1 Catalogue

Figure 1 shows the attributes and class hierarchy for the main DCAT-AP class, the Catalogue class.

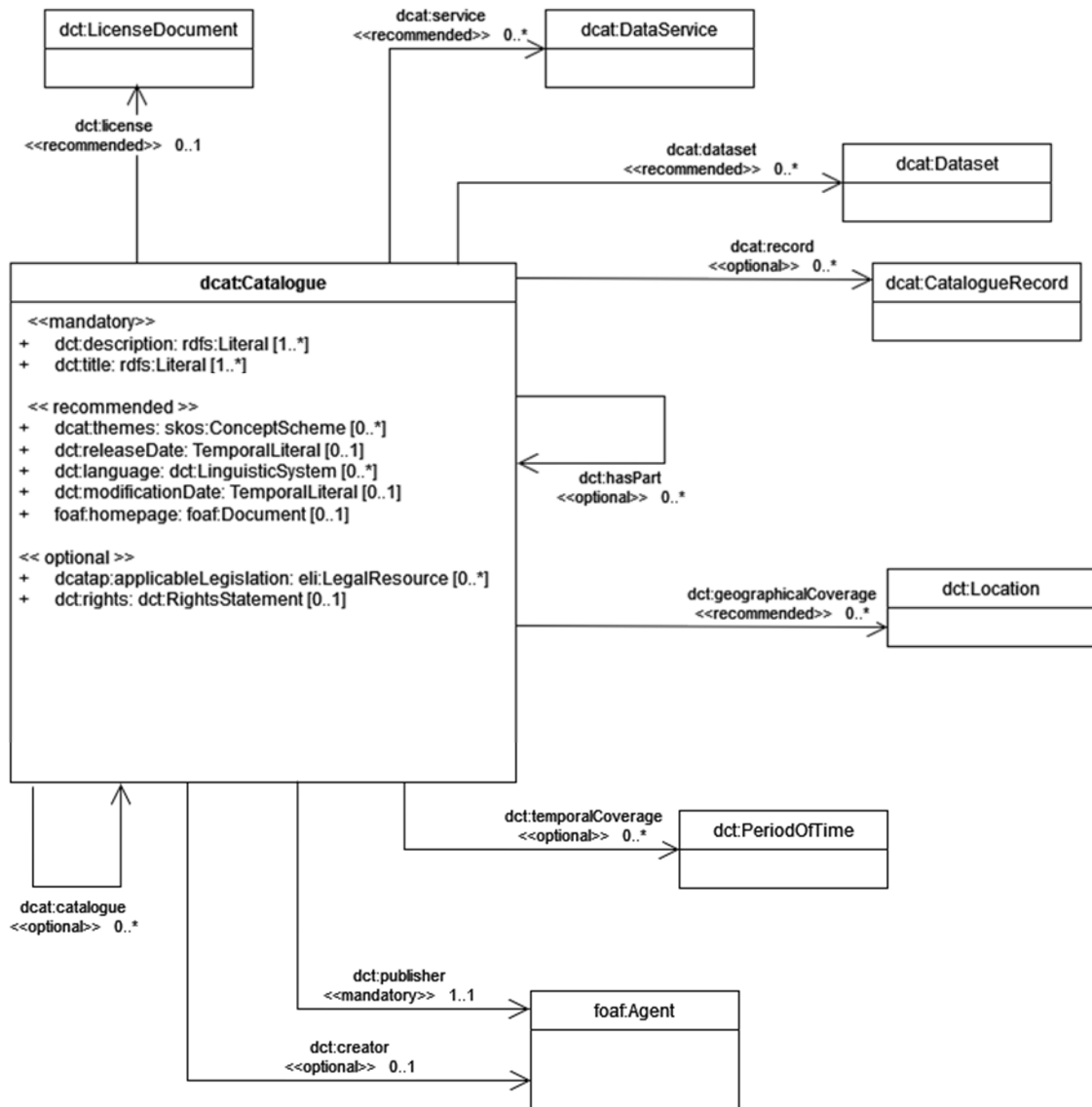


Figure 1: Attributes and class hierarchy for the Catalogue class

This class is meant for describing a catalogue or repository that hosts the Datasets or Data Services being described. It has the following properties: applicableLegislation, catalogue, creator, dataset, description, geographicalCoverage, hasPart, homepage, language, licence, modificationDate, publisher, record, releaseDate, rights, service, temporalCoverage, themes, and title.

Table 1 summarizes these properties as on which type of NGSI-LD property they are mapped into, its description and usage recommendation, its cardinality and the range for each of them.

Table 1: Details on the Catalogue entities' properties

Property	NGSI-LD type	Description and Usage	Card	Range
applicableLegislation	Property	The legislation that mandates the creation or management of the Catalogue.	0..*	eli:LegalResource
catalogue	Relationship	A catalogue whose contents are of interest in the context of this catalogue.	0..*	dcat:Catalogue
creator	Relationship	An entity responsible for the creation of the catalogue.	0..1	foaf:Agent
dataset	Relationship	A Dataset that is part of the Catalogue. As empty Catalogues are usually indications of problems, this property should be combined with the property service to implement an empty Catalogue check.	0..*	dcat:Dataset
description	Property	A free-text account of the Catalogue. This property can be repeated for parallel language versions of the description.	1..*	rdfs:Literal
geographicalCoverage	Relationship	A geographical area covered by the Catalogue. It can be represented using a controlled vocabulary or with geographic coordinates. The EU Vocabularies Name Authority Lists have to be used for continents, countries and places that are in those lists; if a particular location is not in one of the mentioned Named Authority Lists, Geonames URIs have to be used.	0..*	dct:Location
hasPart	Relationship	A related Catalogue that is part of the described Catalogue.	0..*	dcat:Catalogue
homepage	Property	A web page that acts as the main page for the Catalogue.	0..1	foaf:Document
language	Property	A language used in the textual metadata describing titles, descriptions, etc. of the Datasets in the Catalogue. This property can be repeated if the metadata is provided in multiple languages. EU Vocabularies Languages Named Authority List (http://publications.europa.eu/resource/authority/language).	0..*	dct:LinguisticSystem
license	Property	A licence under which the Catalogue can be used or reused.	0..1	dct:LicenseDocument
modificationDate	Property	The most recent date on which the Catalogue was modified.	0..1	rdfs:Literal
publisher	Relationship	An entity (organisation) responsible for making the Catalogue available.	1	foaf:Agent
record	Relationship	A Catalogue Record that is part of the Catalogue.	0..*	dcat:CatalogueRecord
releaseDate	Property	The date of formal issuance (e.g. publication) of the Catalogue.	0..1	rdfs:Literal
rights	Property	A statement that specifies rights associated with the Catalogue.	0..1	dct:RightsStatement
service	Relationship	A site or end-point (Data Service) that is listed in the Catalogue. As empty Catalogues are usually indications of problems, this property should be combined with the property dataset to implement an empty Catalogue check.	0..*	dcat:DataService
temporalCoverage	Property	A temporal period that the Catalogue covers.	0..*	dct:PeriodOfTime

Property	NGSI-LD type	Description and Usage	Card	Range
themes	Property	A knowledge organization system used to classify the Resources that are in the Catalogue. This property refers to a knowledge organization system used to classify the Catalogue's Datasets. It needs to have at least the value NAL:data-theme as this is the mandatory controlled vocabulary for dcat:theme. The values to be used for this property are the URIs of the concepts in the Dataset Theme Vocabulary (http://publications.europa.eu/resource/authority/data-theme).	0..*	skos:ConceptScheme
title	Property	A name given to the Catalogue. This property can be repeated for parallel language versions of the name.	1..*	rdfs:Literal

Listing 1 shows an excerpt of the schema for the NGSI-LD mapping for the DCAT-AP Catalogue class. The complete JSON Schema can be found in Annex B.

Listing 1: Snippet of the JSON Schema for the NGSI-LD Catalogue entity

```
{
  "$schema": "https://json-schema.org/draft/2020-12/schema",
  "$schemaVersion": "1.0.1",
  "$id": "DCAT-AP_NGSI-LD_Mapping/Catalogue/schema.json",
  "title": "Catalogue DCAT-AP",
  "description": "Catalogue of datasets compliant with DCAT-AP specification version 3.0.0.",
  "type": "object",
  "properties": {
    "type": {
      "description": "Property. Model:'https://schema.org/Text'. It has to be Catalogue",
      "type": "string",
      "enum": ["Catalogue"]
    },
    "id": {
      "description": " Identifier format of any NGSI entity of type Catalogue.",
      "type": "string",
      "minLength": 1,
      "maxLength": 256,
      "pattern": "^[\\w\\-\\.\\{\\}\\$\\+\\*\\[\\]\\`|~^@!,:\\\\\\\\]+ $"
    },
    "applicableLegislation": {
      "description": "Property. Model:'http://data.europa.eu/eli/ontology#LegalResource'. The legislation that mandates the creation or management of the Catalog",
      ...
    },
    "catalogue": {
      "description": "Relationship. Model:'http://www.w3.org/ns/dcat#Catalog'. This relationship refers to the catalogue(s) whose contents are of interest in the context of this catalogue",
      ...
    },
    "creator": {
      "description": "Relationship. Model:'http://xmlns.com/foaf/0.1/Agent'. The entities primarily responsible for producing the catalogue",
      ...
    },
    "dataset": {
      "description": "Relationship. Model:'http://www.w3.org/ns/dcat#dataset'. This relationship links the Catalogue with the Dataset(s) that is(are) part of the Catalogue",
      ...
    },
    "description": {
      "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. This property contains a free-text account of the Catalogue. This property can contain parallel language versions of the description.",
      ...
    },
    "geographicalCoverage": {
      "description": "Relationship. Model:'http://purl.org/dc/terms/Location'. This relationship refers to a geographical area covered by the Catalogue",
      ...
    }
  },
}
```

```

"hasPart": {
  "description": "Relationship. Model:'http://www.w3.org/ns/dcat#Catalog'. This relationship
refers to a related Catalogue that is part of the described Catalogue",
  ...
},
"homepage": {
  "description": "Property. Model:'http://xmlns.com/foaf/0.1/homepage'. This property refers
to a web page that acts as the main page for the Catalogue",
  ...
},
"language": {
  "description": "Property. Model:'http://purl.org/dc/terms/LinguisticSystem'. This property
refers to a language used in the textual metadata describing titles, descriptions, etc. of the
Datasets in the Catalogue. This property can include multiple references if the metadata is
provided in multiple languages. DCAT-AP specification mandates the use of EU Vocabularies
Languages Named Authority List",
  ...
},
"license": {
  "description": "Relationship. Model:'http://purl.org/dc/terms/LicenseDocument'. This
relationship links to the licence under which the Catalogue can be used or reused",
  ...
},
"modificationDate": {
  "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. This
property contains the most recent date on which the Catalogue was modified",
  ...
},
"publisher": {
  "description": "Relationship. Model:'http://xmlns.com/foaf/0.1/#term_Agent'. This
relationship links to an entity (organisation) responsible for making the Catalogue available",
  ...
},
"record": {
  "description": "Relationship. Model:'http://www.w3.org/ns/dcat#CatalogRecord'. This
relationship refers to the Catalogue Record(s) that is(are) part of the Catalogue",
  ...
},
"releaseDate": {
  "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. This
property contains the date of formal issuance (e.g., publication) of the Catalogue",
  ...
},
"rights": {
  "description": "Property. Model:'http://purl.org/dc/terms/RightsStatement'. This property
refers to a statement that specifies rights associated with the Catalogue. DCAT-AP specification
mandates the use of Access Rights Named Authority List vocabulary",
  ...
},
"service": {
  "description": "Relationship. Model:'http://www.w3.org/ns/dcat#DataService'. This
relationship refers to the site(s) or end-point(s) (Data Service) that is(are) listed in the
Catalogue",
  ...
},
"temporalCoverage": {
  "description": "Property. Model:'http://purl.org/dc/terms/PeriodOfTime'. This property
refers to the temporal period that the Catalogue covers",
  ...
},
"themes": {
  "description": "Property. Model:'http://www.w3.org/2004/02/skos/core#ConceptScheme'. This
property refers to the knowledge organization system(s) used to classify the Catalogue's Datasets.
DCAT-AP specification mandates the use of Dataset Theme Vocabulary",
  ...
},
"title": {
  "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. This
property contains a name given to the Catalogue. This property can contain parallel language
versions of the title",
  ...
},
"@context": {
  "type": "array"
}
},
"required": [
  "id",

```

```

    "type",
    "description",
    "publisher",
    "title"
  ]
}

```

Some examples of the usage of the NGS-LD entity of type Catalogue can be found in Annex A.

5.1.2 Dataset

Figure 2 shows the attributes and class hierarchy for the DCAT-AP Dataset class.

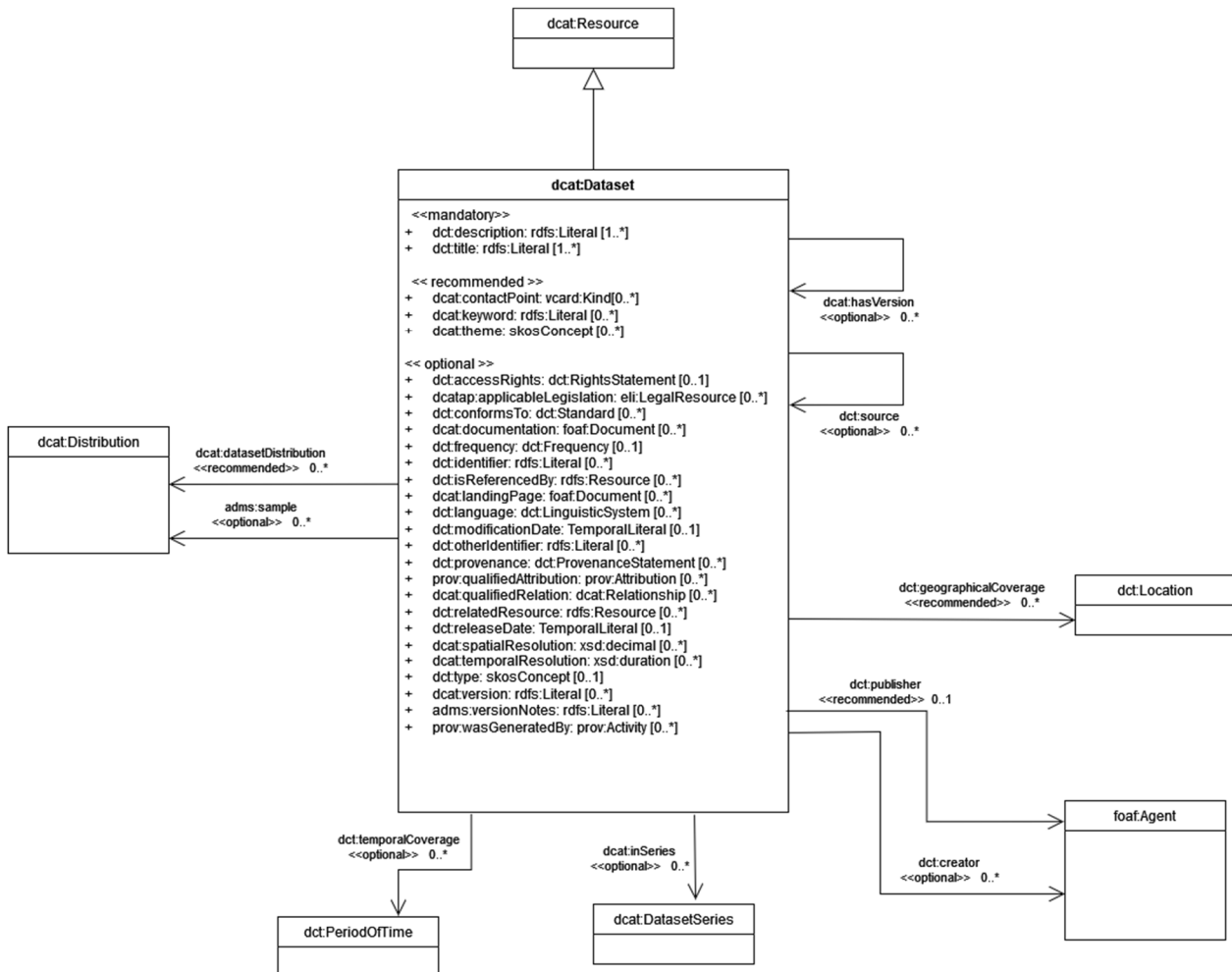


Figure 2: Attributes and class hierarchy for the Dataset class

This class is meant for describing a conceptual entity that represents the information published. It has the following properties: accessRights, applicableLegislation, conformsTo, contactPoint, creator, datasetDistribution, description, documentation, frequency, geographicalcoverage, hasVersion, identifier, inSeries, isReferencedBy, keyword, landingPage, language, modificationDate, otherIdentifier, provenance, publisher, qualifiedAttribution, qualifiedRelation, relatedResource, releaseDate, sample, source, spatialResolution, temporalCoverage, temporalResolution, theme, title, type, version, versionNotes, and wasGeneratedBy.

Table 2 summarizes these properties as on which type of NGS-LD property they are mapped into, its description and usage recommendation, its cardinality and the range for each of them.

Table 2: Details on the Dataset entities' properties

Property	NGSI-LD type	Description and Usage	Card.	Range
accessRights	Property	Information that indicates whether the Dataset is publicly accessible, has access restrictions or is not public.	0..1	dct:RightsStatement
applicableLegislation	Property	The legislation that mandates the creation or management of the Dataset.	0..*	eli:LegalResource
conformsTo	Property	An implementing rule or other specification.	0..*	dct:Standard
contactPoint	Relationship	Contact information that can be used for sending comments about the Dataset.	0..*	vcard:Kind
creator	Relationship	An entity responsible for producing the dataset.	0..*	foaf:Agent
datasetDistribution	Relationship	An available Distribution for the Dataset.	0..*	dcat:Distribution
description	Property	A free-text account of the Dataset. This property can be repeated for parallel language versions of the description.	1..*	rdfs:Literal
documentation	Property	A page or document about this Dataset.	0..*	foaf:Document
frequency	Property	The frequency at which the Dataset is updated. EU Vocabularies Frequency Named Authority List (http://publications.europa.eu/resource/authority/frequency).	0..1	dct:Frequency
geographicalCoverage	Relationship	A geographic region that is covered by the Dataset. It can be represented using a controlled vocabulary or with geographic coordinates. The EU Vocabularies Name Authority Lists have to be used for continents, countries and places that are in those lists; if a particular location is not in one of the mentioned Named Authority Lists, Geonames URIs have to be used.	0..*	dct:Location
hasVersion	Relationship	A related Dataset that is a version, edition, or adaptation of the described Dataset.	0..*	dcat:Dataset
inSeries	Relationship	A dataset series of which the dataset is part.	0..*	dcat:DatasetSeries
isReferencedBy	Relationship	A related resource, such as a publication, that references, cites, or otherwise points to the dataset.	0..*	rdfs:Resource
keyword	Property	A keyword or tag describing the Dataset.	0..*	rdfs:Literal
landingPage	Property	A web page that acts as the main page for the Catalogue. It is intended to point to a landing page at the original data provider, not to a page on a site of a third party, such as an aggregator.	0..*	foaf:Document
language	Property	A language of the Dataset. This property can be repeated if there are multiple languages in the Dataset. EU Vocabularies Languages Named Authority List (http://publications.europa.eu/resource/authority/language).	0..*	dct:LinguisticSystem
modificationDate	Property	The most recent date on which the Dataset was changed or modified.	0..1	rdfs:Literal
otherIdentifier	Property	A secondary identifier of the Dataset. Examples are DataCite, DOI, EZID or W3ID.	0..*	rdfs:Literal
provenance	Property	A statement about the lineage of a Dataset.	0..*	dct:ProvenanceStatement

Property	NGSI-LD type	Description and Usage	Card.	Range
publisher	Relationship	An entity (organisation) responsible for making the Dataset available.	0..1	foaf:Agent
qualifiedAttribution	Relationship	An Agent having some form of responsibility for the resource.	0..*	dcat:Attribution
qualifiedRelation	Relationship	A description of a relationship with another resource.	0..*	dcat:Relationship
relatedResource	Relationship	A related resource.	0..*	rdfs:Resource
releaseDate	Property	The date of formal issuance (e.g. publication) of the Dataset.	0..1	rdfs:Literal
sample	Relationship	A sample distribution of the dataset.	0..*	dcat:Distribution
source	Relationship	A related Dataset from which the described Dataset is derived.	0..*	dcat:Dataset
spatialResolution	Property	The minimum spatial separation resolvable in a dataset, measured in meters.	0..*	xsd:decimal
temporalCoverage	Property	A temporal period that the Dataset covers.	0..*	dcat:PeriodOfTime
temporalResolution	Property	The minimum time period resolvable in the dataset.	0..*	xsd:duration
theme	Property	A category of the Dataset. A Dataset may be associated with multiple themes. The values to be used for this property are the URIs of the concepts in the Dataset Theme Vocabulary (http://publications.europa.eu/resource/authority/data-theme).	0..*	skos:Concept
title	Property	A name given to the Dataset. This property can be repeated for parallel language versions of the name.	1..*	rdfs:Literal
datasetType	Property	A type of the Dataset. A recommended controlled vocabulary data-type is foreseen.	0..1	skos:Concept
version	Property	The version indicator (name or identifier) of a resource.	0..*	rdfs:Literal
versionNotes	Property	A description of the differences between this version and a previous version of the Dataset. This property can be repeated for parallel language versions of the version notes.	0..*	rdfs:Literal
wasGeneratedBy	Relationship	An activity that generated, or provides the business context for, the creation of the dataset.	0..*	prov:Activity

Listing 2 shows an excerpt of the schema for the NGSI-LD mapping for the DCAT-AP Dataset class. The complete JSON Schema can be found in Annex B.

Listing 2: Snippet of the JSON Schema for the NGSI-LD Dataset entity

```
{
  "$schema": " https://json-schema.org/draft/2020-12/schema ",
  "$schemaVersion": "1.0.1",
  "$id": "DCAT-AP_NGSI-LD_Mapping/Dataset/schema.json",
  "title": "Dataset DCAT-AP",
  "description": "Datasets compliant with DCAT-AP specification version 3.0.0.",
  "type": "object",
  "properties": {
    "type": {
      "description": "Property. Model:'https://schema.org/Text'. It has to be Dataset",
      "type": "string",
      "enum": ["Dataset"]
    },
    "id": {
      "description": " Identifier format of any NGSI entity of type Dataset.",
      ...
    }
  },
}
```

```

"accessRights": {
  "description": "Property. Model:'http://purl.org/dc/terms/RightsStatement'. This property
refers to a statement that specifies rights associated with the Dataset. The Access Rights Named
Authority List is the recommended vocabulary provided at
http://publications.europa.eu/resource/authority/access-right",
  ...
},
"applicableLegislation": {
  "description": "Property. Model:'http://data.europa.eu/eli/ontology#LegalResource'. The
legislation that mandates the creation or management of the Dataset. It is aligned with the
ontology included in Council conclusions inviting the introduction of the European Legislation
Identifier (ELI). In this data specification the use is restricted to instances of this class that
follow the (ELI) URI guidelines.",
  ...
},
"conformsTo": {
  "description": "Relationship. Model:'http://purl.org/dc/terms/Standard'. An implementing
rule or other specification.",
  ...
},
"contactPoint": {
  "description": "Relationship. Model:'vcard\thttp://www.w3.org/2006/vcard/ns#Kind'. Contact
information that can be used for sending comments about the Dataset. Note that the class Kind is
the parent class for the four explicit types of vCard (Individual, Organization, Location,
Group).",
  ...
},
"creator": {
  "description": "Relationship. Model:'http://xmlns.com/foaf/0.1/Agent'. The entities
primarily responsible for producing the dataset",
  ...
},
"datasetDistribution": {
  "description": "Relationship. Model:'http://www.w3.org/ns/dcat#dataset'. This relationship
links to available Distribution(s) for the Dataset.",
  ...
},
"description": {
  "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. This
property contains a free-text account of the Dataset. This property can be repeated for parallel
language versions of the description.",
  ...
},
"documentation": {
  "description": "Property. Model:'http://xmlns.com/foaf/0.1/homepage'. This property refers
to a page or document about this Dataset.",
  ...
},
"frequency": {
  "description": "Property. Model:'http://purl.org/dc/terms/Frequency'. This property refers
to the frequency at which the Dataset is updated. The EU Vocabularies Frequency Named Authority
List is the recommended vocabulary provided at
http://publications.europa.eu/resource/authority/frequency",
  ...
},
"geographicalCoverage": {
  "description": "Relationship. Model:'http://purl.org/dc/terms/Location'. This relationship
refers to a geographical area covered by the Catalogue",
  ...
},
"hasVersion": {
  "description": "Relationship. Model:'http://www.w3.org/ns/dcat#Catalog'. This relationship
refers to a related Dataset that is a version, edition, or adaptation of the described Dataset.",
  ...
},
"inSeries": {
  "description": "Relationship. Model:'http://www.w3.org/ns/dcat#DatasetSeries'. This
relationship links to the dataset series of which the dataset is part.",
  ...
},
"isReferencedBy": {
  "description": "Relationship. Model:'http://www.w3.org/2000/01/rdf-schema#Resource'. A
related resource, such as a publication, that references, cites, or otherwise points to the
dataset.",
  ...
},
"keyword": {

```



```

    "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. This
property contains a keyword or tag describing the Dataset. This property can contain as many
keywords as necessary",
    ...
  },
  "landingPage": {
    "description": "Property. Model:'http://xmlns.com/foaf/0.1/homepage'. This property refers
to a web page that provides access to the Dataset, its Distributions and/or additional
information.",
    ...
  },
  "language": {
    "description": "Property. Model:'http://purl.org/dc/terms/LinguisticSystem'. This property
refers to a language of the Dataset. This property can be repeated if the metadata is provided in
multiple languages. The EU Vocabularies Languages Named Authority List is the recommended
vocabulary provided at http://publications.europa.eu/resource/authority/language",
    ...
  },
  "modificationDate": {
    "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. This
property contains the most recent date on which the Catalogue was modified",
    ...
  },
  "otherIdentifier": {
    "description": "A secondary identifier of the Dataset. Examples are MAST/ADS, DataCite, DOI,
EZID or W3ID.",
    ...
  },
  "provenance": {
    "description": "Property. Model:'http://purl.org/dc/terms/ProvenanceStatement'. A statement
about the lineage of a Dataset. Any changes in ownership and custody of the Dataset since its
creation that are significant for its authenticity, integrity, and interpretation.",
    ...
  },
  "publisher": {
    "description": "Relationship. Model:'http://xmlns.com/foaf/0.1/#term_Agent'. This
relationship links to an entity (organisation) responsible for making the Dataset available",
    ...
  },
  "qualifiedAttribution": {
    "description": "Relationship. Model:'http://www.w3.org/ns/prov#Attribution'.Used to link to
an Agent having some form of responsibility for the resource, but where the nature of the
relationship is known but does not match one of the standard [DCTERMS] properties (dct:creator,
dct:publisher).",
    ...
  },
  "qualifiedRelation": {
    "description": "Relationship. Model:'http://www.w3.org/ns/dcat#Relationship'.Used to link to
another resource where the nature of the relationship is known but does not match one of the
standard [DCTERMS] properties or [PROV-O] properties",
    ...
  },
  "relatedResource": {
    "description": "Relationship. Model:'http://www.w3.org/2000/01/rdf-schema#Resource'.A
related resource.",
    ...
  },
  "releaseDate": {
    "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. This
property contains the date of formal issuance (e.g., publication) of the Dataset",
    ...
  },
  "sample": {
    "description": "Relationship. Model:'http://www.w3.org/ns/dcat#dataset'. This relationship
links to sample Distribution(s) of the Dataset.",
    ...
  },
  "source": {
    "description": "Relationship. Model:'http://www.w3.org/ns/dcat#Catalog'. This relationship
refers to a related Dataset from which the described Dataset is derived.",
    ...
  },
  "spatialResolution": {
    "description": "Property. Model:'http://www.w3.org/2001/XMLSchema#decimal'. This property
refers to the minimum spatial separation resolvable in a dataset, measured in meters.",
    ...
  },
}

```

```

    "temporalCoverage": {
      "description": "Property. Model:'http://purl.org/dc/terms/PeriodOfTime'. This property
refers to the temporal period that the Dataset covers",
      ...
    },
    "temporalResolution": {
      "description": "Property. Model:'http://www.w3.org/2001/XMLSchema#duration'. This property
refers to the minimum time period resolvable in the dataset.",
      ...
    },
    "theme": {
      "description": "Property. Model:'http://www.w3.org/2004/02/skos/core#ConceptScheme'. This
property refers to a knowledge organization system used to classify the Catalogue's Datasets. The
Dataset Theme Vocabulary is the recommended vocabulary provided at
http://publications.europa.eu/resource/authority/data-theme",
      ...
    },
    "title": {
      "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. This
property contains a name given to the Dataset. This property can be repeated for parallel language
versions of the title",
      ...
    },
    "datasetType": {
      "description": "Property. Model:'http://www.w3.org/2004/02/skos/core#Concept'. This property
contains the nature or genre of the resource. The Dataset-type authority table is the recommended
vocabulary provided at http://publications.europa.eu/resource/dataset/dataset-type",
      ...
    },
    "version": {
      "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. The version
indicator (name or identifier) of a resource.",
      ...
    },
    "versionNotes": {
      "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. A
description of the differences between this version and a previous version of the Dataset. This
property can be repeated for parallel language versions of the version notes.",
      ...
    },
    "wasGeneratedBy": {
      "description": "Relationship. Model:'http://www.w3.org/ns/prov#Activity'. An activity that
generated, or provides the business context for, the creation of the dataset",
      ...
    },
    "@context": {
      "type": "array"
    }
  },
  "required": ["id", "type", "description", "publisher", "title"],
  "additionalProperties": false
}

```

Some examples of the usage of the NGS-LD entity of type Dataset can be found in Annex A.

5.1.3 Dataset Series

Figure 3 shows the attributes and class hierarchy for the DCAT-AP DatasetSeries class.

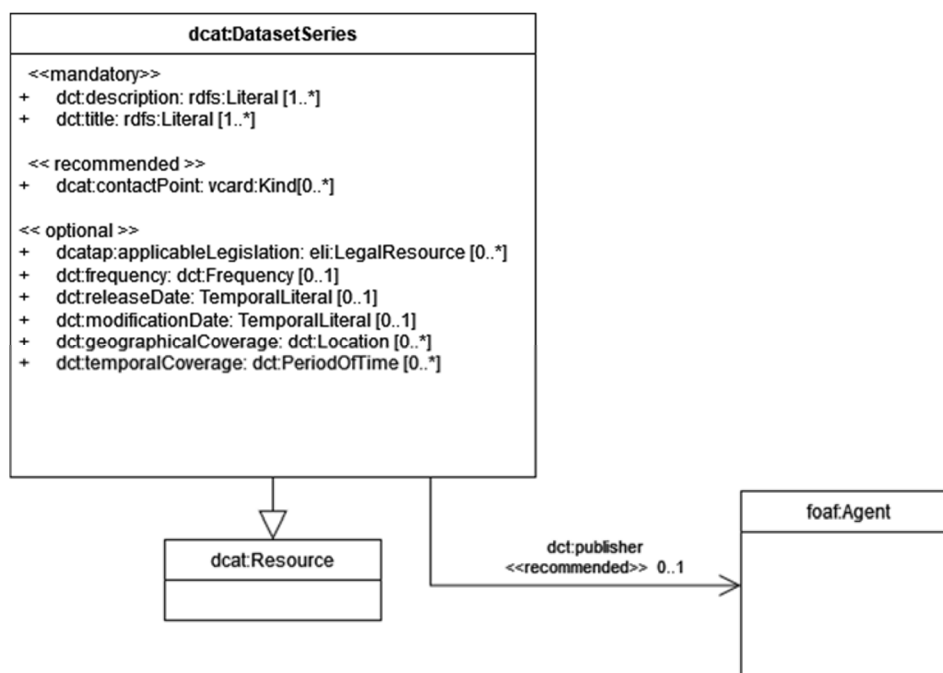


Figure 3: Attributes and class hierarchy for the DatasetSeries class

This class is meant for representing a collection of datasets that are published separately, but share some characteristics that group them. It has the following properties: applicable legislation, contact point, description, frequency, geographical coverage, modification date, publisher, release date, temporal coverage, and title.

Table 3 summarizes these properties as on which type of NGS-LD property they are mapped into, its description and usage recommendation, its cardinality and the range for each of them.

Table 3: Details on the DatasetSeries entities' properties

Property	NGSI-LD type	Description and Usage	Card.	Range
applicableLegislation	Property	The legislation that mandates the creation or management of the Dataset Series.	0..*	eli:LegalResource
contactPoint	Relationship	Contact information that can be used for sending comments about the Dataset Series.	0..*	vcard:Kind
description	Property	A free-text account of the Dataset Series. This property can be repeated for parallel language versions. It is recommended to provide an indication about the dimensions the Dataset Series evolves.	1..*	rdfs:Literal
frequency	Property	The frequency at which the Dataset Series is updated. EU Vocabularies Frequency Named Authority List (http://publications.europa.eu/resource/authority/frequency).	0..1	dct:Frequency
geographicalCoverage	Relationship	A geographic region that is covered by the Dataset Series. It can be represented using a controlled vocabulary or with geographic coordinates. The EU Vocabularies Name Authority Lists have to be used for continents, countries and places that are in those lists; if a particular location is not in one of the mentioned Named Authority Lists, Geonames URIs have to be used.	0..*	dct:Location

Property	NGSI-LD type	Description and Usage	Card.	Range
modificationDate	Property	The most recent date on which the Dataset Series was changed or modified. This is not equal to the most recent modified dataset in the collection of the dataset series.	0..1	rdfs:Literal
publisher	Relationship	An entity (organisation) responsible for ensuring the coherency of the Dataset Series. The publisher of the dataset series may not be the publisher of all datasets. E.g. a digital archive could take over the publishing of older datasets in the series.	0..1	foaf:Agent
releaseDate	Property	The date of formal issuance (e.g. publication) of the Dataset Series. The moment when the dataset series was established as a managed resource. This is not equal to the release date of the oldest dataset in the collection of the dataset series.	0..1	rdfs:Literal
temporalCoverage	Property	A temporal period that the Dataset Series covers. When temporal coverage is a dimension in the dataset series then the temporal coverage of each dataset in the collection should be part of the temporal coverage. In that case, an open-ended value is recommended, e.g. after 2012.	0..*	dcat:PeriodOfTime
title	Property	A name given to the Dataset Series. This property can be repeated for parallel language versions of the name.	1..*	rdfs:Literal

Listing 3 shows an excerpt of the schema for the NGSI-LD mapping for the DCAT-AP Dataset Series class. The complete JSON Schema can be found in Annex B.

Listing 3: Snippet of the JSON Schema for the NGSI-LD Dataset Series entity

```
{
  "$schema": "https://json-schema.org/draft/2020-12/schema",
  "$schemaVersion": "1.0.1",
  "$id": "DCAT-AP_NGSI-LD_Mapping/DatasetSeries/schema.json",
  "title": "Dataset DCAT-AP",
  "description": "Dataset Series compliant with DCAT-AP specification version 3.0.0.",
  "type": "object",
  "properties": {
    "type": {
      "description": "Property. Model:'https://schema.org/Text'. It has to be DatasetSeries",
      "type": "string",
      "enum": ["DatasetSeries"]
    },
    "id": {
      "description": " Identifier format of any NGSI entity of type DatasetSeries.",
      ...
    },
    "applicableLegislation": {
      "description": "Property. Model:'http://data.europa.eu/eli/ontology#LegalResource'. The legislation that mandates the creation or management of the Dataset. It is aligned with the ontology included in Council conclusions inviting the introduction of the European Legislation Identifier (ELI). In this data specification the use is restricted to instances of this class that follow the (ELI) URI guidelines.",
      ...
    },
    "contactPoint": {
      "description": "Relationship. Model:'vcard\\thttp://www.w3.org/2006/vcard/ns#Kind'. Contact information that can be used for sending comments about the Dataset Series. Note that the class Kind is the parent class for the four explicit types of vCard (Individual, Organization, Location, Group).",
      ...
    },
    "description": {
      "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. This property contains a free-text account of the Dataset Series. This property can be repeated for parallel language versions of the description.",
      ...
    }
  }
}
```

```

    ...
  },
  "frequency": {
    "description": "Property. Model:'http://purl.org/dc/terms/Frequency'. This property refers
to the frequency at which the Dataset Series is updated. The EU Vocabularies Frequency Named
Authority List is the recommended vocabulary provided at
http://publications.europa.eu/resource/authority/frequency",
    ...
  },
  "geographicalCoverage": {
    "description": "Relationship. Model:'http://purl.org/dc/terms/Location'. This relationship
refers to a geographical area covered by the Catalogue",
    ...
  },
  "modificationDate": {
    "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. This
property contains the most recent date on which the Catalogue was modified",
    ...
  },
  "publisher": {
    "description": "Relationship. Model:'http://xmlns.com/foaf/0.1/#term_Agent'. This
relationship links to an entity (organisation) responsible for making the Dataset available",
    ...
  },
  "releaseDate": {
    "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. This
property contains the date of formal issuance (e.g., publication) of the Dataset",
    ...
  },
  "temporalCoverage": {
    "description": "Property. Model:'http://purl.org/dc/terms/PeriodOfTime'. This property
refers to the temporal period that the Dataset covers",
    ...
  },
  "title": {
    "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. This
property contains a name given to the Dataset Series. This property can be repeated for parallel
language versions of the title",
    ...
  },
  "@context": {
    "type": "array"
  }
},
"required": ["id", "type", "description", "title"],
"additionalProperties": false
}

```

Some examples of the usage of the NGSI-LD entity of type DatasetSeries can be found in Annex A.

5.1.4 Distribution

Figure 4 shows the attributes and class hierarchy for the DCAT-AP Distribution class.

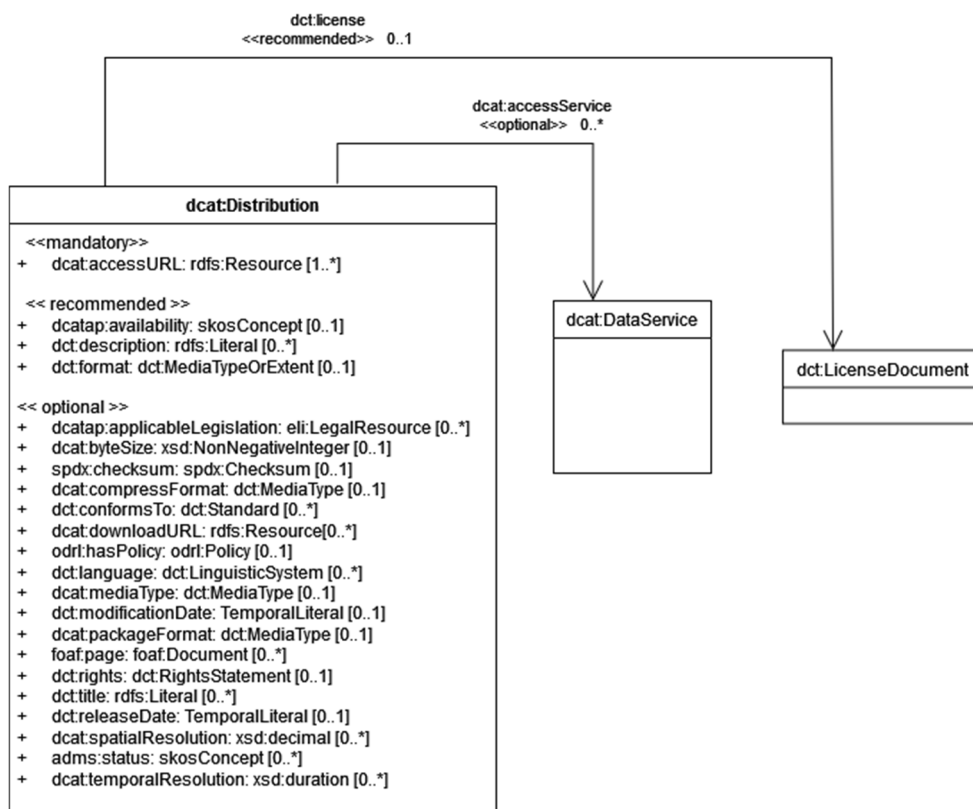


Figure 4: Attributes and class hierarchy for the Distribution class

This class is meant for describing a physical embodiment of the Dataset in a particular format. Distributions are specific representations of a dataset, described with the intent to facilitate the delivery of the data as file to a user. The access URL (preferably download URL) will provide a simple way to obtain (download) the content of the dataset in the representation specified by the distribution. The obtained (downloaded) content is fully determined by the publisher of the distribution. Only after obtaining the data the (re)user can change the data according to its needs.

It has the following properties: accessService, accessURL, applicableLegislation, availability, byteSize, checksum, compressionFormat, description, documentation, downloadURL, format, hasPolicy, language, licence, linkedSchemas, mediaType, modificationDate, packagingFormat, releaseDate, rights, spatialResolution, status, temporalResolution, and title.

Table 4 summarizes these properties as on which type of NGS-LD property they are mapped into, its description and usage recommendation, its cardinality and the range for each of them.

Table 4: Details on the Distribution entities' properties

Property	NGSI-LD type	Description and Usage	Card.	Range
accessService	Relationship	A data service that gives access to the distribution of the dataset.	0..*	dcat:DataService
accessURL	Property	A URL that gives access to a Distribution of the Dataset. The resource at the access URL may contain information about how to get the Dataset.	1..*	dcat:endpointURL
applicableLegislation	Property	The legislation that mandates the creation or management of the Dataset Series.	0..*	eli:LegalResource
availability	Property	An indication how long it is planned to keep the Distribution of the Dataset available.	0..1	skos:Concept
byteSize	Property	The size of a Distribution in bytes.	0..1	xsd:nonNegativeInteger
checksum	Relationship	A mechanism that can be used to verify that the contents of a distribution have not changed. The checksum is related to the downloadURL.	0..1	dcat:Checksum

Property	NGSI-LD type	Description and Usage	Card.	Range
compressionFormat	Property	The format of the file in which the data is contained in a compressed form, e.g. to reduce the size of the downloadable file. It SHOULD be expressed using a media type as defined in the official register of media types managed by IANA.	0..1	dct:MediaType
description	Property	A free-text account of the Distribution. This property can be repeated for parallel language versions of the description.	0..*	rdfs:Literal
documentation	Property	A page or document about this Distribution.	0..*	foaf:Document
downloadURL	Property	A URL that is a direct link to a downloadable file in a given format.	0..*	dcat:downloadURL
format	Property	The file format of the Distribution.	0..1	dcat:MediaTypeOrExtent
hasPolicy	Relationship	The policy expressing the rights associated with the distribution if using the ODRL vocabulary.	0..1	odrl:Policy
language	Property	A language used in the Distribution. This property can be repeated if the metadata is provided in multiple languages. EU Vocabularies Languages Named Authority List (http://publications.europa.eu/resource/authority/language).	0..*	dct:LinguisticSystem
license	Property	A licence under which the Distribution is made available.	0..1	dct:LicenseDocument
linkedSchemas	Property	An established schema to which the described Distribution conforms.	0..*	dct:Standard
mediaType	Property	The media type of the Distribution as defined in the official register of media types managed by IANA.	0..1	dcat:MediaType
modificationDate	Property	The most recent date on which the Distribution was changed or modified.	0..1	rdfs:Literal
packagingFormat	Property	The format of the file in which one or more data files are grouped together, e.g. to enable a set of related files to be downloaded together. It SHOULD be expressed using a media type as defined in the official register of media types managed by IANA.	0..1	dcat:MediaType
releaseDate	Property	The date of formal issuance (e.g. publication) of the Distribution.	0..1	rdfs:Literal
rights	Property	A statement that specifies rights associated with the Distribution.	0..1	dct:RightsStatement
spatialResolution	Property	The minimum spatial separation resolvable in a dataset distribution, measured in meters.	0..*	xsd:decimal
status	Property	The status of the distribution in the context of maturity lifecycle. It HAS TO take one of the values Completed, Deprecated, Under Development, Withdrawn.	0..1	skos:Concept
temporalResolution	Property	The minimum time period resolvable in the dataset distribution.	0..*	xsd:duration
title	Property	A name given to the Distribution. This property can be repeated for parallel language versions of the description.	1..*	rdfs:Literal

Listing 4 shows an excerpt of the schema for the NGSI-LD mapping for the DCAT-AP Distribution class. The complete JSON Schema can be found in Annex B.

Listing 4: Snippet of the JSON Schema for the NGSI-LD Distribution entity

```
{
  "$schema": "http://json-schema.org/draft-07/schema#",
  "$schemaVersion": "1.0.1",
```

```

"$id": "DCAT-AP_NGSI-LD_Mapping/Distribution/schema.json",
"title": "Distribution DCAT-AP",
"description": "Distribution of data compliant with DCAT-AP specification version 3.0.0.",
"type": "object",
"properties": {
  "type": {
    "description": "Property. Model:'https://schema.org/Text'. It has to be Distribution",
    "type": "string",
    "enum": [
      "Distribution"
    ]
  },
  "id": {
    "description": " Identifier format of any NGSI entity of type Distribution.",
    "type": "string",
    "minLength": 1,
    "maxLength": 256,
    "pattern": "^([\\w\\-\\.\\{\\}\\$\\+\\*\\[\\]\\`|~^@!,:\\\\\\\\]+)$"
  },
  "accessService": {
    "description": "Relationship. Model:'http://www.w3.org/ns/dcat#dataset'. This property links to a data service that gives access to the distribution of the dataset.",
    ...
  },
  "accessURL": {
    "description": "Property. Model:'https://www.w3.org/ns/dcat#accessURL'. The file format of the Distribution.",
    ...
  },
  "applicableLegislation": {
    "description": "Property. Model:'http://data.europa.eu/eli/ontology#LegalResource'. The legislation that mandates the creation or management of the Dataset. It is aligned with the ontology included in Council conclusions inviting the introduction of the European Legislation Identifier (ELI). In this data specification the use is restricted to instances of this class that follow the (ELI) URI guidelines.",
    ...
  },
  "availability": {
    "description": "Property. Model:'http://www.w3.org/2004/02/skos/core#Concept'. An indication how long it is planned to keep the Distribution of the Dataset available.",
    ...
  },
  "byteSize": {
    "description": "Property. Model:'https://www.w3.org/2001/XMLSchema#nonNegativeInteger'. The size of a Distribution in bytes. ",
    ...
  },
  "checksum": {
    "description": "Relationship. Model:'https://spdx.org/rdf/terms/#checksum'. A mechanism that can be used to verify that the contents of a distribution have not changed.",
    ...
  },
  "compressionFormat": {
    "description": "Property. Model:'http://purl.org/dc/terms/MediaType'. The format of the file in which the data is contained in a compressed form, e.g. to reduce the size of the downloadable file. It SHOULD be expressed using a media type as defined in the official register of media types managed by IANA.",
    ...
  },
  "description": {
    "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. This property contains a free-text account of the Distribution. This property can be repeated for parallel language versions of the description.",
    ...
  },
  "documentation": {
    "description": "Property. Model:'http://xmlns.com/foaf/0.1/homepage'. This property refers to a page or document about this Distribution. ",
    ...
  },
  "downloadURL": {
    "description": "Property. Model:'https://www.w3.org/ns/dcat#downloadURL'. A URL that is a direct link to a downloadable file in a given format.",
    ...
  },
  "format": {
    "description": "Property. Model:'http://purl.org/dc/terms/MediaTypeOrExtent'. The file format of the Distribution.",
  }
}

```



```

...
},
"hasPolicy": {
  "description": "Relationship. Model:'http://www.w3.org/ns/dcat#Catalog'. This property
refers to the policy(ies) expressing the rights associated with the distribution if using the
[ODRL] vocabulary.",
  ...
},
"language": {
  "description": "Property. Model:'http://purl.org/dc/terms/LinguisticSystem'. This property
refers to a language of the Dataset. This property can be repeated if the metadata is provided in
multiple languages. The EU Vocabularies Languages Named Authority List is the recommended
vocabulary provided at http://publications.europa.eu/resource/authority/language",
  ...
},
"license": {
  "description": "Relationship. Model:'http://purl.org/dc/terms/LicenseDocument'. This
property links to the licence under which the Catalogue can be used or reused",
  ...
},
"linkedSchemas": {
  "description": "Relationship. Model:'http://purl.org/dc/terms/Standard'. An established
schema to which the described Distribution conforms. ",
  ...
},
"mediaType": {
  "description": "Property. Model:'http://purl.org/dc/terms/MediaType'. The media type of the
Distribution as defined in the official register of media types managed by IANA.",
  ...
},
"modificationDate": {
  "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. This
property contains the most recent date on which the Catalogue was modified",
  ...
},
"packagingFormat": {
  "description": "Property. Model:'http://purl.org/dc/terms/MediaType'. The format of the file
in which one or more data files are grouped together, e.g. to enable a set of related files to be
downloaded together. It SHOULD be expressed using a media type as defined in the official register
of media types managed by IANA.",
  ...
},
"releaseDate": {
  "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. This
property contains the date of formal issuance (e.g., publication) of the Dataset",
  ...
},
"rights": {
  "description": "Property. Model:'http://purl.org/dc/terms/RightsStatement'. This property
refers to a statement that specifies rights associated with the Catalogue. The Access Rights Named
Authority List is the recommended vocabulary provided at
http://publications.europa.eu/resource/authority/access-right",
  ...
},
"spatialResolution": {
  "description": "Property. Model:'http://www.w3.org/2001/XMLSchema#decimal'. This property
refers to the minimum spatial separation resolvable in a dataset, measured in meters.",
  ...
},
"status": {
  "description": "Property. Model:'http://www.w3.org/ns/adms#status'. The status of the
distribution in the context of maturity lifecycle. It HAS TO take one of the values Completed,
Deprecated, Under Development, Withdrawn",
  ...
},
"temporalResolution": {
  "description": "Property. Model:'http://www.w3.org/2001/XMLSchema#duration'. This property
refers to the minimum time period resolvable in the dataset.",
  ...
},
"title": {
  "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. This
property contains a name given to the Distribution. This property can be repeated for parallel
language versions of the title",
  ...
},
"@context": {
  "type": "array"
}

```

```

    },
    "required": [
      "id",
      "type",
      "accessURL",
    ],
    "additionalProperties": false
  }
}

```

Some examples of the usage of the NGSI-LD entity of type Distribution can be found in Annex A.

5.1.5 Data Service

Figure 5 shows the attributes and class hierarchy for the DCAT-AP DataService class.

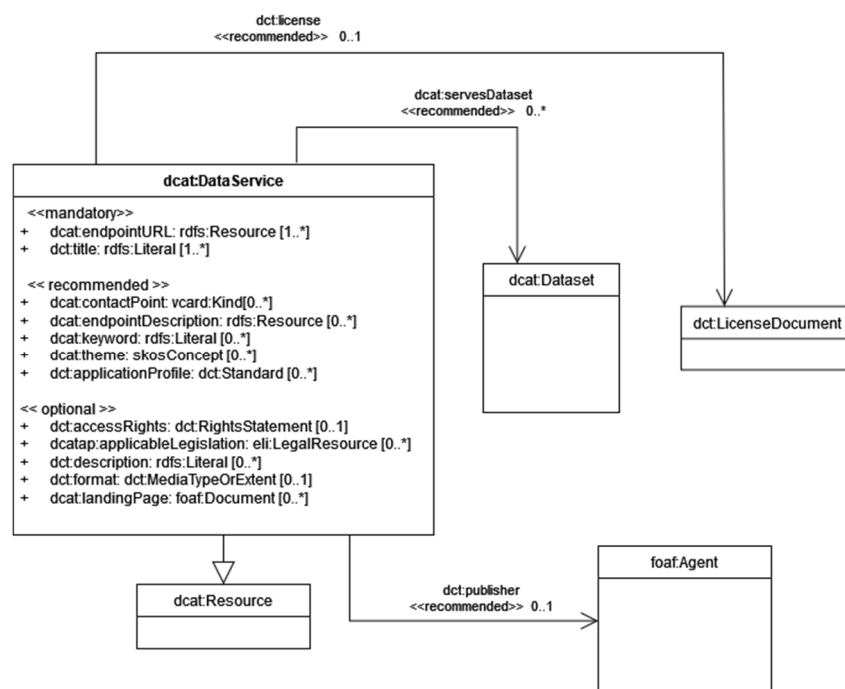


Figure 5: Attributes and class hierarchy for the Distribution class

This class is meant for describing a collection of operations that provides access to one or more datasets or data processing functions.

A first distinction between distributions and data services is their dependency on a dataset for their existence. A distribution cannot exist without its dataset. It is a specific representation of a dataset. Whereas a data service is an entity in its own right. It provides access to datasets or it provides data processing functions. The independence also holds between the distributions of a dataset, and the data service which provides access to that dataset. The distributions are not required to be the result of the data service operations. However, they may.

Many of the properties of distributions are file oriented (downloadURL, format, byte size, checksum, modification date, etc.). The relevance of this information is reduced for data services, related information is present in a very different form and thus under different terminology. For instance, data services do and can provide format transformations, language transformations and schema transformations on request. Also, the handling of trust is different. While tampering of downloadable content is detected by e.g. checksums, data services create often a trusted channel using security measures such as authentication and encryption. This reduces the need for additional trust checks on the data.

It has the following properties: access rights, applicable legislation, application profile, contact point, description, endpoint description, endpoint URL, format, keyword, landing page, licence, publisher, serves dataset, theme, and title.

Table 5 summarizes these properties as on which type of NGSI-LD property they are mapped into, its description and usage recommendation, its cardinality and the range for each of them.

Table 5: Details on the Distribution entities' properties

Property	NGSI-LD type	Description and Usage	Card.	Range
accessRights	Property	Information regarding access or restrictions based on privacy, security, or other policies.	0..1	dct:RightsStatement
applicableLegislation	Property	The legislation that mandates the creation or management of the Data Service.	0..*	eli:LegalResource
applicationProfile	Property	An established (technical) standard to which the Data Service conforms. The standards referred here SHOULD describe the Data Service and not the data it serves. The latter is provided by the dataset with which this Data Service is connected. For instance the data service adheres to the OGC WFS API standard, while the associated dataset adheres to the INSPIRE Address data model.	0..*	dct:Standard
contactPoint	Relationship	Contact information that can be used for sending comments about the Data Service.	0..*	vcard:Kind
description	Property	A free-text account of the Data Service. This property can be repeated for parallel language versions of the description.	0..*	rdfs:Literal
endpointDescription	Property	A description of the services available via the end-points, including their operations, parameters etc. The property gives specific details of the actual endpoint instances, while the property application profile (dct:conformsTo) is used to indicate the general standard or specification that the endpoints implement.	0..*	rdfs:Resource
endpointURL	Property	The root location or primary endpoint of the service (an IRI).	1..*	dcat:endpointURL
format	Property	The structure that can be returned by querying the endpointURL.	0..*	dcat:MediaTypeOrExtent
keyword	Property	A keyword or tag describing the Data Service.	0..*	rdfs:Literal
landingPage	Property	A web page that provides access to the Data Service and/or additional information. It is intended to point to a landing page at the original data service provider, not to a page on a site of a third party, such as an aggregator.	0..*	foaf:Document
license	Property	A licence under which the Data service is made available.	0..1	dct:LicenseDocument
publisher	Relationship	An entity (organisation) responsible for making the Data Service available.	0..1	foaf:Agent
servesDataset	Relationship	This property refers to a collection of data that this data service can distribute.	0..*	dcat:Dataset
theme	Property	A category of the Data Service. A Data Service may be associated with multiple themes.	0..*	skos:Concept
title	Property	A name given to the Data Service. This property can be repeated for parallel language versions of the name.	1..*	rdfs:Literal

Listing 5 shows an excerpt of the schema for the NGSI-LD mapping for the DCAT-AP Data Service class. The complete JSON Schema can be found in Annex B.

Listing 5: Snippet of the JSON Schema for the NGSI-LD Data Service entity

```
{
```

```

"$schema": "https://json-schema.org/draft/2020-12/schema",
"$schemaVersion": "1.0.1",
"$id": "DCAT-AP_NGSI-LD_Mapping/DataService/schema.json",
"title": "Data Service DCAT-AP",
"description": "Data Services compliant with DCAT-AP specification version 3.0.0.",
"type": "object",
"properties": {
  "type": {
    "description": "Property. Model:'https://schema.org/Text'. It has to be DataService",
    "type": "string",
    "enum": [
      "DataService"
    ]
  },
  "id": {
    "description": "Identifier format of any NGSI entity of type DataService.",
    "type": "string",
    "minLength": 1,
    "maxLength": 256,
    "pattern": "^[\\w\\-\\.\\{\\}\\$\\+\\*\\[\\]\\`|~^@!,:\\\\\\\\]+$"
  },
  "accessRights": {
    "description": "Property. Model:'http://purl.org/dc/terms/RightsStatement'. This property refers to a statement that specifies rights associated with the Data Service. The Access Rights Named Authority List is the recommended vocabulary provided at http://publications.europa.eu/resource/authority/access-right",
    "type": "string"
  },
  "applicableLegislation": {
    "description": "Property. Model:'http://data.europa.eu/eli/ontology#LegalResource'. The legislation that mandates the creation or management of the Data Service. It is aligned with the ontology included in Council conclusions inviting the introduction of the European Legislation Identifier (ELI). In this data specification the use is restricted to instances of this class that follow the (ELI) URI guidelines.",
    "type": "string"
  },
  "applicationProfile": {
    "description": "Relationship. Model:'http://purl.org/dc/terms/Standard'. An established (technical) standard to which the Data Service conforms. \tThe standards referred here SHOULD describe the Data Service and not the data it serves. The latter is provided by the dataset with which this Data Service is connected. For instance, the data service adheres to the OGC WFS API standard, while the associated dataset adheres to the INSPIRE Address data model.",
    "type": "string"
  },
  "contactPoint": {
    "description": "Relationship. Model:'vcard\\thttp://www.w3.org/2006/vcard/ns#Kind'. Contact information that can be used for sending comments about the Data Service. Note that the class Kind is the parent class for the four explicit types of vCard (Individual, Organization, Location, Group).",
    "type": "string"
  },
  "description": {
    "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. This property contains a free-text account of the Data Service. This property can be repeated for parallel language versions of the description.",
    "type": "string"
  },
  "endpointDescription": {
    "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Resource'. A description of the services available via the end-points, including their operations, parameters etc. \tThe property gives specific details of the actual endpoint instances, while the property application profile (dct:conformsTo) is used to indicate the general standard or specification that the endpoints implement.",
    "type": "string"
  },
  "endpointURL": {
    "description": "Property. Model:'https://www.w3.org/ns/dcat#accessURL'. The root location or primary endpoint of the service (an IRI).",
    "type": "string"
  },
  "format": {
    "description": "Property. Model:'http://purl.org/dc/terms/MediaTypeOrExtent'. The structure that can be returned by querying the endpointURL.",
    "type": "string"
  }
}

```

```

"keyword": {
  "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. This
property contains a keyword or tag describing the Data Service. This property can contain as many
keywords as necessary",
  ...
},
"landingPage": {
  "description": "Property. Model:'http://xmlns.com/foaf/0.1/homepage'. This property refers
to a web page that provides access to the Data Service and/or additional information.",
  ...
},
"license": {
  "description": "Relationship. Model:'http://purl.org/dc/terms/LicenseDocument'. A licence
under which the Data service is made available. ",
  ...
},
"publisher": {
  "description": "Relationship. Model:'http://xmlns.com/foaf/0.1/#term_Agent'. This property
links to an entity (organisation) responsible for making the Data Service available",
  ...
},
"servesDataset": {
  "description": "Relationship. Model:'http://www.w3.org/ns/dcat#Dataset'. This property
refers to a collection of data that this data service can distribute.",
  ...
},
"theme": {
  "description": "Property. Model:'http://www.w3.org/2004/02/skos/core#ConceptScheme'. This
property refers to a knowledge organization system used to classify the Catalogue's Datasets. The
Dataset Theme Vocabulary is the recommended vocabulary provided at
http://publications.europa.eu/resource/authority/data-theme",
  ...
},
"title": {
  "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. This
property contains a name given to the Data Service. This property can be repeated for parallel
language versions of the title",
  ...
},
"@context": {
  "type": "array"
}
},
"required": [
  "id",
  "type",
  "endpointURL",
  "title"
],
"additionalProperties": false
}

```

Some examples of the usage of the NGSI-LD entity of type DataService can be found in Annex A.

5.1.6 Agent

Figure 6 shows the attributes and class hierarchy for the DCAT-AP Agent class.

foaf:Agent	
<<mandatory>>	+ foaf:name: rdfs:Literal [1..*]
<<recommended >>	+ dct:agentType: skos:Concept [0..1]

Figure 6: Attributes and class hierarchy for the Agent class

This class is meant for describing any entity carrying out actions with respect to the entities Catalogue and the Catalogued Resources (i.e. Datasets and Data Services).

It has the following properties: name and type.

Table 6 summarizes these properties as on which type of NGSI-LD property they are mapped into, its description and usage recommendation, its cardinality and the range for each of them.

Table 6: Details on the Agent entities' properties

Property	NGSI-LD type	Description and Usage	Card.	Range
name	Property	A name of the agent. This property can be repeated for different versions of the name (e.g. the name in different languages)	1..*	rdfs:Literal
agentType	Property	The nature of the agent.	0..1	skos:Concept

Listing 6 shows a excerpt of the schema for the NGSI-LD mapping for the DCAT-AP Data Service class. The complete JSON Schema can be found in Annex B.

Listing 6: Snippet of the JSON Schema for the NGSI-LD Data Service entity

```
{
  "$schema": "https://json-schema.org/draft/2020-12/schema",
  "$schemaVersion": "1.0.1",
  "$id": "DCAT-AP_NGSI-LD_Mapping/Agent/schema.json",
  "title": "DCAT-AP Agent",
  "description": "Agents compliant with DCAT-AP specification version 3.0.0.",
  "type": "object",
  "properties": {
    "type": {
      "description": "Property. Model:'https://schema.org/Text'. It has to be Agent",
      "type": "string",
      "enum": ["Agent"]
    },
    "id": {
      "description": "Identifier format of any NGSI entity of type DataService.",
      ...
    },
    "name": {
      "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. This property contains a name of the agent. This property can be repeated for different versions of the name (e.g. the name in different languages).",
      ...
    },
    "agentType": {
      "description": "Property. http://www.w3.org/2004/02/skos/core#Concept'. The nature of the agent.",
      ...
    }
  },
  "required": ["id", "type", "name"],
  "additionalProperties": false
}
```

5.1.7 Location

Figure 7 shows the attributes and class hierarchy for the DCAT-AP Location class.

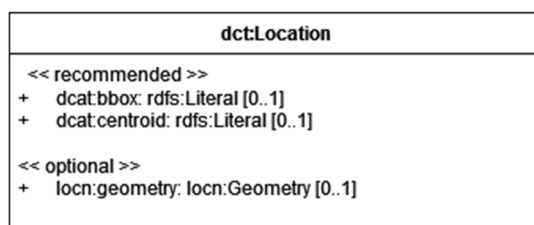


Figure 7: Attributes and class hierarchy for the Location class

This class is meant for describing a spatial region or named place. It has the following properties: bbox, centroid and geometry.

Table 7 summarizes these properties as on which type of NGSI-LD property they are mapped into, its description and usage recommendation, its cardinality and the range for each of them.

Table 7: Details on the Location entities' properties

Property	NGSI-LD type	Description and Usage	Card.	Range
bbox	VocabProperty	The geographic bounding box of a resource. The EU Vocabularies Name Authority Lists have to be used for continents, countries and places that are in those lists; if a particular location is not in one of the mentioned Named Authority Lists, Geonames URIs have to be used.	0..1	rdfs:Literal
centroid	VocabProperty	The geographic centre (centroid) of a resource. The EU Vocabularies Name Authority Lists have to be used for continents, countries and places that are in those lists; if a particular location is not in one of the mentioned Named Authority Lists, Geonames URIs have to be used.	0..1	rdfs:Literal
geometry	GeoProperty	The corresponding geometry for a resource.	0..1	locn:Geomety

Listing 7 shows an excerpt of the schema for the NGSI-LD mapping for the DCAT-AP Location class. The complete JSON Schema can be found in Annex B.

Listing 7: Snippet of the JSON Schema for the NGSI-LD Location entity

```
{
  "$schema": "https://json-schema.org/draft/2020-12/schema",
  "$schemaVersion": "1.0.1",
  "$id": "DCAT-AP_NGSI-LD_Mapping/Location/schema.json",
  "title": " DCAT-AP Location",
  "description": "Location compliant with DCAT-AP specification version 3.0.0.",
  "type": "object",
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "Location"
      ]
    },
    "description": "Property. Model:'https://schema.org/Text'. It has to be Location"
  },
  "id": {
    "description": " Identifier format of any NGSI entity of type Location.",
    ...
  },
  "bbox": {
    "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. The
    geographic bounding box of a resource. The EU Vocabularies Name Authority Lists have to be used
    for continents, countries and places that are in those lists; if a particular location is not in
    one of the mentioned Named Authority Lists, Geonames URIs have to be used. The EU Vocabularies
    Continents Named Authority List, EU Vocabularies Countries Named Authority List, EU Vocabularies
    Places Named Authority List and Geonames are provided at
    http://publications.europa.eu/resource/authority/continent,
    http://publications.europa.eu/resource/authority/country,
    http://publications.europa.eu/resource/authority/place and http://sws.geonames.org/",
    ...
  },
  "centroid": {
    "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. The
    geographic center (centroid) of a resource. The EU Vocabularies Name Authority Lists have to be
    used for continents, countries and places that are in those lists; if a particular location is not
    in one of the mentioned Named Authority Lists, Geonames URIs have to be used. The EU Vocabularies
    Continents Named Authority List, EU Vocabularies Countries Named Authority List, EU Vocabularies
    Places Named Authority List and Geonames are provided at
    http://publications.europa.eu/resource/authority/continent,
    http://publications.europa.eu/resource/authority/country,
    http://publications.europa.eu/resource/authority/place and http://sws.geonames.org/",
    ...
  },
  "geometry": {
    "description": "GeoProperty. Model:' http://www.w3.org/ns/locn#Geometry'. This property
    refers to a geographic region that is covered by the corresponding resource (i.e. Catalogue,
    Dataset or DatasetSeries).",
    ...
  },
  "@context": {
    "type": "array"
  }
}
```

```

"required": [
  "id",
  "type"
],
"additionalProperties": false
}

```

Some examples of the usage of the NGSI-LD entity of type Location can be found in Annex A.

5.1.8 Catalogue Record

Figure 8 shows the attributes and class hierarchy for the DCAT-AP CatalogueRecord class.

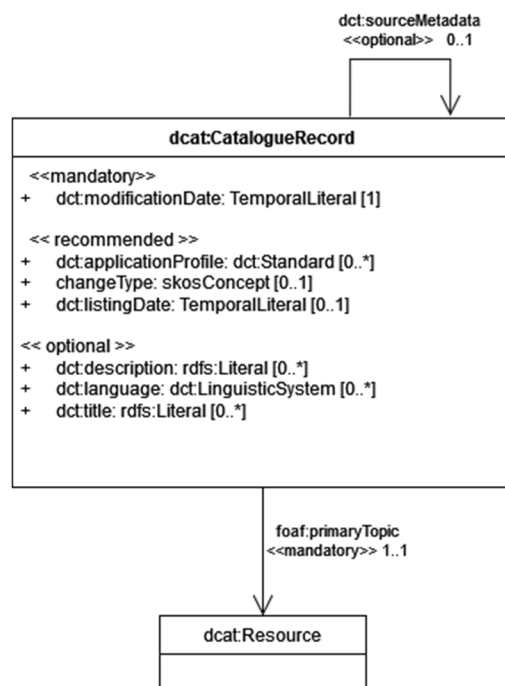


Figure 8: Attributes and class hierarchy for the CatalogueRecord class

This class is meant for providing a description of a Catalogued Resource's entry in the Catalogue. It has the following properties: application profile, change type, description, language, listing date, modification date, primary topic, source metadata, and title.

Table 8 summarizes these properties as on which type of NGSI-LD property they are mapped into, its description and usage recommendation, its cardinality and the range for each of them.

Table 8: Details on the CatalogueRecord entities' properties

Property	NGSI-LD type	Description and Usage	Card.	Range
applicationProfile	Property	An Application Profile that the Catalogued Resource's metadata conforms to.	0..*	dct:Standard
changeType	Property	The status of the catalogue record in the context of editorial flow of the dataset and data service descriptions.	0..1	skos:Concept
description	Property	A free-text account of the record. This property can be repeated for parallel language versions of the description.	0..*	rdfs:Literal

Property	NGSI-LD type	Description and Usage	Card.	Range
language	Property	A language used in the textual metadata describing titles, descriptions, etc. of the Catalogued Resource. This property can be repeated if the metadata is provided in multiple languages. EU Vocabularies Languages Named Authority List (http://publications.europa.eu/resource/authority/language).	0..*	dct:LinguisticSystem
listingDate	Property	The date on which the description of the Resource was included in the Catalogue.	0..1	rdfs:Literal
modificationDate	Property	The most recent date on which the Catalogue entry was changed or modified.	1	rdfs:Literal
primaryTopic	Relationship	A link to the Dataset, Data service or Catalogue described in the record. A catalogue record will refer to one entity in a catalogue. This can be either a Dataset or a Data Service. To ensure an unambiguous reading of the cardinality the range is set to Catalogued Resource. However, it is not the intend with this range to require the explicit use of the class Catalogued Record. As abstract class, a subclass should be used.	1	dcat:Resource
sourceMetadata	Relationship	The original metadata that was used in creating metadata for the Dataset.	0..1	dcat:CatalogueRecord
title	Property	A name given to the Data Service. This property can be repeated for parallel language versions of the name.	0..*	rdfs:Literal

Listing 8 shows an excerpt of the schema for the NGSI-LD mapping for the DCAT-AP Catalogue Record class. The complete JSON Schema can be found in Annex B.

Listing 8: Snippet of the JSON Schema for the NGSI-LD Catalogue Record entity

```
{
  "$schema": "https://json-schema.org/draft/2020-12/schema",
  "$schemaVersion": "1.0.1",
  "$id": "DCAT-AP_NGSI-LD_Mapping/CatalogueRecord/schema.json",
  "title": "DCAT-AP Catalogue Record",
  "description": "Catalogue Record compliant with DCAT-AP specification version 3.0.0.",
  "type": "object",
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "CatalogueRecord"
      ],
      "description": "Property. Model:'https://schema.org/Text'. It has to be CatalogueRecord"
    },
    "id": {
      "description": "Identifier format of any NGSI entity of type CatalogueRecord.",
      ...
    },
    "applicationProfile": {
      "description": "Relationship. Model:'http://purl.org/dc/terms/Standard'. An Application Profile that the Catalogued Resource's metadata conforms to.",
      ...
    },
    "changeType": {
      "description": "Property. Model:'http://www.w3.org/ns/adms#status'. The status of the catalogue record in the context of editorial flow of the dataset and data service descriptions.",
      ...
    },
    "description": {
      "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. A free-text account of the record. This property can be repeated for parallel language versions of the description. ",
      ...
    },
  },
}
```

```

    "language": {
      "description": "Property. Model:'http://purl.org/dc/terms/LinguisticSystem'. A language used
in the textual metadata describing titles, descriptions, etc. of the Catalogued Resource. This
property can be repeated if the metadata is provided in multiple languages.",
      ...
    },
    "listingDate": {
      "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. The date on
which the description of the Resource was included in the Catalogue.",
      ...
    },
    "modificationDate": {
      "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. The most
recent date on which the Catalogue entry was changed or modified.",
      ...
    },
    "primaryTopic": {
      "description": "Relationship. Model:'http://www.w3.org/ns/dcat#Resource'. A link to the
Dataset, Data service or Catalogue described in the record. A catalogue record will refer to one
entity in a catalogue. This can be either a Dataset or a Data Service. To ensure an unambiguous
reading of the cardinality the range is set to Catalogued Resource. However, it is not the intend
with this range to require the explicit use of the class Catalogued Record. As abstract class, an
subclass should be used.",
      ...
    },
    "sourceMetadata": {
      "description": "Relationship. Model:'http://www.w3.org/ns/dcat#CatalogueRecord'. The
original metadata that was used in creating metadata for the Dataset.",
      ...
    },
    "title": {
      "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. This
property contains a name given to the Catalogue Record. This property can be repeated for parallel
language versions of the name.",
      ...
    },
    "@context": {
      "type": "array"
    }
  },
  "required": [
    "id",
    "type",
    "primaryTopic",
    "modificationDate"
  ],
  "additionalProperties": false
}

```

Some examples of the usage of the NGS-LD entity of type CatalogueRecord can be found in Annex A.

5.1.9 Catalogued Resource

This class is meant for describing a resource published or curated by a single agent. DCAT-AP specification does not impose any additional requirements to properties for this entity.

This class Catalogued Record is an abstract class for DCAT-AP. Therefore, only subclasses (i.e. Dataset, Dataset Series and Data Service) should be used in a data exchange.

The present document does not impose any additional requirements to properties for this entity.

5.1.10 Checksum

This class is meant for describing a value that allows the contents of a file to be authenticated.

This class allows the results of a variety of checksum and cryptographic message digest algorithms to be represented. It has the following properties are defined: algorithm, and checksum value.

Table 9 summarizes these properties as on which type of NGS-LD property they are mapped into, its description and usage recommendation, its cardinality and the range for each of them.

Table 9: Details on the Checksum entities' properties

Property	NGSI-LD type	Description and Usage	Card.	Range
algorithm	Property	The algorithm used to produce the subject Checksum.	1	spdx:algorithm
checksumValue	Property	A lower case hexadecimal encoded digest value produced using a specific algorithm.	1	xsd:hexBinary

Listing 9 shows an excerpt of the schema for the NGSI-LD mapping for the DCAT-AP Checksum class. The complete JSON Schema can be found in Annex B.

Listing 9: Snippet of the JSON Schema for the NGSI-LD Checksum entity

```
{
  "$schema": "https://json-schema.org/draft/2020-12/schema",
  "$schemaVersion": "1.0.1",
  "$id": "DCAT-AP_NGSI-LD_Mapping/Checksum/schema.json",
  "title": " DCAT-AP Checksum ",
  "description": "Checksum compliant with DCAT-AP specification version 3.0.0.",
  "type": "object",
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "Checksum"
      ],
      "description": "Property. Model:'https://schema.org/Text'. It has to be Checksum"
    },
    "id": {
      "description": " Identifier format of any NGSI entity of type Checksum.",
      ...
    },
    "algorithm": {
      "description": "Relationship. Model:' http://data.europa.eu/r5r/ChecksumAlgorithm'. An Application Profile that the Catalogued Resource's metadata conforms to.",
      ...
    },
    "checksumValue": {
      "description": "Property. Model:' https://www.w3.org/2001/XMLSchema#hexBinary'. A lower case hexadecimal encoded digest value produced using a specific algorithm. ",
      ...
    },
    "@context": {
      "type": "array"
    }
  },
  "required": [
    "id",
    "type",
    "primaryTopic",
    "modificationDate"
  ],
  "additionalProperties": false
}
```

6 NGSI-LD handling of DCAT-AP Location entities

As it has been introduced in clause 5.1.7, the DCAT-AP specification defines a specific DCAT-AP class for describing the areas covered by Catalogues, Datasets and Dataset Series. This class acts as the Range for the geographicalCoverage attribute for these entities.

While in NGSI-LD the description of locations and/or areas is typically handled making use of GeoProperties (in order to exploit the special geographical queries defined in the API), in the present document, the solution proposed has adopted a different approach in order to make the NGSI-LD mapping as respectful with the DCAT-AP specification as possible.

In this sense, the `geographicalCoverage` attribute of DCAT-AP Catalogues, Datasets and Dataset Series, have been modelled as a Relationship, connecting any entity of these types with a specific Location entity, which, in turn is described using any of the attributes specified in clause 5.1.7.

This way, the use of controlled vocabularies, as it is recommended in the DCAT-AP specification, as well as detailed geometries (using NGSI-LD `GeoProperty` associated functionalities), is possible.

7 NGSI-LD handling of DCAT-AP based entities

7.0 Foreword

Clause 7 describes potential additions to the NGSI-LD API to directly generate the datasets' description from the actual context information (i.e. NGSI-LD entities and corresponding knowledge graph) that is available at a NGSI-LD Context Broker.

7.1 Creation of Data Services, Datasets and Dataset Series

7.1.0 Foreword

NGSI-LD is meant for enabling access to context data. DCAT-AP, on contrary, is meant for sharing information about Catalogues containing Datasets and Data Services descriptions in Europe. Basically, while NGSI-LD is focused on providing access to data, DCAT-AP's scope is on the description of metadata mainly about how these data are organised.

Having said this, metadata is, on its own, context information. Thus, it is subject to be expressed following the NGSI-LD information model (which is the main objective of the present document) and to be available through specific resources of the NGSI-LD API.

For this latter aspect, in this clause some options are discussed to be considered for augmenting the NGSI-LD API.

Before delving deeper into the details of these options, it is worth highlighting some important considerations on the mutual implications between NGSI-LD and DCAT-AP.

Firstly, DCAT-AP defines a hierarchy of classes on which the Catalogue is at the top; Datasets belong to a Catalogue; and data are accessible whether on a Distribution or through a Data Service. Figure 9 shows this hierarchy and the relationship among the NGSI-LD entities defined to represent these DCAT-AP classes.

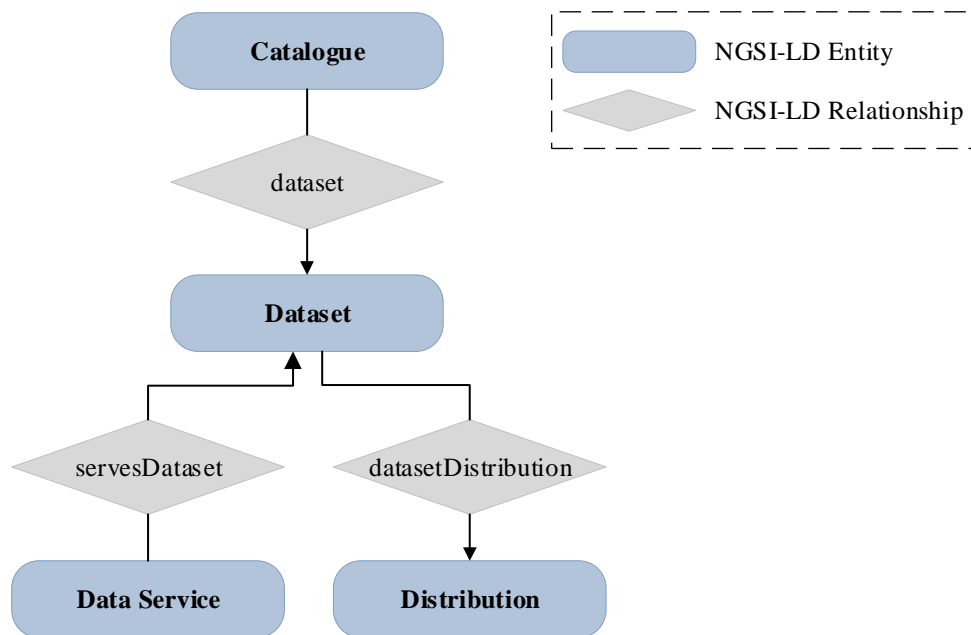


Figure 9: Relationships among Catalogue, Dataset, Data Service and Distribution classes

In this sense, neither Catalogue entities nor Dataset entities provide details on how to actually have access to data, but they are the Distribution and DataService entities the ones that contains the actual endpoints to download or query the data respectively. The reason for having two alternatives is related to the fact that DCAT-AP establishes a distinction between data arranged in a file (the concept behind DCAT-AP Distributions, "A physical embodiment of the Dataset in a particular format.") and data that is available through a service (the concept behind DCAT-AP Data Services, "A collection of operations that provides access to one or more datasets or data processing functions.").

However, it is clear that the DCAT-AP Data Service definition is the one that best fits with the way in which NGSI-LD makes context data available. Thus, in clause 7.1.1, the recommendations will focus on the description of data availability through DataServices entities, for which the corresponding NGSI-LD API resource has to be included as its *endpointURL* property as it is shown in Figure 10.

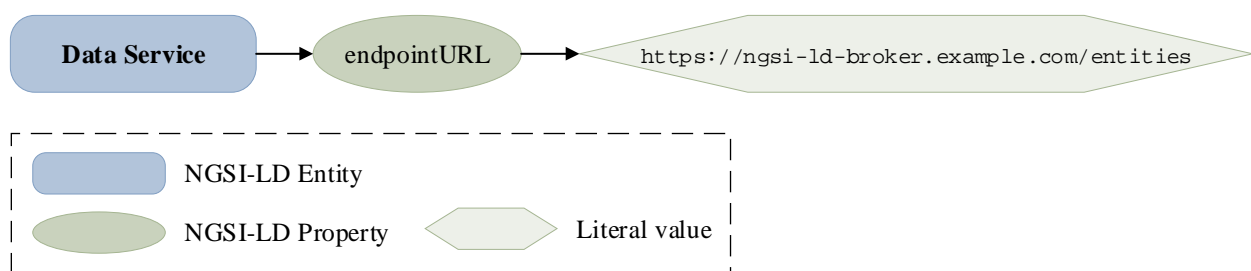


Figure 10: Example of endpointURL property specification within a DataService entity

Finally, the inclusion of the Dataset Series concept is an option that DCAT-AP supports to arrange Datasets that are related to one another beyond the fact that they are all contained in the same Catalogue. Figure 11 shows this hierarchy and the relationship among the NGSI-LD entities defined to represent these DCAT-AP classes.

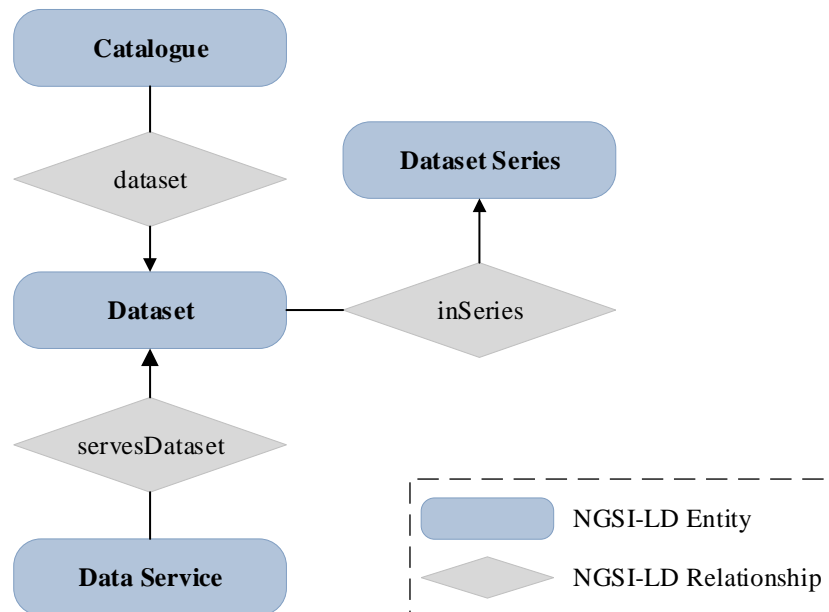


Figure 11: Relationships among Catalogue, Dataset, Data Service and DatasetSeries classes

7.1.1 Data Services

With the purpose of the autonomous creation of Data Services, a new resource would need to be included to the NGSI-LD API, */dataservices*. By means of this resource the DataService type entities stored in the Context Broker can be accessed. The proposed operations comprise the creation of the entity, retrieve of entity, update of attributes and deletion of the entity.

As for the retrieve (GET), update (PUT and/or PATCH) and delete (DELETE) operations, the system behaviour remains the same as for the */entities* resource. Both three actions make use of the id of the entity at the URI of the Context Broker such that:

- Retrieve: GET */dataservices/<entityId>*
- Update (Replace entity): PUT */dataservices/<entityId>*, Body: Entity[]
- Update (Merge entity): PATCH */dataservices/<entityId>*, Body: Entity Fragment[]
- Delete: DELETE */dataservices/<entityId>*

Nonetheless, the entity creation operation is proposed with an autonomous behaviour. Given that a Data Service describes the access to a set of data, its NGSI-LD property *endpointURL* is one of the most critical attributes, setting the access point to this data. The approach proposed enables the embedding of a query in the URI, subsequently being used as part of the URI to filter the data that conforms this Data Service. The general formulation is as follows:

- Autonomous creation: POST */dataservices?q=<query>*

Considering that the creation of entities derived from DCAT-AP needs from the data provider involvement in order to fill most of the entities' attributes, this autonomous POST operation within the NGSI-LD system has to generate the minimum entity required by the DCAT-AP specification. Thus, the autonomously generated entity has to include only its mandatory properties: *id*, *type*, *title*, and *endpointURL*. In the case that the rest of the available attributes presented in the clause 5.1.5 are to be added, PUT (Replace entity) and PATCH (Merge entity) operations described above have to be used.

EXAMPLE:

Autonomous creation

```
Request :
POST /dataservices?q==type="AirQualityObserved"
```

```

Response:
{
  "id": "urn:ngsi-ld:DataService:AirQualityObserved",
  "type": "DataService",
  "title": {
    "type": "Property",
    "value": ["Data Service on Air Quality Observed data."]
  },
  "endpointURL": {
    "type": "Property",
    "@id": "https://ngsi-ld-broker.example.com/entities?type=AirQualityObserved"
  },
  "@context": [
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld",
    "https://semiceu.github.io/DCAT-AP/releases/3.0.0/context/dcat-ap.jsonld",
    {
      "title": "DataService.title",
      "endpointURL": "DataService.endpointURL"
    }
  ]
}

```

Update (Merge entity):

```

Request:
PATCH /dataservices/urn:ngsi-ld:DataService:AirQualityObserved
Body:
{
  "title": {
    "type": "Property",
    "value": [
      "Data Service on air quality data on the city of Santander.",
      {
        "@language": "http://publications.europa.eu/resource/authority/language/SPA",
        "@value": "Data Service con datos sobre la calidad del aire en Santander."
      }
    ]
  },
  "description": {
    "type": "Property",
    "value": [
      "This is the Data Service on air quality data on the city of Santander.",
      {
        "@language": "http://publications.europa.eu/resource/authority/language/SPA",
        "@value": "Esta es la Data Service de la información de calidad del aire en Santander."
      }
    ]
  },
  "license": {
    "type": "Property",
    "@id": "https://creativecommons.org/licenses/by/4.0/"
  },
  "format": {
    "type": "Property",
    "@id": "http://publications.europa.eu/resource/authority/file-type/JSON_LD"
  },
  "landingPage": {
    "type": "Property",
    "@id": "https://ckan.salted-project.eu/"
  },
  "publisher": {
    "type": "Relationship",
    "@id": "urn:ngsi-ld:Agent:SALTED"
  },
  "@context": [
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld",
    "https://semiceu.github.io/DCAT-AP/releases/3.0.0/context/dcat-ap.jsonld",
    {
      "title": "DataService.title",
      "description": "DataService.description",
      "license": "DataService.license",
      "publisher": "DataService.publisher",
      "format": "DataService.format",
      "landingPage": "DataService.landingPage",
      "endpointURL": "DatasetSeries.endpointURL"
    }
  ]
}

```

```

    }
  ]
}

```

Response:
<List of attributes actually merged>

Retrieve:

Request:
GET /dataservices/urn:ngsi-ld:DataService:AirQualityObserved

```

Response:
{
  "id": "urn:ngsi-ld:DataService:AirQualityObserved",
  "type": "DataService",
  "endpointURL": {
    "type": "Property",
    "@id": "https://ngsi-ld-broker.example.com/entities?type=AirQualityObserved"
  },
  "title": {
    "type": "Property",
    "value": [
      "Data Service on air quality data on the city of Santander.",
      {
        "@language": "http://publications.europa.eu/resource/authority/language/SPA",
        "@value": "Data Service con datos sobre la calidad del aire en Santander."
      }
    ]
  },
  "description": {
    "type": "Property",
    "value": [
      "This is the Data Service on air quality data on the city of Santander.",
      {
        "@language": "http://publications.europa.eu/resource/authority/language/SPA",
        "@value": "Esta es la Data Service de la información de calidad del aire en Santander."
      }
    ]
  },
  "license": {
    "type": "Property",
    "@id": "https://creativecommons.org/licenses/by/4.0/"
  },
  "format": {
    "type": "Property",
    "@id": "http://publications.europa.eu/resource/authority/file-type/JSON_LD"
  },
  "landingPage": {
    "type": "Property",
    "@id": " https://ckan.salted-project.eu/"
  },
  "publisher": {
    "type": "Relationship",
    "@id": "urn:ngsi-ld:Agent:SALTED"
  },
  "@context": [
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld",
    "https://semiceu.github.io/DCAT-AP/releases/3.0.0/context/dcat-ap.jsonld",
    {
      "title": "DataService.title",
      "description": "DataService.description",
      "license": "DataService.license",
      "publisher": "DataService.publisher",
      "format": "DataService.format",
      "landingPage": "DataService.landingPage",
      "endpointURL": "DatasetSeries.endpointURL"
    }
  ]
}

```


7.1.2 Datasets

With the purpose of the autonomous creation of Datasets, a new resource should be included to the NGSI-LD API, */datasets*. By means of this resource the Dataset type entities stored in the Context Broker can be accessed. The proposed operations comprise the creation of the entity, retrieve of entity, update of attributes and deletion of the entity.

As for the retrieve (GET), update (PUT and/or PATCH) and delete (DELETE) operations, the system behaviour remains the same as for the */entities* resource. Both three actions make use of the id of the entity at the URI of the Context Broker such that:

- Retrieve: GET */datasets/<entityId>*
- Update (Replace entity): PUT */datasets/<entityId>*, Body: Entity[]
- Update (Merge entity): PATCH */datasets/<entityId>*, Body: Entity Fragment[]
- Delete: DELETE */datasets/<entityId>*

Nonetheless, the entity creation operation is proposed with an autonomous behaviour. The approach proposed enables the embedding of a query in the URI, subsequently being used to establish the aggregation of the data contained in the dataset. The general formulation is as follows:

- Autonomous creation: POST */datasets?q=<query>*

Considering that the creation of entities derived from DCAT-AP needs from the data provider involvement in order to fill most of the entities' attributes, this autonomous POST operation within the NGSI-LD system has to generate the minimum entity required by the DCAT-AP specification. Thus, the generated entity has to include only its mandatory properties: *id*, *type*, *title*, and *description*.

However, within the DCAT-AP specification, Datasets are not, as such, the direct containers of the actual data, but the Distributions and Data Services are the DCAT-AP classes that actually provides access to data. Moreover, as it has been mentioned above, access to context information leveraging the NGSI-LD API fits completely on the DCAT-AP definition of a Data Service (i.e. "A collection of operations that provides access to one or more datasets or data processing functions."). Thus, the most natural and complete way of representing the actual data availability should not be limited to the creation of a Dataset entity, but rather create the underlying DataService entity.

Data Services are related to their parent Dataset through the *servesDataset* attribute on the DataService specification. Hence, when creating the Dataset entity, it is recommended to create or update the corresponding DataService entity establishing the Relationship among them.

In the case that the rest of the available attributes presented in clause 5.1.2 are to be added, PUT (Replace entity) and PATCH (Merge entity) operations described above have to be used.

EXAMPLE:

Autonomous creation

```
Request:
POST /datasets?q==type="AirQualityObserved"
```

```
Response:
[
  {
    "id": "urn:ngsi-ld:Dataset:AirQualityObserved",
    "type": "Dataset",
    "title": {
      "type": "Property",
      "value": ["Dataset on Air Quality Observed data."]
    },
    "description": {
      "type": "Property",
      "value": ["This is the Dataset on Air Quality Observed data."]
    },
    "@context": [
      "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld",
      "https://semiceu.github.io/DCAT-AP/releases/3.0.0/context/dcat-ap.jsonld",
      {
        "title": "Dataset.title",
```

```

    "description": "Dataset.description"
  }
]
},
{
  "id": "urn:ngsi-ld:DataService:AirQualityObserved",
  "type": "DataService",
  "title": {
    "type": "Property",
    "value": ["Data Service on Air Quality Observed data."]
  },
  "endpointURL": {
    "type": "Property",
    "@id": "https://ngsi-ld-broker.example.com/entities?type=AirQualityObserved"
  },
  "servesDataset": {
    "type": "Relationship",
    "@id": "urn:ngsi-ld:Dataset:AirQualityObserved"
  },
  "@context": [
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld",
    "https://semiceu.github.io/DCAT-AP/releases/3.0.0/context/dcat-ap.jsonld",
    {
      "title": "DataService.title",
      "servesDataset": "DataService.servesDataset",
      "endpointURL": "DataService.endpointURL"
    }
  ]
}
]
}
]

```

Update (Merge entity):

```

Request:
PATCH /datasets/urn:ngsi-ld:Dataset:AirQualityObserved
Body:
{
  "title": {
    "type": "Property",
    "value": [
      "Dataset on air quality data on the city of Santander.",
      {
        "@language": "http://publications.europa.eu/resource/authority/language/SPA",
        "@value": "Dataset con datos sobre la calidad del aire en Santander."
      }
    ]
  },
  "description": {
    "type": "Property",
    "value": [
      "This is the Dataset on air quality data on the city of Santander.",
      {
        "@language": "http://publications.europa.eu/resource/authority/language/SPA",
        "@value": "Este es el Dataset de la información de calidad del aire en Santander."
      }
    ]
  },
  "keyword": {
    "type": "Property",
    "value": [
      {
        "@language": "http://publications.europa.eu/resource/authority/language/ENG",
        "@value": "environment"
      },
      {
        "@language": "http://publications.europa.eu/resource/authority/language/SPA",
        "@value": "medioambiente"
      }
    ]
  },
  "language": {
    "type": "Property",
    "value": [
      "http://publications.europa.eu/resource/authority/language/SPA",
      "http://publications.europa.eu/resource/authority/language/ENG"
    ]
  }
}

```

```

},
"releaseDate": {
  "type": "Property",
  "@value": "2022-05-14T12:32:47Z"
},
"geographicalCoverage": {
  "type": "Relationship",
  "@id": "urn:ngsi-ld:Location:Dataset:AirQualityObserved "
},
"accessRights": {
  "type": "Property",
  "@id": "http://publications.europa.eu/resource/authority/access-right/PUBLIC"
},
"@context": [
  "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld",
  "https://semiceu.github.io/DCAT-AP/releases/3.0.0/context/dcat-ap.jsonld",
  {
    "title": "Dataset.title",
    "description": "Dataset.description",
    "publisher": "Dataset.publisher",
    "keyword": "Dataset.keyword",
    "language": "Dataset.language",
    "releaseDate": "Dataset.releaseDate",
    "geographicalCoverage": "Dataset.geographicalCoverage",
    "accessRights": "Dataset.accessRights"
  }
]
}

```

```

Response:
<List of attributes actually merged>

```

Retrieve:

```

Request:
GET /datasets/urn:ngsi-ld:Dataset:AirQualityObserved

```

```

Response:
{
  "id": "urn:ngsi-ld:Dataset:AirQualityObserved",
  "type": "Dataset",
  "title": {
    "type": "Property",
    "value": [
      "Dataset on air quality data on the city of Santander.",
      {
        "@language": "http://publications.europa.eu/resource/authority/language/SPA",
        "@value": "Dataset con datos sobre la calidad del aire en Santander."
      }
    ]
  },
  "description": {
    "type": "Property",
    "value": [
      "This is the Dataset on air quality data on the city of Santander.",
      {
        "@language": "http://publications.europa.eu/resource/authority/language/SPA",
        "@value": "Este es el Dataset de la información de calidad del aire en Santander."
      }
    ]
  },
  "keyword": {
    "type": "Property",
    "value": [
      {
        "@language": "http://publications.europa.eu/resource/authority/language/ENG",
        "@value": "environment"
      },
      {
        "@language": "http://publications.europa.eu/resource/authority/language/SPA",
        "@value": "medioambiente"
      }
    ]
  },
  "language": {

```

```

    "type": "Property",
    "value": [
      "http://publications.europa.eu/resource/authority/language/SPA",
      "http://publications.europa.eu/resource/authority/language/ENG"
    ]
  },
  "releaseDate": {
    "type": "Property",
    "@value": "2022-05-14T12:32:47Z"
  },
  "geographicalCoverage": {
    "type": "Relationship",
    "@id": "urn:ngsi-ld:Location:Dataset:AirQualityObserved "
  },
  "accessRights": {
    "type": "Property",
    "@id": "http://publications.europa.eu/resource/authority/access-right/PUBLIC"
  },
  "@context": [
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld",
    "https://semiceu.github.io/DCAT-AP/releases/3.0.0/context/dcat-ap.jsonld",
    {
      "title": "Dataset.title",
      "description": "Dataset.description",
      "publisher": "Dataset.publisher",
      "keyword": "Dataset.keyword",
      "language": "Dataset.language",
      "releaseDate": "Dataset.releaseDate",
      "geographicalCoverage": "Dataset.geographicalCoverage",
      "accessRights": "Dataset.accessRights"
    }
  ]
}

```

7.1.3 Dataset Series

With the purpose of the autonomous creation of Dataset Series, a new resource should be included to the NGSI-LD API, `/datasetseries`. By means of this resource the DatasetSeries type entities stored in the Context Broker can be accessed. The proposed operations comprise the creation of the entity, retrieve of entity, update of attributes and deletion of the entity.

As for the retrieve (GET), update (PUT and/or PATCH) and delete (DELETE) operations, the system behaviour remains the same as for the `/entities` resource. Both three actions make use of the id of the entity at the URI of the Context Broker such that:

- Retrieve: GET `/datasetseries/<entityId>`
- Update (Replace entity): PUT `/datasetseries/<entityId>`, Body: Entity[]
- Update (Merge entity): PATCH `/datasetseries/<entityId>`, Body: Entity Fragment[]
- Delete: DELETE `/datasetseries/<entityId>`

Nonetheless, the entity creation operation is proposed with an autonomous behaviour. The approach proposed enables the embedding of a query in the URI, subsequently being used to establish the aggregation of the data contained in the dataset. The general formulation is as follows:

- Autonomous creation: POST `/datasetseries?q=<query>`

Considering that the creation of entities derived from DCAT-AP needs from the data provider involvement in order to fill most of the entities' attributes, this autonomous POST operation within the NGSI-LD system has to generate the minimum entity required by the DCAT-AP specification. Thus, the generated entity has to include only its mandatory properties: `id`, `type`, and `title`.

However, within the DCAT-AP specification, Dataset Series does not have much sense if the actual Datasets being part of such series do not exist. Thus, the most complete way of representing the actual existence of a Dataset Series should not be limited to the creation of a DatasetSeries entity on isolation, but rather create the initial Dataset entity on the series.

Datasets are related to their parent Dataset Series through the *inSeries* attribute on the Dataset specification. Hence, when creating the DatasetSeries entity it is recommended to create or update the corresponding Dataset entity establishing the Relationship among them. In case the underlying Dataset does not exist and it has to be created during the Dataset Series creation, then, the corresponding DataService entity has to be created as described in clause 7.1.2.

In the case that the rest of the available attributes presented in clause 5.1.3 are to be added, PUT (Replace entity) and PATCH (Merge entity) operations described above have to be used.

EXAMPLE:

Autonomous creation

```
Request:
POST /datasetseries?q==type="AirQualityObserved"
```

```
Response:
[
  {
    "id": "urn:ngsi-ld:DatasetSeries:AirQualityObserved",
    "type": "DatasetSeries",
    "title": {
      "type": "Property",
      "value": ["Dataset Series on Air Quality Observed data."]
    },
    "@context": [
      "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld",
      "https://semiceu.github.io/DCAT-AP/releases/3.0.0/context/dcat-ap.jsonld",
      {
        "title": "DatasetSeries.title",
      }
    ]
  },
  {
    "id": "urn:ngsi-ld:Dataset:AirQualityObserved",
    "type": "Dataset",
    "title": {
      "type": "Property",
      "value": ["Dataset on Air Quality Observed data."]
    },
    "description": {
      "type": "Property",
      "value": ["This is the Dataset on Air Quality Observed data."]
    },
    "inSeries": {
      "type": "Relationship",
      "@id": "urn:ngsi-ld:DatasetSeries:AirQualityObserved"
    },
    "@context": [
      "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld",
      "https://semiceu.github.io/DCAT-AP/releases/3.0.0/context/dcat-ap.jsonld",
      {
        "title": "Dataset.title",
        "inSeries": "Dataset.inSeries",
        "description": "Dataset.description"
      }
    ]
  },
  {
    "id": "urn:ngsi-ld:DataService:AirQualityObserved",
    "type": "DataService",
    "title": {
      "type": "Property",
      "value": ["Data Service on Air Quality Observed data."]
    },
    "endpointURL": {
      "type": "Property",
      "@id": "https://ngsi-ld-broker.example.com/entities?type=AirQualityObserved"
    },
    "servesDataset": {
```

```

    "type": "Relationship",
    "@id": "urn:ngsi-ld:Dataset:AirQualityObserved"
  },
  "@context": [
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld",
    "https://semiceu.github.io/DCAT-AP/releases/3.0.0/context/dcat-ap.jsonld",
    {
      "title": "DataService.title",
      "endpointURL": "DataService.endpointURL"
    }
  ]
}
]

```

Update (Merge entity):

```

Request:
PATCH /datasetseries/urn:ngsi-ld:DatasetSeries:AirQualityObserved
Body:
{
  "title": {
    "type": "Property",
    "value": [
      "Dataset Series on air quality data on the city of Santander.",
      {
        "@language": "http://publications.europa.eu/resource/authority/language/SPA",
        "@value": "Serie de Dataset con datos sobre la calidad del aire en Santander."
      }
    ]
  },
  "description": {
    "type": "Property",
    "value": [
      "This is the Dataset Series on air quality data on the city of Santander.",
      {
        "@language": "http://publications.europa.eu/resource/authority/language/SPA",
        "@value": "Esta es la Serie de Dataset de la información de calidad del aire en Santander."
      }
    ]
  },
  "releaseDate": {
    "type": "Property",
    "@value": "2022-05-14T12:32:47Z"
  },
  "publisher": {
    "type": "Relationship",
    "@id": "urn:ngsi-ld:Agent:SALTED"
  },
  "geographicalCoverage": {
    "type": "Relationship",
    "@id": "urn:ngsi-ld:Location:DatasetSeries:AirQualityObserved"
  },
  "modificationDate": {
    "type": "Property",
    "@value": "2023-05-16T15:11:59Z"
  },
  "frequency": {
    "type": "Property",
    "value": "http://publications.europa.eu/resource/authority/frequency/MONTHLY"
  },
  "@context": [
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld",
    "https://semiceu.github.io/DCAT-AP/releases/3.0.0/context/dcat-ap.jsonld",
    {
      "title": "DatasetSeries.title",
      "description": "DatasetSeries.description",
      "releaseDate": "DatasetSeries.releaseDate",
      "publisher": "DatasetSeries.publisher",
      "modificationDate": "DatasetSeries.modificationDate",
      "geographicalCoverage": "DatasetSeries.geographicalCoverage",
      "frequency": "DatasetSeries.frequency"
    }
  ]
}

```

```
Response:
<List of attributes actually merged>
```

Retrieve:

```
Request:
GET /datasetseries/urn:ngsi-ld:DatasetSeries:AirQualityObserved
```

```
Response:
{
  "id": "urn:ngsi-ld:DatasetSeries:AirQualityObserved",
  "type": "DatasetSeries",
  "title": {
    "type": "Property",
    "value": [
      "Dataset Series on air quality data on the city of Santander.",
      {
        "@language": "http://publications.europa.eu/resource/authority/language/SPA",
        "@value": "Serie de Dataset con datos sobre la calidad del aire en Santander."
      }
    ]
  },
  "description": {
    "type": "Property",
    "value": [
      "This is the Dataset Series on air quality data on the city of Santander.",
      {
        "@language": "http://publications.europa.eu/resource/authority/language/SPA",
        "@value": "Esta es la Serie de Dataset de la informaci3n de calidad del aire en
Santander."
      }
    ]
  },
  "releaseDate": {
    "type": "Property",
    "@value": "2022-05-14T12:32:47Z"
  },
  "publisher": {
    "type": "Relationship",
    "@id": "urn:ngsi-ld:Agent:SALTED"
  },
  "geographicalCoverage": {
    "type": "Relationship",
    "@id": "urn:ngsi-ld:Location:DatasetSeries:AirQualityObserved"
  },
  "modificationDate": {
    "type": "Property",
    "@value": "2023-05-16T15:11:59Z"
  },
  "frequency": {
    "type": "Property",
    "value": "http://publications.europa.eu/resource/authority/frequency/MONTHLY"
  },
  "@context": [
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld",
    "https://semiceu.github.io/DCAT-AP/releases/3.0.0/context/dcat-ap.jsonld",
    {
      "title": "DatasetSeries.title",
      "description": "DatasetSeries.description",
      "releaseDate": "DatasetSeries.releaseDate",
      "publisher": "DatasetSeries.publisher",
      "modificationDate": "DatasetSeries.modificationDate",
      "geographicalCoverage": "DatasetSeries.geographicalCoverage",
      "frequency": "DatasetSeries.frequency"
    }
  ]
}
```

7.2 Data Services creation upon Context Source registration

A Context Source represents a source of context data within an NGSI-LD architecture. Its registration within the NGSI-LD architecture provides the system with knowledge about what data is available and to which access point it should be requested. This registration is done through the ContextSourceRegistration entity type.

A Data Service is a class defined in DCAT-AP for the description of a collection of operations that provides access to one or more datasets or data processing functions. Therefore, within the NGSI-LD domain, its relationship with Context Sources is straightforward: a DataService entity is used for the description of Context Sources, providing the information and metadata necessary for its full understanding, through the properties and relationships described in clause 5.1.5.

The approach proposed is based on the creation of Data Services upon Context Source registration in an autonomous way, making use of the endpoint and its HTTP binding described in clause 7.1.1. There are several alternatives to consider:

- Creation of a Data Service per type of registered data.
- Creation of a Data Service per registered data type and specified pattern identifier (*idPattern*).
- Creation of a Data Service per Context Source.

Supporting these or other options should be considered for augmenting the NGSI-LD API, but it should be up to the infrastructure manager to decide which approach to implement. Nevertheless, the most straightforward choice would appear to be the first option, where a Data Service is created for each type of data registered.

EXAMPLE:

Autonomous creation

```
Request:
POST /csourceRegistrations?q==type="AirQualityObserved"
{
  "id": "urn:ngsi-ld:ContextSourceRegistration:AirQualityObserved",
  "type": "ContextSourceRegistration",
  "information": [
    {
      "entities": [
        {
          "type": "AirQualityObserved"
        }
      ],
    },
  ],
  "endpoint": " https://ngsi-ld-broker.example.com/entities?type=AirQualityObserved ",
  "@context": [
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld"
  ]
}
```

```
Response:
<Location Header>
```

Retrieve:

```
Request:
GET /dataservices/urn:ngsi-ld:DataService:AirQualityObserved
```

```
Response:
{
  "id": "urn:ngsi-ld:DataService:AirQualityObserved",
  "type": "DataService",
  "title": {
    "type": "Property",
    "value": ["Data Service on Air Quality Observed data."]
  },
  "endpointURL": {
    "type": "Property",
```



```

    "@id": "https://ngsi-ld-broker.example.com/entities?type=AirQualityObserved"
  },
  "@context": [
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld",
  ]
}

```

Update (Merge entity):

```

Request:
PATCH /dataservices/urn:ngsi-ld:DataService:AirQualityObserved
Body:
{
  "title": {
    "type": "Property",
    "value": [
      "Data Service on air quality data on the city of Santander.",
      {
        "@language": "http://publications.europa.eu/resource/authority/language/SPA",
        "@value": "Data Service con datos sobre la calidad del aire en Santander."
      }
    ]
  },
  "description": {
    "type": "Property",
    "value": [
      "This is the Data Service on air quality data on the city of Santander.",
      {
        "@language": "http://publications.europa.eu/resource/authority/language/SPA",
        "@value": "Esta es la Data Service de la información de calidad del aire en Santander."
      }
    ]
  },
  "license": {
    "type": "Property",
    "@id": "https://creativecommons.org/licenses/by/4.0/"
  },
  "format": {
    "type": "Property",
    "@id": "http://publications.europa.eu/resource/authority/file-type/JSON_LD"
  },
  "landingPage": {
    "type": "Property",
    "@id": " https://ckan.salted-project.eu/"
  },
  "publisher": {
    "type": "Relationship",
    "@id": "urn:ngsi-ld:Agent:SALTED"
  },
  "@context": [
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld",
    "https://semiceu.github.io/DCAT-AP/releases/3.0.0/context/dcat-ap.jsonld",
    {
      "title": "DataService.title",
      "description": "DataService.description",
      "license": "DataService.license",
      "publisher": "DataService.publisher",
      "format": "DataService.format",
      "landingPage": "DataService.landingPage",
      "endpointURL": "DatasetSeries.endpointURL"
    }
  ]
}

```

```

Response:
<List of attributes actually merged>

```

Retrieve:

```

Request:
GET /dataservices/urn:ngsi-ld:DataService:AirQualityObserved

```

```

Response:

```

```

{
  "id": "urn:ngsi-ld:DataService:AirQualityObserved",
  "type": "DataService",
  "endpointURL": {
    "type": "Property",
    "@id": "https://ngsi-ld-broker.example.com/entities?type=AirQualityObserved"
  },
  "title": {
    "type": "Property",
    "value": [
      "Data Service on air quality data on the city of Santander.",
      {
        "@language": "http://publications.europa.eu/resource/authority/language/SPA",
        "@value": "Data Service con datos sobre la calidad del aire en Santander."
      }
    ]
  },
  "description": {
    "type": "Property",
    "value": [
      "This is the Data Service on air quality data on the city of Santander.",
      {
        "@language": "http://publications.europa.eu/resource/authority/language/SPA",
        "@value": "Esta es la Data Service de la información de calidad del aire en Santander."
      }
    ]
  },
  "license": {
    "type": "Property",
    "@id": "https://creativecommons.org/licenses/by/4.0/"
  },
  "format": {
    "type": "Property",
    "@id": "http://publications.europa.eu/resource/authority/file-type/JSON_LD"
  },
  "landingPage": {
    "type": "Property",
    "@id": "https://ckan.salted-project.eu/"
  },
  "publisher": {
    "type": "Relationship",
    "@id": "urn:ngsi-ld:Agent:SALTED"
  },
  "@context": [
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld",
    "https://semiceu.github.io/DCAT-AP/releases/3.0.0/context/dcat-ap.jsonld",
    {
      "title": "DataService.title",
      "description": "DataService.description",
      "license": "DataService.license",
      "publisher": "DataService.publisher",
      "format": "DataService.format",
      "landingPage": "DataService.landingPage",
      "endpointURL": "DatasetSeries.endpointURL"
    }
  ]
}

```

7.3 Handling temporal data

Nowadays, temporal data and historical records are a matter of paramount importance for performing analysis and extracting valuable insights. Within the current NGSI-LD infrastructure, there exists a dedicated endpoint for the management of these temporal values, */temporal/entities*. Nevertheless, this approach combined with the presented DCAT-AP structures can be further exploited.

The suggested approach is based on the generation of the hierarchy shown in Figure 12 for handling temporal data, where the entities of type DatasetSeries, Dataset and DataServices are linked through relationships.

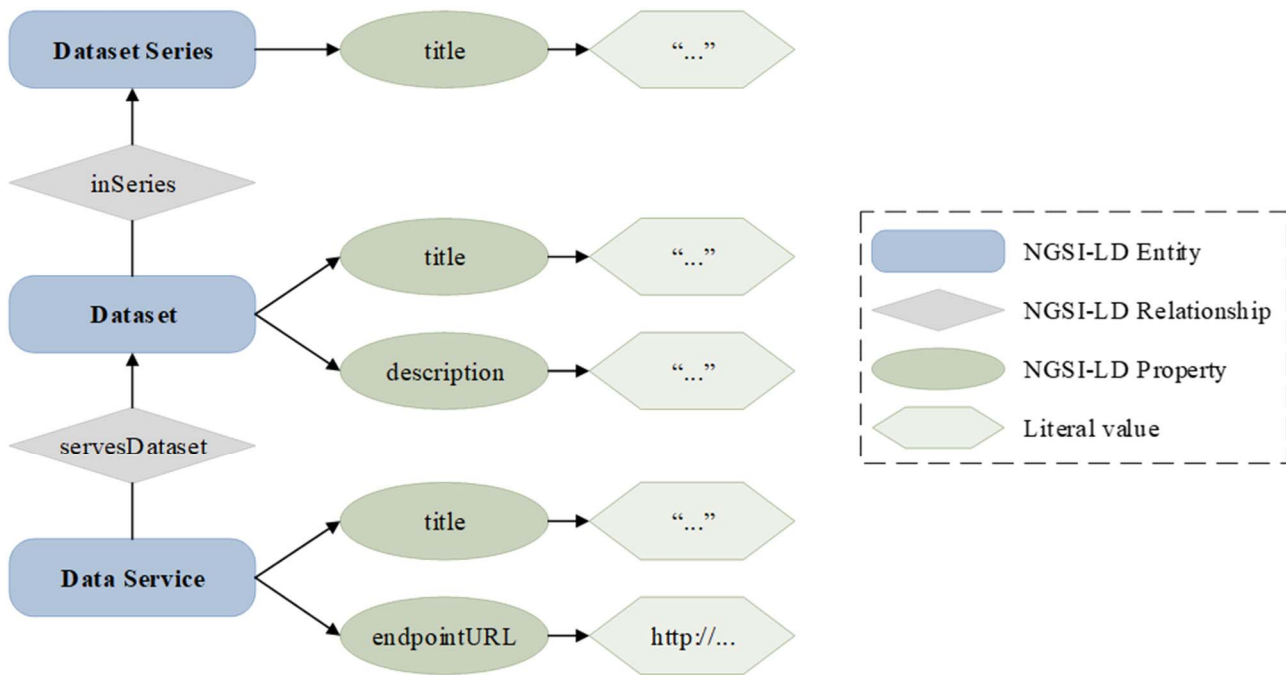


Figure 12: Example of properties specification within a DataService entity for handling temporal data

According to this structure, the parent entity has to be of type DatasetSeries, which defines a set of datasets forming a series that are, basically, structured according to a certain time periodicity. Each entity of type Dataset would describe a set of data with a temporal start and end date, whose data source is defined by a Data Service. This hierarchical structure, which target is based on handling temporal data, has to make use of the endpoints and HTTP requests described in clause 7.1.

The autonomous component of this strategy relies on an extension of the API presented in clause 7.1.3 in order to enable the possibility of specifying certain parameters that trigger the creation of all three entity structures. Its general formulation is:

- Autonomous creation: POST /datasetseries?q=<query>

where:

<query>=type==<type>;frequency=<frequency>;startsAt=<start_date>;endsAt=<end_date>

Given these parameters, the NGSI-LD infrastructure is able to create the Dataset Series entity as well as the required Datasets and Data Services. For example, if *frequency* is "MONTHLY" and *startsAt* and *endsAt* comprise a year of data, then the NGSI-LD infrastructure has to create a Dataset Series containing a Dataset per month (12 Datasets), each of them related with a Data Service (12 Data Services, 1 per month).

EXAMPLE:

(monthly frequency):

```

Data Service - April 2024
{
  "id": "urn:ngsi-ld:DataService:AirQualityObserved:April2024",
  "type": "DataService",
  "endpointURL": {
    "type": "Property",
    "@id": "https://ngsi-ld-broker.example.com/temporal/entities?type=AirQualityObserved&
?timerel=between&timeAt=2024-04-01T00%3A00%3A00Z&endTimeAt=2024-05-01T00%3A00%3A00Z"
  },
  "title": {
    "type": "Property",
    "value": [
      "Data Service on air quality data on the city of Santander from April 2024.",
      {
        "@language": "http://publications.europa.eu/resource/authority/language/SPA",
        "@value": "Data Service con datos sobre la calidad del aire en Santander en abril de
2024."
      }
    ]
  }
}

```

```

    }
  ],
  "description": {
    "type": "Property",
    "value": [
      "This is the Data Service on air quality data on the city of Santander from April 2024.",
      {
        "@language": "http://publications.europa.eu/resource/authority/language/SPA",
        "@value": "Esta es la Data Service de la información de calidad del aire en Santander en
abril de 2024."
      }
    ]
  },
  "format": {
    "type": "Property",
    "@id": "http://publications.europa.eu/resource/authority/file-type/JSON_LD"
  },
  "servesDataset": {
    "type": "Relationship",
    "@id": "urn:ngsi-ld:Dataset:AirQualityObserved:April2024"
  },
  "@context": [
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld",
    "https://semiceu.github.io/DCAT-AP/releases/3.0.0/context/dcat-ap.jsonld",
    {
      "title": "DataService.title",
      "description": "DataService.description",
      "format": "DataService.format",
      "endpointURL": "DatasetSeries.endpointURL",
      "servesDataset": "DataService.servesDataset",
    }
  ]
}

```

Dataset - April 2024

```

{
  "id": "urn:ngsi-ld:Dataset:AirQualityObserved:April2024",
  "type": "Dataset",
  "title": {
    "type": "Property",
    "value": [
      "Dataset on air quality data on the city of Santander from April 2024.",
      {
        "@language": "http://publications.europa.eu/resource/authority/language/SPA",
        "@value": "Dataset con datos sobre la calidad del aire en Santander en abril de 2024."
      }
    ]
  },
  "description": {
    "type": "Property",
    "value": [
      "This is the Dataset on air quality data on the city of Santander from April 2024.",
      {
        "@language": "http://publications.europa.eu/resource/authority/language/SPA",
        "@value": "Este es el Dataset de la información de calidad del aire en Santander en abril
de 2024."
      }
    ]
  },
  "keyword": {
    "type": "Property",
    "value": [
      {
        "@language": "http://publications.europa.eu/resource/authority/language/ENG",
        "@value": "environment"
      },
      {
        "@language": "http://publications.europa.eu/resource/authority/language/SPA",
        "@value": "medioambiente"
      }
    ]
  },
  "language": {
    "type": "Property",
    "value": [
      "http://publications.europa.eu/resource/authority/language/SPA",

```

```

    "http://publications.europa.eu/resource/authority/language/ENG"
  ]
},
"releaseDate": {
  "type": "Property",
  "@value": "2024-05-01T00:00:00Z"
},
"accessRights": {
  "type": "Property",
  "@id": "http://publications.europa.eu/resource/authority/access-right/PUBLIC"
},
"inSeries": {
  "type": "Relationship",
  "@id": "urn:ngsi-ld:DatasetSeries:AirQualityObserved"
},
"@context": [
  "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld",
  "https://semiceu.github.io/DCAT-AP/releases/3.0.0/context/dcat-ap.jsonld",
  {
    "title": "Dataset.title",
    "description": "Dataset.description",
    "keyword": "Dataset.keyword",
    "language": "Dataset.language",
    "releaseDate": "Dataset.releaseDate",
    "accessRights": "Dataset.accessRights",
    "isSeries": "Dataset.isSeries"
  }
]
}

```

```

Data Service - May 2024
{
  "id": "urn:ngsi-ld:DataService:AirQualityObserved:May2024",
  "type": "DataService",
  "endpointURL": {
    "type": "Property",
    "@id": "https://ngsi-ld-broker.example.com/temporal/entities?type=AirQualityObserved&
?timerel=between&timeAt=2024-05-01T00%3A00%3A00Z&endTimeAt=2024-06-01T00%3A00%3A00Z"
  },
  "title": {
    "type": "Property",
    "value": [
      "Data Service on air quality data on the city of Santander from May 2024.",
      {
        "@language": "http://publications.europa.eu/resource/authority/language/SPA",
        "@value": "Data Service con datos sobre la calidad del aire en Santander en mayo de 2024."
      }
    ]
  },
  "description": {
    "type": "Property",
    "value": [
      "This is the Data Service on air quality data on the city of Santander from May 2024.",
      {
        "@language": "http://publications.europa.eu/resource/authority/language/SPA",
        "@value": "Esta es la Data Service de la información de calidad del aire en Santander en
mayo de 2024."
      }
    ]
  },
  "format": {
    "type": "Property",
    "@id": "http://publications.europa.eu/resource/authority/file-type/JSON_LD"
  },
  "servesDataset": {
    "type": "Relationship",
    "@id": "urn:ngsi-ld:Dataset:AirQualityObserved:May2024"
  },
  "@context": [
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld",
    "https://semiceu.github.io/DCAT-AP/releases/3.0.0/context/dcat-ap.jsonld",
    {
      "title": "DataServuce.title",
      "description": "DataService.description",
      "format": "DataService.format",
      "endpointURL": "DatasetSeries.endpointURL",
      "servesDataset": "DataService.servesDataset",
    }
  ]
}

```

```

    }
  ]
}

Dataset - May 2024
{
  "id": "urn:ngsi-ld:Dataset:AirQualityObserved:May2024",
  "type": "Dataset",
  "title": {
    "type": "Property",
    "value": [
      "Dataset on air quality data on the city of Santander from May 2024.",
      {
        "@language": "http://publications.europa.eu/resource/authority/language/SPA",
        "@value": "Dataset con datos sobre la calidad del aire en Santander en mayo de 2024."
      }
    ]
  },
  "description": {
    "type": "Property",
    "value": [
      "This is the Dataset on air quality data on the city of Santander from May 2024.",
      {
        "@language": "http://publications.europa.eu/resource/authority/language/SPA",
        "@value": "Este es el Dataset de la información de calidad del aire en Santander en mayo
de 2024."
      }
    ]
  },
  "keyword": {
    "type": "Property",
    "value": [
      {
        "@language": "http://publications.europa.eu/resource/authority/language/ENG",
        "@value": "environment"
      },
      {
        "@language": "http://publications.europa.eu/resource/authority/language/SPA",
        "@value": "medioambiente"
      }
    ]
  },
  "language": {
    "type": "Property",
    "value": [
      "http://publications.europa.eu/resource/authority/language/SPA",
      "http://publications.europa.eu/resource/authority/language/ENG"
    ]
  },
  "releaseDate": {
    "type": "Property",
    "@value": "2024-06-01T00:00:00Z"
  },
  "accessRights": {
    "type": "Property",
    "@id": "http://publications.europa.eu/resource/authority/access-right/PUBLIC"
  },
  "inSeries": {
    "type": "Relationship",
    "@id": "urn:ngsi-ld:DatasetSeries:AirQualityObserved"
  },
  "@context": [
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld",
    "https://semiceu.github.io/DCAT-AP/releases/3.0.0/context/dcat-ap.jsonld",
    {
      "title": "Dataset.title",
      "description": "Dataset.description",
      "keyword": "Dataset.keyword",
      "language": "Dataset.language",
      "releaseDate": "Dataset.releaseDate",
      "accessRights": "Dataset.accessRights",
      "isSeries": "Dataset.isSeries"
    }
  ]
}

```

Dataset Series

```

{
  "id": "urn:ngsi-ld:DatasetSeries:AirQualityObserved",
  "type": "DatasetSeries",
  "title": {
    "type": "Property",
    "value": [
      "Dataset Series on monthly air quality data on the city of Santander.",
      {
        "@language": "http://publications.europa.eu/resource/authority/language/SPA",
        "@value": "Serie de Dataset mensual con datos sobre la calidad del aire en Santander"
      }
    ]
  },
  "description": {
    "type": "Property",
    "value": [
      "This is the Dataset Series on monthly air quality data on the city of Santander.",
      {
        "@language": "http://publications.europa.eu/resource/authority/language/SPA",
        "@value": "Esta es la Serie de Dataset mensual de la información de calidad del aire en Santander."
      }
    ]
  },
  "releaseDate": {
    "type": "Property",
    "@value": "2022-04-01T00:00:00Z"
  },
  "modificationDate": {
    "type": "Property",
    "@value": "2023-06-01T00:00:00Z"
  },
  "frequency": {
    "type": "Property",
    "value": "http://publications.europa.eu/resource/authority/frequency/MONTHLY"
  },
  "@context": [
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld",
    "https://semiceu.github.io/DCAT-AP/releases/3.0.0/context/dcat-ap.jsonld",
    {
      "title": "DatasetSeries.title",
      "description": "DatasetSeries.description",
      "releaseDate": "DatasetSeries.releaseDate",
      "modificationDate": "DatasetSeries.modificationDate",
      "frequency": "DatasetSeries.frequency"
    }
  ]
}

```

Annex A: Mapping examples

A.0 Foreword

Annex A presents usage examples of DCAT-AP classes mapped into NGSI-LD entities. Furthermore, the @context file that has to be used for any DCAT-AP entity is also provided.

A.1 Catalogue entity

Listing A-1: Basic example of Catalogue

```
{
  "id": "urn:ngsi-ld:Catalogue:id:SALTED-project",
  "type": "Catalogue",
  "title": {
    "type": "Property",
    "value": [
      {
        "@language": "http://publications.europa.eu/resource/authority/language/ENG",
        "@value": "SALTED Project"
      },
      {
        "@language": "http://publications.europa.eu/resource/authority/language/SPA",
        "@value": "Proyecto SALTED"
      }
    ]
  },
  "description": {
    "type": "Property",
    "value": [
      "This is the SALTED Project Catalogue. Data is available in JSON and JSON-LD format.",
      {
        "@language": "http://publications.europa.eu/resource/authority/language/SPA",
        "@value": "Este es el catalogo del proyecto SALTED. La informacion esta disponible en formato JSON y JSON-LD."
      }
    ]
  },
  "publisher": {
    "type": "Relationship",
    "@id": "urn:ngsi-ld:Agent:SALTED"
  },
  "dataset": {
    "type": "Relationship",
    "@id": [
      "urn:ngsi-ld:Dataset:Environment:AirQualityObserved",
      "urn:ngsi-ld:Dataset:Transportation:TrafficFlowObserved",
      "urn:ngsi-ld:Dataset:Parking:ParkingSpot"
    ]
  },
  "homepage": {
    "type": "Property",
    "@id": " https://ckan.salted-project.eu/ "
  },
  "releaseDate": {
    "type": "Property",
    "@value": "2023-05-14T12:32:47Z"
  },
  "geographicalCoverage": {
    "type": "Relationship",
    "@id": "urn:ngsi-ld:Location:Catalogue:SALTED-project"
  },
  "rights": {
    "type": "Property",
    "@id": "http://publications.europa.eu/resource/authority/access-right/PUBLIC"
  },
  "@context": [
```



```

"https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld",
"https://semiceu.github.io/DCAT-AP/releases/3.0.0/context/dcat-ap.jsonld",
{
  "title": "Catalogue.title",
  "description": "Catalogue.description",
  "publisher": "Catalogue.publisher",
  "dataset": "Catalogue.dataset",
  "homepage": "Catalogue.homepage",
  "releaseDate": "Catalogue.releaseDate",
  "geographicalCoverage": "Catalogue.geographicalCoverage",
  "rights": "Catalogue.rights"
}
]
}

```

Listing A-2: Complex example of Catalogue

```

{
  "id": "urn:ngsi-ld:Catalogue:id:SALTED-project",
  "type": "Catalogue",
  "title": {
    "type": "Property",
    "value": [
      {
        "@language": "http://publications.europa.eu/resource/authority/language/ENG",
        "@value": "SALTED Project"
      },
      {
        "@language": "http://publications.europa.eu/resource/authority/language/SPA",
        "@value": "Proyecto SALTED"
      }
    ]
  },
  "description": {
    "type": "Property",
    "value": [
      "This is the SALTED Project Catalogue. Data is available in JSON and JSON-LD format.",
      {
        "@language": "http://publications.europa.eu/resource/authority/language/SPA",
        "@value": "Este es el catalogo del proyecto SALTED. La informacion esta disponible en formato JSON y JSON-LD."
      }
    ]
  },
  "publisher": {
    "type": "Relationship",
    "@id": "urn:ngsi-ld:Agent:SALTED"
  },
  "dataset": {
    "type": "Relationship",
    "@id": [
      "urn:ngsi-ld:Dataset:Environment:AirQualityObserved",
      "urn:ngsi-ld:Dataset:Transportation:TrafficFlowObserved",
      "urn:ngsi-ld:Dataset:Parking:ParkingSpot"
    ]
  },
  "service": {
    "type": "Relationship",
    "@id": [
      "https://ckan.salted-project.eu/retriever/realtime/AirQualityObserved",
      "https://ckan.salted-project.eu/retriever/realtime/TrafficFlowObserved",
      "https://ckan.salted-project.eu/retriever/realtime/ParkingSpot"
    ]
  },
  "homepage": {
    "type": "Property",
    "@id": " https://ckan.salted-project.eu/ "
  },
  "language": {
    "type": "Property",
    "value": [
      "http://publications.europa.eu/resource/authority/language/SPA",
      "http://publications.europa.eu/resource/authority/language/ENG"
    ]
  },
  "license": {

```

```

    "type": "Property",
    "@id": "https://creativecommons.org/licenses/by/4.0/"
  },
  "releaseDate": {
    "type": "Property",
    "@value": "2023-05-14T12:32:47Z"
  },
  "geographicalCoverage": {
    "type": "Relationship",
    "@id": "urn:ngsi-ld:Location:Catalogue:SALTED-project"
  },
  "temporalCoverage": {
    "type": "Property",
    "@value": [
      {
        "startDate": "2023-05-14T12:32:47Z",
        "endDate": "2023-05-15T12:32:47Z"
      }
    ]
  },
  "themes": {
    "type": "Property",
    "value": [
      {
        "@id": "http://publications.europa.eu/resource/authority/data-theme/AGRI"
      }
    ]
  },
  "modificationDate": {
    "type": "Property",
    "@value": "2023-05-16T15:11:59Z"
  },
  "hasPart": {
    "type": "Relationship",
    "@id": [
      "urn:ngsi-ld:Catalogue:id:SALTED-project:Mobility",
      "urn:ngsi-ld:Catalogue:id:SALTED-project:Environment",
      "urn:ngsi-ld:Catalogue:id:SALTED-project:Agriculture"
    ]
  },
  "record": {
    "type": "Relationship",
    "@id": [
      "urn:ngsi-ld:Catalogue:id:record:SALTED-project:8e7aff2d-39b1-412d-96c6-18960a7ff41b"
    ]
  },
  "catalogue": {
    "type": "Relationship",
    "@id": [
      "urn:ngsi-ld:Catalogue:id:YODA-project"
    ]
  },
  "rights": {
    "type": "Property",
    "@id": "http://publications.europa.eu/resource/authority/access-right/PUBLIC"
  },
  "creator": {
    "type": "Relationship",
    "@id": "urn:ngsi-ld:Agent:UNICAN"
  },
  "@context": [
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld",
    "https://semiceu.github.io/DCAT-AP/releases/3.0.0/context/dcat-ap.jsonld",
    {
      "title": "Catalogue.title",
      "description": "Catalogue.description",
      "publisher": "Catalogue.publisher",
      "dataset": "Catalogue.dataset",
      "service": "Catalogue.service",
      "homepage": "Catalogue.homepage",
      "releaseDate": "Catalogue.releaseDate",
      "geographicalCoverage": "Catalogue.geographicalCoverage",
      "rights": "Catalogue.rights",
      "temporalCoverage": "Catalogue.temporalCoverage",
      "themes": "Catalogue.themes",
      "creator": "Catalogue.creator",
      "catalogue": "Catalogue.catalogue",
      "record": "Catalogue.record",
    }
  ]
}

```

```

    "hasPart": "Catalogue.hasPart",
    "modificationDate": "Catalogue.modificationDate",
    "license": "Catalogue.license",
    "language": "Catalogue.language"
  }
]
}

```

A.2 Dataset entity

Listing A-3: Basic example of Dataset

```

{
  "id": "urn:ngsi-ld:Dataset:Parking:ParkingSpot",
  "type": "Dataset",
  "title": {
    "type": "Property",
    "value": [
      "Dataset on status of Santander parking spots",
      {
        "@language": "http://publications.europa.eu/resource/authority/language/SPA",
        "@value": "Dataset con el estado de las plazas de aparcamiento en Santander"
      }
    ]
  },
  "description": {
    "type": "Property",
    "value": [
      "This is the SALTED Project Catalogue. Data is available in JSON and JSON-LD format.",
      {
        "@language": "http://publications.europa.eu/resource/authority/language/SPA",
        "@value": "Este es el catalogo del proyecto SALTED. La informacion esta disponible en formato JSON y JSON-LD."
      }
    ]
  },
  "keyword": {
    "type": "Property",
    "value": [
      {
        "@language": "http://publications.europa.eu/resource/authority/language/ENG",
        "@value": "mobility"
      },
      {
        "@language": "http://publications.europa.eu/resource/authority/language/SPA",
        "@value": "movilidad"
      }
    ]
  },
  "publisher": {
    "type": "Relationship",
    "@id": "urn:ngsi-ld:Agent:SALTED"
  },
  "datasetDistribution": {
    "type": "Relationship",
    "@id": [
      "urn:ngsi-ld:Distribution:Parking:ParkingSpot:json",
      "urn:ngsi-ld:Distribution:Parking:ParkingSpot:json-ld",
      "urn:ngsi-ld:Distribution:Parking:ParkingSpot:csv"
    ]
  },
  "language": {
    "type": "Property",
    "value": [
      "http://publications.europa.eu/resource/authority/language/SPA",
      "http://publications.europa.eu/resource/authority/language/ENG"
    ]
  },
  "releaseDate": {
    "type": "Property",
    "@value": "2022-05-14T12:32:47Z"
  },
  "geographicalCoverage": {

```

```

    "type": "Relationship",
    "@id": "urn:ngsi-ld:Location:Dataset:Parking:ParkingSpot"
  },
  "theme": {
    "type": "Property",
    "value": [
      {
        "@id": "http://publications.europa.eu/resource/authority/data-theme/TRAN"
      }
    ]
  },
  "frequency": {
    "type": "Property",
    "value": "http://publications.europa.eu/resource/authority/frequency/CONT"
  },
  "accessRights": {
    "type": "Property",
    "@id": "http://publications.europa.eu/resource/authority/access-right/PUBLIC"
  },
  "@context": [
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld",
    "https://semiceu.github.io/DCAT-AP/releases/3.0.0/context/dcat-ap.jsonld",
    {
      "title": "Dataset.title",
      "description": "Dataset.description",
      "publisher": "Dataset.publisher",
      "keyword": "Dataset.keyword",
      "language": "Dataset.language",
      "datasetDistribution": "Dataset.datasetDistribution",
      "releaseDate": "Dataset.releaseDate",
      "geographicalCoverage": "Dataset.geographicalCoverage",
      "theme": "Dataset.theme",
      "frequency": "Dataset.frequency",
      "accessRights": "Dataset.accessRights"
    }
  ]
}

```

Listing A-4: Complex example of Dataset

```

{
  "id": "urn:ngsi-ld:Dataset:Parking:ParkingSpot",
  "type": "Dataset",
  "title": {
    "type": "Property",
    "value": [
      "Dataset on status of Santander parking spots",
      {
        "@language": "http://publications.europa.eu/resource/authority/language/SPA",
        "@value": "Dataset con el estado de las plazas de aparcamiento en Santander"
      }
    ]
  },
  "description": {
    "type": "Property",
    "value": [
      "This is the SALTED Project Catalogue. Data is available in JSON and JSON-LD format.",
      {
        "@language": "http://publications.europa.eu/resource/authority/language/SPA",
        "@value": "Este es el catalogo del proyecto SALTED. La informacion esta disponible en formato JSON y JSON-LD."
      }
    ]
  },
  "keyword": {
    "type": "Property",
    "value": [
      {
        "@language": "http://publications.europa.eu/resource/authority/language/ENG",
        "@value": "mobility"
      },
      {
        "@language": "http://publications.europa.eu/resource/authority/language/SPA",
        "@value": "movilidad"
      }
    ]
  }
}

```

```

},
"datasetType": {
  "type": "Property",
  "value": "TEST_DATA"
},
"publisher": {
  "type": "Relationship",
  "@id": "urn:ngsi-ld:Agent:SALTED"
},
"datasetDistribution": {
  "type": "Relationship",
  "@id": [
    "urn:ngsi-ld:Distribution:Parking:ParkingSpot:json",
    "urn:ngsi-ld:Distribution:Parking:ParkingSpot:json-ld",
    "urn:ngsi-ld:Distribution:Parking:ParkingSpot:csv"
  ]
},
"inSeries": {
  "type": "Relationship",
  "@id": [
    "urn:ngsi-ld:DatasetSeries:Parking"
  ]
},
"sample": {
  "type": "Relationship",
  "@id": [
    "urn:ngsi-ld:Distribution:Parking:ParkingSpot:json:sample1",
    "urn:ngsi-ld:Distribution:Parking:ParkingSpot:json:sample2"
  ]
},
"landingPage": {
  "type": "Property",
  "@id": " https://ckan.salted-project.eu/ "
},
"language": {
  "type": "Property",
  "value": [
    "http://publications.europa.eu/resource/authority/language/SPA",
    "http://publications.europa.eu/resource/authority/language/ENG"
  ]
},
"releaseDate": {
  "type": "Property",
  "@value": "2022-05-14T12:32:47Z"
},
"geographicalCoverage": {
  "type": "Relationship",
  "@id": "urn:ngsi-ld:Location:Dataset:Parking:ParkingSpot"
},
"temporalCoverage": {
  "type": "Property",
  "@value": [
    {
      "startDate": "2023-05-14T12:32:47Z",
      "endDate": "2023-05-15T12:32:47Z"
    }
  ]
},
"theme": {
  "type": "Property",
  "value": [
    {
      "@id": "http://publications.europa.eu/resource/authority/data-theme/TRAN"
    }
  ]
},
"modificationDate": {
  "type": "Property",
  "@value": "2023-05-16T15:11:59Z"
},
"version": {
  "type": "Property",
  "value": "2.0"
},
"versionNotes": {
  "type": "Property",
  "value": [
    "Additional parking spots added respect version 1.0",

```

```

    {
      "@language": "http://publications.europa.eu/resource/authority/language/SPA",
      "@value": "Incluidas nuevas plazas de aparcamiento respecto a la version 1.0"
    }
  ]
},
"hasVersion": {
  "type": "Relationship",
  "@id": [
    "urn:ngsi-ld:Dataset:Parking:ParkingSpot:v1",
    "urn:ngsi-ld:Dataset:Parking:ParkingSpot:v2"
  ]
},
"frequency": {
  "type": "Property",
  "value": "http://publications.europa.eu/resource/authority/frequency/CONT"
},
"spatialResolution": {
  "type": "Property",
  "value": 10
},
"temporalResolution": {
  "type": "Property",
  "value": "PT5M"
},
"source": {
  "type": "Relationship",
  "@id": [
    "urn:ngsi-ld:Dataset:Parking"
  ]
},
"accessRights": {
  "type": "Property",
  "@id": "http://publications.europa.eu/resource/authority/access-right/PUBLIC"
},
"creator": {
  "type": "Relationship",
  "@id": [
    "urn:ngsi-ld:Agent:UNICAN"
  ]
},
"qualifiedAttribution": {
  "type": "Relationship",
  "@id": [
    "urn:ngsi-ld:Agent:SantanderMunicipality"
  ]
},
"wasGeneratedBy": {
  "type": "Relationship",
  "@id": [
    "urn:ngsi-ld:Activity:SmartSantander"
  ]
},
"conformsTo": {
  "type": "Property",
  "@id": [
    "urn:ngsi-ld:Standard:NGSI-LD"
  ]
},
"@context": [
  "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld",
  "https://semiceu.github.io/DCAT-AP/releases/3.0.0/context/dcat-ap.jsonld",
  {
    "title": "Dataset.title",
    "description": "Dataset.description",
    "publisher": "Dataset.publisher",
    "keyword": "Dataset.keyword",
    "datasetType": "Dataset.datasetType",
    "language": "Dataset.language",
    "datasetDistribution": "Dataset.datasetDistribution",
    "releaseDate": "Dataset.releaseDate",
    "geographicalCoverage": "Dataset.geographicalCoverage",
    "theme": "Dataset.theme",
    "frequency": "Dataset.frequency",
    "accessRights": "Dataset.accessRights",
    "temporalCoverage": "Dataset.temporalCoverage",
    "inSeries": "Dataset.inSeries",
    "sample": "Dataset.sample",
  }
]

```

```

    "landingPage": "Dataset.landingPage",
    "modificationDate": "Dataset.modificationDate",
    "version": "Dataset.version",
    "versionNotes": "Dataset.versionNotes",
    "hasVersion": "Dataset.hasVersion",
    "frequency": "Dataset.frequency",
    "spatialResolution": "Dataset.spatialResolution",
    "temporalResolution": "Dataset.temporalResolution",
    "source": "Dataset.source",
    "creator": "Dataset.creator",
    "qualifiedAttribution": "Dataset.qualifiedAttribution",
    "wasGeneratedBy": "Dataset.wasGeneratedBy",
    "conformsTo": "Dataset.conformsTo"
  }
]
}

```

A.3 Distribution entity

Listing A-5: Basic example of Distribution

```

{
  "id": "urn:ngsi-ld:Distribution:Parking:ParkingSpot",
  "type": "Distribution",
  "title": {
    "type": "Property",
    "value": [
      "Distribution on status of Santander parking spots in JSON-LD format",
      {
        "@language": "http://publications.europa.eu/resource/authority/language/SPA",
        "@value": "Distribution con el estado de las plazas de aparcamiento en Santander en
formato JSON-LD"
      }
    ]
  },
  "description": {
    "type": "Property",
    "value": [
      "This is the Distribution of Santander parking spots availability in JSON-LD format.",
      {
        "@language": "http://publications.europa.eu/resource/authority/language/SPA",
        "@value": "Esta es la Distribution de la información de disponibilidad de plazas de
aparcamiento en Santander en formato JSON-LD."
      }
    ]
  },
  "format": {
    "type": "Property",
    "@id": "http://publications.europa.eu/resource/authority/file-type/JSON_LD"
  },
  "accessURL": {
    "type": "Property",
    "@id": "https://ckan.salted-project.eu/retriever/realtime/parkingSpots.jsonld"
  },
  "releaseDate": {
    "type": "Property",
    "@value": "2022-05-14T12:32:47Z"
  },
  "license": {
    "type": "Property",
    "@id": "https://creativecommons.org/licenses/by/4.0/"
  },
  "status": {
    "type": "Property",
    "value": "Completed"
  },
  "@context": [
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld",
    "https://semiceu.github.io/DCAT-AP/releases/3.0.0/context/dcat-ap.jsonld",
    {
      "title": "Distribution.title",
      "description": "Distribution.description",
      "releaseDate": "Distribution.releaseDate",

```

```

    "status": "Distribution.status",
    "license": "Distribution.license",
    "accessURL": "Distribution.accessURL",
    "format": "Distribution.format",
  }
]
}

```

Listing A-6: Complex example of Distribution

```

{
  "id": "urn:ngsi-ld:Distribution:Parking:ParkingSpot",
  "type": "Distribution",
  "title": {
    "type": "Property",
    "value": [
      "Distribution on status of Santander parking spots in JSON-LD format",
      {
        "@language": "http://publications.europa.eu/resource/authority/language/SPA",
        "@value": "Distribution con el estado de las plazas de aparcamiento en Santander en formato JSON-LD"
      }
    ]
  },
  "description": {
    "type": "Property",
    "value": [
      "This is the Distribution of Santander parking spots availability in JSON-LD format.",
      {
        "@language": "http://publications.europa.eu/resource/authority/language/SPA",
        "@value": "Esta es la Distribution de la información de disponibilidad de plazas de aparcamiento en Santander en formato JSON-LD."
      }
    ]
  },
  "format": {
    "type": "Property",
    "@id": "http://publications.europa.eu/resource/authority/file-type/JSON_LD"
  },
  "accessURL": {
    "type": "Property",
    "@id": "https://ckan.salted-project.eu/retriever/realtime/parkingSpots.jsonld"
  },
  "downloadURL": {
    "type": "Property",
    "@id": "https://ckan.salted-project.eu/retriever/realtime/parkingSpots.jsonld"
  },
  "documentation": {
    "type": "Property",
    "@id": " https://ckan.salted-project.eu/ "
  },
  "language": {
    "type": "Property",
    "value": [
      "http://publications.europa.eu/resource/authority/language/SPA",
      "http://publications.europa.eu/resource/authority/language/ENG"
    ]
  },
  "releaseDate": {
    "type": "Property",
    "@value": "2022-05-14T12:32:47Z"
  },
  "modificationDate": {
    "type": "Property",
    "@value": "2023-05-16T15:11:59Z"
  },
  "spatialResolution": {
    "type": "Property",
    "value": 100
  },
  "temporalResolution": {
    "type": "Property",
    "value": "PT5M"
  },
  "rights": {
    "type": "Property",

```



```

    "@id": "http://publications.europa.eu/resource/authority/access-right/PUBLIC"
  },
  "license": {
    "type": "Property",
    "@id": "https://creativecommons.org/licenses/by/4.0/"
  },
  "status": {
    "type": "Property",
    "value": "Completed"
  },
  "linkedSchemas": {
    "type": "Property",
    "@id": [
      "urn:ngsi-ld:Standard:NGSI-LD"
    ]
  },
  "@context": [
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld",
    "https://semiceu.github.io/DCAT-AP/releases/3.0.0/context/dcat-ap.jsonld",
    {
      "title": "Distribution.title",
      "description": "Distribution.description",
      "releaseDate": "Distribution.releaseDate",
      "modificationDate": "Distribution.modificationDate",
      "linkedSchemas": "Distribution.linkedSchemas",
      "status": "Distribution.status",
      "license": "Distribution.license",
      "rights": "Distribution.rights",
      "temporalResolution": "Distribution.temporalResolution",
      "spatialResolution": "Distribution.spatialResolution",
      "language": "Distribution.language",
      "documentation": "Distribution.documentation",
      "downloadURL": "Distribution.downloadURL",
      "accessURL": "Distribution.accessURL",
      "format": "Distribution.format",
    }
  ]
}

```

A.4 Data Service entity

Listing A-7: Basic example of Data Service

```

{
  "id": "urn:ngsi-ld:DataService:Parking:ParkingSpot",
  "type": "DataService",
  "title": {
    "type": "Property",
    "value": [
      "Data Service on status of Santander parking spots",
      {
        "@language": "http://publications.europa.eu/resource/authority/language/SPA",
        "@value": "Data Service con el estado de las plazas de aparcamiento en Santander"
      }
    ]
  },
  "description": {
    "type": "Property",
    "value": [
      "This is the Data Service of Santander parking spots availability",
      {
        "@language": "http://publications.europa.eu/resource/authority/language/SPA",
        "@value": "Esta es la Data Service de la información de disponibilidad de plazas de aparcamiento en Santander"
      }
    ]
  },
  "endpointURL": {
    "type": "Property",
    "@id": "https://ngsi-ld-broker.example.com/entities"
  },
  "@context": [
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld",

```

```

"https://semiceu.github.io/DCAT-AP/releases/3.0.0/context/dcat-ap.jsonld",
{
  "title": "DataService.title",
  "description": "DataService.description",
  "endpointURL": "DataService.endpointURL"
}
]
}

```

Listing A-8: Complex example of Dataset Series

```

{
  "id": "urn:ngsi-ld:DataService:Parking:ParkingSpot",
  "type": "DataService",
  "title": {
    "type": "Property",
    "value": [
      "Data Service on status of Santander parking spots",
      {
        "@language": "http://publications.europa.eu/resource/authority/language/SPA",
        "@value": "Data Service con el estado de las plazas de aparcamiento en Santander"
      }
    ]
  },
  "description": {
    "type": "Property",
    "value": [
      "This is the Data Service of Santander parking spots availability",
      {
        "@language": "http://publications.europa.eu/resource/authority/language/SPA",
        "@value": "Esta es la Data Service de la información de disponibilidad de plazas de aparcamiento en Santander"
      }
    ]
  },
  "endpointURL": {
    "type": "Property",
    "@id": "https://ngsi-ld-broker.example.com/entities"
  },
  "license": {
    "type": "Property",
    "@id": "https://creativecommons.org/licenses/by/4.0/"
  },
  "format": {
    "type": "Property",
    "@id": "http://publications.europa.eu/resource/authority/file-type/JSON_LD"
  },
  "landingPage": {
    "type": "Property",
    "@id": " https://ckan.salted-project.eu/ "
  },
  "publisher": {
    "type": "Relationship",
    "@id": "urn:ngsi-ld:Agent:SALTED"
  },
  "@context": [
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld",
    "https://semiceu.github.io/DCAT-AP/releases/3.0.0/context/dcat-ap.jsonld",
    {
      "title": "DataService.title",
      "description": "DataService.description",
      "license": "DataService.license",
      "publisher": "DataService.publisher",
      "format": "DataService.format",
      "landingPage": "DataService.landingPage",
      "endpointURL": "DatasetSeries.endpointURL"
    }
  ]
}

```

A.5 Dataset Series entity

Listing A-9: Basic example of Dataset Series

```
{
  "id": "urn:ngsi-ld:DatasetSeries:Parking:ParkingSpot",
  "type": "DatasetSeries",
  "title": {
    "type": "Property",
    "value": [
      "Dataset Series on status of Santander parking spots ",
      {
        "@language": "http://publications.europa.eu/resource/authority/language/SPA",
        "@value": "Dataset Series con el estado de las plazas de aparcamiento en Santander "
      }
    ]
  },
  "description": {
    "type": "Property",
    "value": [
      "This is the Dataset Series of Santander parking spots availability",
      {
        "@language": "http://publications.europa.eu/resource/authority/language/SPA",
        "@value": "Esta es la Dataset Series de la información de disponibilidad de plazas de aparcamiento en Santander"
      }
    ]
  },
  "releaseDate": {
    "type": "Property",
    "@value": "2022-05-14T12:32:47Z"
  },
  "@context": [
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld",
    "https://semiceu.github.io/DCAT-AP/releases/3.0.0/context/dcat-ap.jsonld",
    {
      "title": "DatasetSeries.title",
      "description": "DatasetSeries.description",
      "releaseDate": "DatasetSeries.releaseDate"
    }
  ]
}
```

Listing A-10: Complex example of Dataset Series

```
{
  "id": "urn:ngsi-ld:DatasetSeries:Parking:ParkingSpot",
  "type": "DatasetSeries",
  "title": {
    "type": "Property",
    "value": [
      "Dataset Series on status of Santander parking spots ",
      {
        "@language": "http://publications.europa.eu/resource/authority/language/SPA",
        "@value": "Dataset Series con el estado de las plazas de aparcamiento en Santander "
      }
    ]
  },
  "description": {
    "type": "Property",
    "value": [
      "This is the Dataset Series of Santander parking spots availability",
      {
        "@language": "http://publications.europa.eu/resource/authority/language/SPA",
        "@value": "Esta es la Dataset Series de la información de disponibilidad de plazas de aparcamiento en Santander"
      }
    ]
  },
  "releaseDate": {
    "type": "Property",
    "@value": "2022-05-14T12:32:47Z"
  },
}
```

```

"publisher": {
  "type": "Relationship",
  "@id": "urn:ngsi-ld:Agent:SALTED"
},
"geographicalCoverage": {
  "type": "Relationship",
  "@id": "urn:ngsi-ld:Location: DatasetSeries: Parking: ParkingSpot"
},
"modificationDate": {
  "type": "Property",
  "@value": "2023-05-16T15:11:59Z"
},
"frequency": {
  "type": "Property",
  "value": "http://publications.europa.eu/resource/authority/frequency/MONTHLY"
},
"@context": [
  "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld",
  "https://semiceu.github.io/DCAT-AP/releases/3.0.0/context/dcat-ap.jsonld",
  {
    "title": "DatasetSeries.title",
    "description": "DatasetSeries.description",
    "releaseDate": "DatasetSeries.releaseDate",
    "publisher": "DatasetSeries.publisher",
    "modificationDate": "DatasetSeries.modificationDate",
    "geographicalCoverage": "DatasetSeries.geographicalCoverage",
    "frequency": "DatasetSeries.frequency"
  }
]
}

```

A.6 Location entity

Listing A-11: Basic example of Location

```

{
  "id": "urn:ngsi-ld:Location:Dataset: Parking: ParkingSpot",
  "type": "Location",
  "bbox": {
    "type": "VocabProperty",
    "vocab": "ESP_SDR"
  },
  "@context": [
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld",
    "https://semiceu.github.io/DCAT-AP/releases/3.0.0/context/dcat-ap.jsonld",
    {
      "bbox": "Location.bbox"
    },
    {
      "ESP_SDR": "http://publications.europa.eu/resource/authority/place/ESP_SDR"
    }
  ]
}

```

Listing A-12: Complex example of Location

```

{
  "id": "urn:ngsi-ld:Location:Dataset: Parking: ParkingSpot",
  "type": "Location",
  "bbox": {
    "type": "VocabProperty",
    "vocab": "ESP_SDR"
  },
  "centroid": {
    "type": "VocabProperty",
    "vocab": "Santander"
  },
  "geometry": {
    "type": "GeoProperty",
    "value": {
      "type": "Polygon",

```

```

    "coordinates": [[[-3.8613506, 43.4568056], [-3.7923199, 43.4897909], [-3.7675689,
43.4670319], [-3.8434119, 43.4376179], [-3.8613506, 43.4568056]]]
  },
  },
  "@context": [
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld",
    "https://semiceu.github.io/DCAT-AP/releases/3.0.0/context/dcat-ap.jsonld",
    {
      "bbox": "Location.bbox",
      "geometry": "Location.geometry"
    },
    {
      "ESP_SDR": "http://publications.europa.eu/resource/authority/place/ESP_SDR"
      "Santander": "https://www.geonames.org/3109718"
    }
  ]
}

```

A.7 Catalogue Record entity

Listing A-13: Basic example of Catalogue Record

```

{
  "id": "urn:ngsi-ld:CatalogueRecord:Parking:ParkingSpot",
  "type": "CatalogueRecord",
  "primaryTopic": {
    "type": "Relationship",
    "@id": "urn:ngsi-ld:DataService:Parking:ParkingSpot"
  },
  "listingDate": {
    "type": "Property",
    "@value": "2022-05-14T12:32:47Z"
  },
  "modificationDate": {
    "type": "Property",
    "@value": "2023-05-16T15:11:59Z"
  },
  "@context": [
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld",
    "https://semiceu.github.io/DCAT-AP/releases/3.0.0/context/dcat-ap.jsonld",
    {
      "listingDate": "CatalogueRecord.listingDate",
      "primaryTopic": "CatalogueRecord.primaryTopic",
      "modificationDate": "CatalogueRecord.modificationDate",
    }
  ]
}

```

Listing A-14: Complex example of Catalogue Record

```

{
  "id": "urn:ngsi-ld:CatalogueRecord:Parking:ParkingSpot",
  "type": "CatalogueRecord",
  "primaryTopic": {
    "type": "Relationship",
    "@id": "urn:ngsi-ld:DataService:Parking:ParkingSpot"
  },
  "listingDate": {
    "type": "Property",
    "@value": "2022-05-14T12:32:47Z"
  },
  "modificationDate": {
    "type": "Property",
    "@value": "2023-05-16T15:11:59Z"
  },
  "title": {
    "type": "Property",
    "value": [
      "Catalogue Record on status of Santander parking spots",
      {
        "@language": "http://publications.europa.eu/resource/authority/language/SPA",

```

```

    "@value": "Catalogue Record con el estado de las plazas de aparcamiento en Santander "
  }
]
},
"description": {
  "type": "Property",
  "value": [
    "This is a Catalogue Record for the Santander parking spots availability",
    {
      "@language": "http://publications.europa.eu/resource/authority/language/SPA",
      "@value": "Este es un Catalogue Record de la información de disponibilidad de plazas de
aparcamiento en Santander"
    }
  ]
},
"@context": [
  "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld",
  "https://semiceu.github.io/DCAT-AP/releases/3.0.0/context/dcat-ap.jsonld",
  {
    "title": "CatalogueRecord.title",
    "description": "CatalogueRecord.description",
    "listingDate": "CatalogueRecord.listingDate",
    "primaryTopic": "CatalogueRecord.primaryTopic",
    "modificationDate": "CatalogueRecord.modificationDate",
  }
]
}

```

A.8 @context files for DCAT-AP NGSI-LD entities

Listing A-15: @context file for NGSI-LD Catalogue entities

```

{
  "@context": [
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld",
    "https://semiceu.github.io/DCAT-AP/releases/3.0.0/context/dcat-ap.jsonld",
    {
      "applicableLegislation": "Catalogue.applicableLegislation",
      "catalogue": "Catalogue.catalogue",
      "creator": "Catalogue.creator",
      "dataset": "Catalogue.dataset",
      "description": "Catalogue.description",
      "geographicalCoverage": "Catalogue.geographicalCoverage",
      "hasPart": "Catalogue.hasPart",
      "homepage": "Catalogue.homepage",
      "language": "Catalogue.language",
      "licence": "Catalogue.licence",
      "modificationDate": "Catalogue.modificationDate",
      "publisher": "Catalogue.publisher",
      "record": "Catalogue.record",
      "releaseDate": "Catalogue.releaseDate",
      "rights": "Catalogue.rights",
      "service": "Catalogue.service",
      "temporalCoverage": "Catalogue.temporalCoverage",
      "themes": "Catalogue.themes",
      "title": "Catalogue.title"
    }
  ]
}

```

Listing A-16: @context file for NGSI-LD Dataset entities

```

{
  "@context": [
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld",
    "https://semiceu.github.io/DCAT-AP/releases/3.0.0/context/dcat-ap.jsonld",
    {
      "accessRights": "Dataset.accessRights",
      "applicableLegislation": "Dataset.applicableLegislation",
      "conformsTo": "Dataset.conformsTo",
      "contactPoint": "Dataset.contactPoint",
    }
  ]
}

```

```

"creator": "Dataset.creator",
"datasetDistribution": "Dataset.datasetDistribution",
"description": "Dataset.description",
"documentation": "Dataset.documentation",
"frequency": "Dataset.frequency",
"geographicalCoverage": "Dataset.geographicalCoverage",
"hasVersion": "Dataset.hasVersion",
"identifier": "Dataset.identifier",
"inSeries": "Dataset.inSeries",
"isReferencedBy": "Dataset.isReferencedBy",
"keyword": "Dataset.keyword",
"landingPage": "Dataset.landingPage",
"language": "Dataset.language",
"modificationDate": "Dataset.modificationDate",
"otherIdentifier": "Dataset.otherIdentifier",
"provenance": "Dataset.provenance",
"publisher": "Dataset.publisher",
"qualifiedAttribution": "Dataset.qualifiedAttribution",
"qualifiedRelation": "Dataset.qualifiedRelation",
"relatedResource": "Dataset.relatedResource",
"releaseDate": "Dataset.releaseDate",
"sample": "Dataset.sample",
"source": "Dataset.source",
"spatialResolution": "Dataset.spatialResolution",
"temporalCoverage": "Dataset.temporalCoverage",
"temporalResolution": "Dataset.temporalResolution",
"theme": "Dataset.theme",
"title": "Dataset.title",
"type": "Dataset.type",
"version": "Dataset.version",
"versionNotes": "Dataset.versionNotes",
"wasGeneratedBy": "Dataset.wasGeneratedBy"
}
]
}

```

Listing A-17: @context file for NGSi-LD Distribution entities

```

{
"@context": [
"https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld",
"https://semiceu.github.io/DCAT-AP/releases/3.0.0/context/dcat-ap.jsonld",
{
"accessService": "Distribution.accessService",
"accessUrl": "Distribution.accessUrl",
"applicableLegislation": "Distribution.applicableLegislation",
"availability": "Distribution.availability",
"byteSize": "Distribution.byteSize",
"checksum": "Distribution.checksum",
"compressionFormat": "Distribution.compressionFormat",
"description": "Distribution.description",
"documentation": "Distribution.documentation",
"downloadUrl": "Distribution.downloadUrl",
"format": "Distribution.format",
"hasPolicy": "Distribution.hasPolicy",
"language": "Distribution.language",
"licence": "Distribution.licence",
"linkedSchemas": "Distribution.linkedSchemas",
"mediaType": "Distribution.mediaType",
"modificationDate": "Distribution.modificationDate",
"packagingFormat": "Distribution.packagingFormat",
"releaseDate": "Distribution.releaseDate",
"rights": "Distribution.rights",
"spatialResolution": "Distribution.spatialResolution",
"status": "Distribution.status",
"temporalResolution": "Distribution.temporalResolution",
"title": "Distribution.title"
}
]
}

```

Listing A-18: @context file for NGSi-LD Dataset Series entities

```

{
  "@context": [
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld",
    "https://semiceu.github.io/DCAT-AP/releases/3.0.0/context/dcat-ap.jsonld",
    {
      "applicableLegislation": "DatasetSeries.applicableLegislation",
      "contactPoint": "DatasetSeries.contactPoint",
      "description": "DatasetSeries.description",
      "frequency": "DatasetSeries.frequency",
      "geographicalCoverage": "DatasetSeries.geographicalCoverage",
      "modificationDate": "DatasetSeries.modificationDate",
      "publisher": "DatasetSeries.publisher",
      "releaseDate": "DatasetSeries.releaseDate",
      "temporalCoverage": "DatasetSeries.temporalCoverage",
      "title": "DatasetSeries.title"
    }
  ]
}

```

Listing A-19: @context file for NGSi-LD Data Service entities

```

{
  "@context": [
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld",
    "https://semiceu.github.io/DCAT-AP/releases/3.0.0/context/dcat-ap.jsonld",
    {
      "accessRights": "DataService.accessRights",
      "applicableLegislation": "DataService.applicableLegislation",
      "applicationProfile": "DataService.applicationProfile",
      "contactPoint": "DataService.contactPoint",
      "description": "DataService.description",
      "endpointDescription": "DataService.endpointDescription",
      "endpointUrl": "DataService.endpointUrl",
      "format": "DataService.format",
      "keyword": "DataService.keyword",
      "landingPage": "DataService.landingPage",
      "licence": "DataService.licence",
      "publisher": "DataService.publisher",
      "servesDataset": "DataService.servesDataset",
      "theme": "DataService.theme",
      "title": "DataService.title"
    }
  ]
}

```

Listing A-20: @context file for NGSi-LD Catalogue Record entities

```

{
  "@context": [
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld",
    "https://semiceu.github.io/DCAT-AP/releases/3.0.0/context/dcat-ap.jsonld",
    {
      "applicationProfile": "CatalogueRecord.applicationProfile",
      "changeType": "CatalogueRecord.changeType",
      "description": "CatalogueRecord.description",
      "language": "CatalogueRecord.language",
      "listingDate": "CatalogueRecord.listingDate",
      "modificationDate": "CatalogueRecord.modificationDate",
      "primaryTopic": "CatalogueRecord.primaryTopic",
      "sourceMetadata": "CatalogueRecord.sourceMetadata",
      "title": "CatalogueRecord.title"
    }
  ]
}

```


Listing A-21: @context file for NGSi-LD Checksum entities

```

{
  "@context": [
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld",
    "https://semiceu.github.io/DCAT-AP/releases/3.0.0/context/dcat-ap.jsonld",
    {
      "algorithm": "Checksum.algorithm",
      "checksumValue": "Checksum.checksumValue"
    }
  ]
}

```

Listing A-22: @context file for NGSi-LD Agent entities

```

{
  "@context": [
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld",
    "https://semiceu.github.io/DCAT-AP/releases/3.0.0/context/dcat-ap.jsonld",
    {
      "name": "Agent.name",
      "agentType": "Agent.type"
    }
  ]
}

```

Listing A-23: @context file for NGSi-LD Location entities

```

{
  "@context": [
    "https://uri.etsi.org/ngsi-ld/v1/ngsi-ld-core-context-v1.7.jsonld",
    "https://semiceu.github.io/DCAT-AP/releases/3.0.0/context/dcat-ap.jsonld",
    {
      "bbox": "Location.bbox",
      "centroid": "Location.centroid",
      "geometry": "Location.geometry"
    },
    {
      "ESP": "http://publications.europa.eu/resource/authority/country/ESP",
      "ESP_SDR": "http://publications.europa.eu/resource/authority/place/ESP_SDR",
      "EUROPE": "http://publications.europa.eu/resource/authority/continent/EUROPE",
      "AMERICA": "http://publications.europa.eu/resource/authority/continent/AMERICA",
      "ANTARCTICA": "http://publications.europa.eu/resource/authority/continent/ANTARCTICA",
      "ASIA": "http://publications.europa.eu/resource/authority/continent/ASIA",
      "OCEANIA": "http://publications.europa.eu/resource/authority/continent/OCEANIA",
      "AFRICA": "http://publications.europa.eu/resource/authority/continent/AFRICA",
      "Santander": "https://www.geonames.org/3109718"
    }
  ]
}

```

NOTE: Further countries and places can be added to the @context so that the bbox and centroid VocabProperties can be properly coerced to the corresponding EU Vocabularies Name Authority Lists as they are available at <http://publications.europa.eu/resource/authority/continent>, <http://publications.europa.eu/resource/authority/country>, <http://publications.europa.eu/resource/authority/place>, or, if a particular location is not in one of the mentioned Named Authority Lists, the Geonames URI provided at <http://sws.geonames.org/>.

Annex B: DCAT-AP Entities JSON Schemas

B.0 Foreword

This Annex presents the complete JSON Schemas for the DCAT-AP classes mapping as NGSI-LD entities.

B.1 Catalogue entity JSON Schema

Listing B-1: JSON Schema for the NGSI-LD Catalogue entity

```
{
  "$schema": "https://json-schema.org/draft/2020-12/schema",
  "$schemaVersion": "1.0.1",
  "$id": "DCAT-AP_NGSI-LD_Mapping/Catalogue/schema.json",
  "title": "Catalogue DCAT-AP",
  "description": "Catalogue of datasets compliant with DCAT-AP specification version 3.0.0.",
  "type": "object",
  "properties": {
    "type": {
      "description": "Property. Model:'https://schema.org/Text'. It has to be Catalogue",
      "type": "string",
      "enum": [
        "Catalogue"
      ]
    },
    "id": {
      "description": " Identifier format of any NGSI entity of type Catalogue.",
      "type": "string",
      "minLength": 1,
      "maxLength": 256,
      "pattern": "^[\\w\\-\\.\\{\\}\\$\\+\\*\\[\\]\\`|~^@!,:\\\\\\\\]+ $"
    },
    "applicableLegislation": {
      "description": "Property. Model:'http://data.europa.eu/eli/ontology#LegalResource'. The legislation that mandates the creation or management of the Catalogue. It is aligned with the ontology included in Council conclusions inviting the introduction of the European Legislation Identifier (ELI). In this data specification the use is restricted to instances of this class that follow the (ELI) URI guidelines.",
      "type": "object",
      "properties": {
        "type": {
          "type": "string",
          "enum": [
            "Property"
          ]
        }
      }
    },
    "@id": {
      "type": "array",
      "items": {
        "type": "string",
        "format": "uri",
      }
    }
  },
  "required": [
    "type",
    "@id"
  ],
  "additionalProperties": false
},
"catalogue": {
  "description": "Relationship. Model:'http://www.w3.org/ns/dcat#Catalog'. This property refers to the catalogue(s) whose contents are of interest in the context of this catalogue",
  "type": "object",
  "properties": {
    "type": {
      "type": "string",

```

```

    "enum": [
      "Relationship"
    ]
  },
  "@id": {
    "type": "array",
    "items": {
      "anyOf": [
        {
          "type": "string",
          "minLength": 1,
          "maxLength": 256,
          "pattern": "^[\\w\\-\\.\\.\\{\\}\\$\\+\\*\\[\\]\\`|~^@!,:\\\\\\\\]+$",
          "description": " Identifier format of any NGSI entity of type Catalogue."
        },
        {
          "type": "string",
          "format": "uri",
          "description": "Reference identifier of any NGSI entity of type Catalogue."
        }
      ]
    }
  }
},
"required": [
  "type",
  "@id"
],
"additionalProperties": false
},
"creator": {
  "description": "Relationship. Model:'http://xmlns.com/foaf/0.1/Agent'. An entity responsible
for the creation of the catalogue.",
  "type": "object",
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "Relationship"
      ]
    }
  },
  "@id": {
    "type": "string",
    "minLength": 1,
    "maxLength": 256,
    "pattern": "^[\\w\\-\\.\\.\\{\\}\\$\\+\\*\\[\\]\\`|~^@!,:\\\\\\\\]+$",
    "description": " Reference identifier of an entity primarily responsible for producing
the catalogue"
  }
},
"required": [
  "type",
  "@id"
],
"additionalProperties": false
},
"dataset": {
  "description": "Relationship. Model:'http://www.w3.org/ns/dcat#dataset'. This property links
the Catalogue with the Dataset(s) that is(are) part of the Catalogue",
  "type": "object",
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "Relationship"
      ]
    }
  },
  "@id": {
    "type": "array",
    "items": {
      "anyOf": [
        {
          "type": "string",
          "minLength": 1,
          "maxLength": 256,
          "pattern": "^[\\w\\-\\.\\.\\{\\}\\$\\+\\*\\[\\]\\`|~^@!,:\\\\\\\\]+$",
          "description": "Identifier format of any NGSI entity of type Dataset."
        }
      ]
    }
  }
},

```

```

        {
          "type": "string",
          "format": "uri",
          "description": "Reference identifier of any NGSI entity of type Dataset."
        }
      ]
    }
  },
  "required": [
    "type",
    "@id"
  ],
  "additionalProperties": false
},
"description": {
  "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. This property contains a free-text account of the Catalogue. This property can contain parallel language versions of the description.",
  "type": "object",
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "Property"
      ]
    },
    "value": {
      "type": "array",
      "items": {
        "anyOf": [
          {
            "type": "string"
          },
          {
            "type": "object",
            "properties": {
              "@language": {
                "type": "string",
                "pattern":
"^http:\\\\\\.\\./publications\\.europa\\.eu\\/resource\\/authority\\/language\\/\\[A-Z\\]{3}$"
              },
              "@value": {
                "type": "string"
              }
            }
          }
        ],
        "required": [
          "@value",
          "@language"
        ],
        "additionalProperties": false
      }
    }
  ],
  "description": "Catalogue description in different languages."
}
},
"required": [
  "type",
  "value"
],
"additionalProperties": false
},
"geographicalCoverage": {
  "description": "Relationship. Model:'http://purl.org/dc/terms/Location'. This property refers to a geographical area covered by the Catalogue",
  "type": "object",
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "Relationship"
      ]
    },
    "@id": {
      "type": "string",
      "minLength": 1,
      "maxLength": 256,

```

```

    "pattern": "^[\\w\\-\\.\\{\\}\\$\\|+\\*\\[\\]\\`~^@!,:\\\\\\\\]+$",
    "description": "Reference identifier of any NGSI entity of type Location."
  }
},
"required": [
  "type",
  "@id"
],
"additionalProperties": false
},
"hasPart": {
  "description": "Relationship. Model:'http://www.w3.org/ns/dcat#Catalog'. This property
refers to a related Catalogue that is part of the described Catalogue",
  "type": "object",
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "Relationship"
      ]
    },
    "@id": {
      "type": "array",
      "items": {
        "anyOf": [
          {
            "type": "string",
            "minLength": 1,
            "maxLength": 256,
            "pattern": "^[\\w\\-\\.\\{\\}\\$\\|+\\*\\[\\]\\`~^@!,:\\\\\\\\]+$",
            "description": " Identifier format of any NGSI entity of type Catalogue."
          },
          {
            "type": "string",
            "format": "uri",
            "description": "Reference identifier of any NGSI entity of type Catalogue."
          }
        ]
      }
    }
  }
},
"required": [
  "type",
  "@id"
],
"additionalProperties": false
},
"homepage": {
  "description": "Property. Model:'http://xmlns.com/foaf/0.1/homepage'. This property refers
to a web page that acts as the main page for the Catalogue",
  "type": "object",
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "Property"
      ]
    },
    "@id": {
      "type": "string",
      "format": "uri"
    }
  }
},
"required": [
  "type",
  "@id"
],
"additionalProperties": false
},
"language": {
  "description": "Property. Model:'http://purl.org/dc/terms/LinguisticSystem'. This property
refers to a language used in the textual metadata describing titles, descriptions, etc. of the
Datasets in the Catalogue. This property can include multiple references if the metadata is
provided in multiple languages. DCAT-AP specification mandates the use of EU Vocabularies
Languages Named Authority List",
  "type": "object",
  "properties": {
    "type": {

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        "type": "string",
        "enum": [
            "Property"
        ]
    },
    "value": {
        "type": "array",
        "items": {
            "description": "Individual identifier of the language",
            "type": "string",
            "pattern":
"^http:\\\\\\.\\.\\.publications\\.\\.europa\\.\\.eu\\.\\.resource\\.\\.authority\\.\\.language\\.\\.\\[A-Z\\]{3}$"
        }
    },
    "required": [
        "type",
        "value"
    ],
    "additionalProperties": false
},
"license": {
    "description": "Property. Model:'http://purl.org/dc/terms/LicenseDocument'. This property
links to the licence under which the Catalogue can be used or reused",
    "type": "object",
    "properties": {
        "type": {
            "type": "string",
            "enum": [
                "Property"
            ]
        },
        "@id": {
            "type": "string",
            "format": "uri"
        }
    },
    "required": [
        "type",
        "@id"
    ],
    "additionalProperties": false
},
"modificationDate": {
    "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. This
property contains the most recent date on which the Catalogue was modified",
    "type": "object",
    "properties": {
        "type": {
            "type": "string",
            "enum": [
                "Property"
            ]
        },
        "@value": {
            "type": "string",
            "format": "date-time"
        }
    },
    "required": [
        "type",
        "@value"
    ],
    "additionalProperties": false
},
"publisher": {
    "description": "Relationship. Model:'http://xmlns.com/foaf/0.1/#term_Agent'. This property
links to an entity (organisation) responsible for making the Catalogue available",
    "type": "object",
    "properties": {
        "type": {
            "type": "string",
            "enum": [
                "Relationship"
            ]
        },
        "@id": {
            "type": "string",

```

```

        "minLength": 1,
        "maxLength": 256,
        "pattern": "^[\\w\\-\\.\\{\\}\\$\\+\\*\\[\\]\\`~^@!,:\\\\\\\\]+$",
        "description": " Reference identifier of an entity primarily responsible for making the
Catalogue available"
    },
    },
    "required": [
        "type",
        "@id"
    ],
    "additionalProperties": false
},
"record": {
    "description": "Relationship. Model:'http://www.w3.org/ns/dcat#CatalogRecord'. This property
refers to the Catalogue Record(s) that is(are) part of the Catalogue",
    "type": "object",
    "properties": {
        "type": {
            "type": "string",
            "enum": [
                "Relationship"
            ]
        },
    },
    "@id": {
        "type": "array",
        "items": {
            "anyOf": [
                {
                    "type": "string",
                    "minLength": 1,
                    "maxLength": 256,
                    "pattern": "^[\\w\\-\\.\\{\\}\\$\\+\\*\\[\\]\\`~^@!,:\\\\\\\\]+$",
                    "description": " Identifier format of any NGSI entity of type CatalogueRecord."
                },
                {
                    "type": "string",
                    "format": "uri",
                    "description": "Reference identifier of any NGSI entity of type CatalogueRecord."
                }
            ]
        }
    }
},
"required": [
    "type",
    "@id"
],
"additionalProperties": false
},
"releaseDate": {
    "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. This
property contains the date of formal issuance (e.g., publication) of the Catalogue",
    "type": "object",
    "properties": {
        "type": {
            "type": "string",
            "enum": [
                "Property"
            ]
        },
    },
    "@value": {
        "type": "string",
        "format": "date-time"
    }
},
"required": [
    "type",
    "@value"
],
"additionalProperties": false
},
"rights": {
    "description": "Property. Model:'http://purl.org/dc/terms/RightsStatement'. This property
refers to a statement that specifies rights associated with the Catalogue. DCAT-AP specification
mandates the use of Access Rights Named Authority List vocabulary",
    "type": "object",
    "properties": {

```

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    "type": {
      "type": "string",
      "enum": [
        "Property"
      ]
    },
    "@id": {
      "type": "string",
      "pattern": "^http:\\\\\\.\\.\\.\\.publications\\.\\.europa\\.\\.eu\\.\\.resource\\.\\.authority\\.\\.access-
right\\.\\.\\/[A-Z]{6,12}$"
    }
  },
  "required": [
    "type",
    "@id"
  ],
  "additionalProperties": false
},
"service": {
  "description": "Relationship. Model:'http://www.w3.org/ns/dcat#DataService'. This property
refers to the site(s) or end-point(s) (Data Service) that is(are) listed in the Catalogue",
  "type": "object",
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "Relationship"
      ]
    }
  },
  "@id": {
    "type": "array",
    "items": {
      "anyOf": [
        {
          "type": "string",
          "minLength": 1,
          "maxLength": 256,
          "pattern": "^[\\w\\-\\.\\{\\}\\$\\+\\*\\[\\]\\`~^@!,:\\\\\\\\]+$",
          "description": " Identifier format of any NGSI entity of type DataService."
        },
        {
          "type": "string",
          "format": "uri",
          "description": "Endpoint of the Data Service."
        }
      ]
    }
  }
},
"required": [
  "type",
  "@id"
],
"additionalProperties": false
},
"temporalCoverage": {
  "description": "Property. Model:'http://purl.org/dc/terms/PeriodOfTime'. This property
refers to the temporal period that the Catalogue covers",
  "type": "object",
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "Property"
      ]
    }
  },
  "@value": {
    "type": "array",
    "items": {
      "type": "object",
      "properties": {
        "beginning": {
          "type": "string",
          "description": "The beginning of a period or interval."
        },
        "end": {
          "type": "string",
          "description": "The end of a period or interval."
        }
      }
    }
  }
}

```



```

    },
    "startDate": {
      "type": "string",
      "format": "date-time",
      "description": "The start of the period."
    },
    "endDate": {
      "type": "string",
      "format": "date-time",
      "description": "The end of the period."
    }
  },
  "additionalProperties": false
}
},
"required": [
  "type",
  "@value"
],
"additionalProperties": false
},
"themes": {
  "description": "Property. Model:'http://www.w3.org/2004/02/skos/core#ConceptScheme'. This
property refers to the knowledge organization system(s) used to classify the Catalogue's Datasets.
DCAT-AP specification mandates the use of Dataset Theme Vocabulary",
  "type": "object",
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "Property"
      ]
    },
    "value": {
      "type": "array",
      "items": {
        "description": "Individual identifiers of the themes",
        "type": "object",
        "properties": {
          "@id": {
            "type": "string",
            "pattern": "^http:\\/\\/\\/publications\\.europa\\.eu\\/resource\\/authority\\/data-
theme\\/\\/[A-Z]{4}$"
          }
        },
        "required": [
          "@id"
        ],
        "additionalProperties": false
      }
    }
  },
  "required": [
    "type",
    "value"
  ],
  "additionalProperties": false
},
"title": {
  "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. This
property contains a name given to the Catalogue. This property can contain parallel language
versions of the title",
  "type": "object",
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "Property"
      ]
    },
    "value": {
      "type": "array",
      "items": {
        "description": "Property. Title in different languages",
        "anyOf": [
          {
            "type": "string"
          }
        ]
      }
    }
  }
}

```

```

    },
    {
      "type": "object",
      "properties": {
        "@language": {
          "type": "string",
          "pattern":
"^http:\\\\\\.\\publications\\.europa\\.eu\\/resource\\/authority\\/language\\/\\[A-Z\\]{3}$"
        },
        "@value": {
          "type": "string"
        }
      },
      "required": [
        "@value",
        "@language"
      ],
      "additionalProperties": false
    }
  ]
}
},
"required": [
  "type",
  "value"
],
"additionalProperties": false
},
"@context": {
  "type": "array"
}
},
"required": [
  "id",
  "type",
  "description",
  "publisher",
  "title"
]
}
}

```

B.2 Dataset entity JSON Schema

Listing B-2: JSON Schema for the NGSI-LD Dataset entity

```

{
  "$schema": "https://json-schema.org/draft/2020-12/schema",
  "$schemaVersion": "1.0.1",
  "$id": "DCAT-AP_NGSI-LD_Mapping/Dataset/schema.json",
  "title": "Dataset DCAT-AP",
  "description": "Datasets compliant with DCAT-AP specification version 3.0.0.",
  "type": "object",
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "Dataset"
      ],
      "description": "Property. Model:'https://schema.org/Text'. It has to be Dataset"
    },
    "id": {
      "type": "string",
      "minLength": 1,
      "maxLength": 256,
      "pattern": "^[\\w\\-\\.\\{\\}\\$\\+\\*\\[\\]\\`|~^@!,:\\\\\\\\]+$",
      "description": "Identifier format of any NGSI entity of type Dataset."
    },
    "accessRights": {
      "description": "Property. Model:'http://purl.org/dc/terms/RightsStatement'. This property refers to a statement that specifies rights associated with the Dataset. The Access Rights Named Authority List is the recommended vocabulary provided at http://publications.europa.eu/resource/authority/access-right",
    }
  }
}

```

```

    "type": "object",
    "properties": {
      "type": {
        "type": "string",
        "enum": [
          "Property"
        ]
      },
      "@id": {
        "type": "string",
        "pattern": "^http:\\\\\\.\\.\\.\\.publications\\.\\.eu\\.\\.resource\\.\\.authority\\.\\.access-
right\\.\\.\\/[A-Z]{6,12}$"
      }
    },
    "required": [
      "type",
      "@id"
    ],
    "additionalProperties": false
  },
  "applicableLegislation": {
    "description": "Property. Model:'http://data.europa.eu/eli/ontology#LegalResource'. The
legislation that mandates the creation or management of the Dataset. It is aligned with the
ontology included in Council conclusions inviting the introduction of the European Legislation
Identifier (ELI). In this data specification the use is restricted to instances of this class that
follow the (ELI) URI guidelines.",
    "type": "object",
    "properties": {
      "type": {
        "type": "string",
        "enum": [
          "Property"
        ]
      },
      "@id": {
        "type": "array",
        "items": {
          "type": "string",
          "format": "uri",
          "description": " Reference identifier of an Standard"
        }
      }
    },
    "required": [
      "type",
      "@id"
    ],
    "additionalProperties": false
  },
  "conformsTo": {
    "description": "Property. Model:'http://purl.org/dc/terms/Standard'. An implementing rule or
other specification.",
    "type": "object",
    "properties": {
      "type": {
        "type": "string",
        "enum": [
          "Property"
        ]
      },
      "@id": {
        "type": "array",
        "items": {
          "anyOf": [
            {
              "type": "string",
              "minLength": 1,
              "maxLength": 256,
              "pattern": "^[\\w\\-\\.\\{\\}\\$\\+\\*\\[\\]\\`|~@!,:\\\\\\\\]+$",
              "description": " Reference identifier of an Standard"
            },
            {
              "type": "string",
              "format": "uri"
            }
          ]
        }
      }
    }
  }
}

```

```

    },
    "required": [
      "type",
      "@id"
    ],
    "additionalProperties": false
  },
  "contactPoint": {
    "description": "Relationship. Model: 'vcard\thttp://www.w3.org/2006/vcard/ns#Kind'. Contact information that can be used for sending comments about the Dataset. Note that the class Kind is the parent class for the four explicit types of vCard (Individual, Organization, Location, Group).",
    "type": "object",
    "properties": {
      "type": {
        "type": "string",
        "enum": [
          "Relationship"
        ]
      },
      "@id": {
        "type": "string",
        "format": "uri"
      }
    },
    "required": [
      "type",
      "@id"
    ],
    "additionalProperties": false
  },
  "creator": {
    "description": "Relationship. Model: 'http://xmlns.com/foaf/0.1/Agent'. The entities primarily responsible for producing the dataset",
    "type": "object",
    "properties": {
      "type": {
        "type": "string",
        "enum": [
          "Relationship"
        ]
      },
      "@id": {
        "type": "array",
        "items": {
          "type": "string",
          "minLength": 1,
          "maxLength": 256,
          "pattern": "^[\\w\\-\\.\\{\\}\\$\\+\\*\\[\\]\\`~^@!,:\\\\\\\\]+$",
          "description": " Reference identifier of an entity primarily responsible for producing the dataset"
        }
      }
    },
    "required": [
      "type",
      "@id"
    ],
    "additionalProperties": false
  },
  "datasetDistribution": {
    "description": "Relationship. Model: 'http://www.w3.org/ns/dcat#Distribution'. This property links to available Distribution(s) for the Dataset.",
    "type": "object",
    "properties": {
      "type": {
        "type": "string",
        "enum": [
          "Relationship"
        ]
      },
      "@id": {
        "type": "array",
        "items": {
          "anyOf": [
            {
              "type": "string",
              "minLength": 1,

```

```

        "maxLength": 256,
        "pattern": "^[\\w\\-\\.\\{\\}\\$\\+\\*\\[\\]\\`|~^@!,:\\\\\\\\]+$",
        "description": "Identifier format of any NGSI entity of type Distribution."
    },
    {
        "type": "string",
        "format": "uri",
        "description": "Reference identifier of any NGSI entity of type Distribution."
    }
]
}
},
"required": [
    "type",
    "@id"
],
"additionalProperties": false
},
"description": {
    "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. This property contains a free-text account of the Dataset. This property can be repeated for parallel language versions of the description.",
    "type": "object",
    "properties": {
        "type": {
            "type": "string",
            "enum": [
                "Property"
            ]
        },
        "value": {
            "type": "array",
            "items": {
                "anyOf": [
                    {
                        "type": "string"
                    },
                    {
                        "type": "object",
                        "properties": {
                            "@language": {
                                "type": "string",
                                "pattern":
"^http:\\\\\\.\\.\\.publications\\.\\.europa\\.\\.eu\\.\\.resource\\.\\.authority\\.\\.language\\.\\.\\/[A-Z]{3}$"
                            },
                            "@value": {
                                "type": "string"
                            }
                        }
                    }
                ]
            },
            "required": [
                "@value",
                "@language"
            ],
            "additionalProperties": false
        }
    },
    "description": "Dataset description in different languages."
}
},
"required": [
    "type",
    "value"
],
"additionalProperties": false
},
"documentation": {
    "description": "Property. Model:'http://xmlns.com/foaf/0.1/homepage'. This property refers to a page or document about this Dataset.",
    "type": "object",
    "properties": {
        "type": {
            "type": "string",
            "enum": [
                "Property"
            ]
        }
    }
},

```

```

    "@id": {
      "type": "string",
      "format": "uri"
    }
  },
  "required": [
    "type",
    "@id"
  ],
  "additionalProperties": false
},
"frequency": {
  "description": "Property. Model:'http://purl.org/dc/terms/Frequency'. This property refers
to the frequency at which the Dataset is updated. The EU Vocabularies Frequency Named Authority
List is the recommended vocabulary provided at
http://publications.europa.eu/resource/authority/frequency",
  "type": "object",
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "Property"
      ]
    },
    "value": {
      "type": "string",
      "pattern":
"^http:\\\\publications\\.europa\\.eu\\\\resource\\\\authority\\\\frequency\\\\/"
    }
  },
  "required": [
    "type",
    "value"
  ],
  "additionalProperties": false
},
"geographicalCoverage": {
  "description": "Relationship. Model:'http://purl.org/dc/terms/Location'. This relationship
refers to a geographical area covered by the Dataset",
  "type": "object",
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "Relationship"
      ]
    },
    "@id": {
      "type": "string",
      "minLength": 1,
      "maxLength": 256,
      "pattern": "^[\\w\\-\\.\\{\\}\\$\\+\\*\\[\\]\\`|~^@!,:\\\\\\\\]+$",
      "description": "Reference identifier of any NGSI entity of type Location."
    }
  },
  "required": [
    "type",
    "@id"
  ],
  "additionalProperties": false
},
"hasVersion": {
  "description": "Relationship. Model:'http://www.w3.org/ns/dcat#Catalog'. This property
refers to a related Dataset that is a version, edition, or adaptation of the described Dataset.",
  "type": "object",
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "Relationship"
      ]
    },
    "@id": {
      "type": "array",
      "items": {
        "anyOf": [
          {
            "type": "string",

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```

        "minLength": 1,
        "maxLength": 256,
        "pattern": "^[\\w\\-\\.\\.\\{\\}\\$\\+\\*\\[\\]\\`~^@!,:\\\\\\\\]+$",
        "description": " Identifier format of any NGSI entity of type Dataset."
    },
    {
        "type": "string",
        "format": "uri",
        "description": "Reference identifier of any NGSI entity of type Dataset."
    }
]
}
},
"required": [
    "type",
    "@id"
],
"additionalProperties": false
},
"inSeries": {
    "description": "Relationship. Model:'http://www.w3.org/ns/dcat#DatasetSeries'. This property
links to the dataset series of which the dataset is part.",
    "type": "object",
    "properties": {
        "type": {
            "type": "string",
            "enum": [
                "Relationship"
            ]
        },
        "@id": {
            "type": "array",
            "items": {
                "anyOf": [
                    {
                        "type": "string",
                        "minLength": 1,
                        "maxLength": 256,
                        "pattern": "^[\\w\\-\\.\\.\\{\\}\\$\\+\\*\\[\\]\\`~^@!,:\\\\\\\\]+$",
                        "description": "Identifier format of any NGSI entity of type DatasetSeries."
                    },
                    {
                        "type": "string",
                        "format": "uri",
                        "description": "Reference identifier of any NGSI entity of type DatasetSeries."
                    }
                ]
            }
        }
    }
},
"required": [
    "type",
    "@id"
],
"additionalProperties": false
},
"isReferencedBy": {
    "description": "Relationship. Model:'http://www.w3.org/2000/01/rdf-schema#Resource'.A
related resource, such as a publication, that references, cites, or otherwise points to the
dataset.",
    "type": "object",
    "properties": {
        "type": {
            "type": "string",
            "enum": [
                "Relationship"
            ]
        },
        "@id": {
            "type": "array",
            "items": {
                "anyOf": [
                    {
                        "type": "string",
                        "minLength": 1,
                        "maxLength": 256,
                        "pattern": "^[\\w\\-\\.\\.\\{\\}\\$\\+\\*\\[\\]\\`~^@!,:\\\\\\\\]+$",

```

```

        "description": " Identifier format of any NGSI entity of type Resource."
      },
      {
        "type": "string",
        "format": "uri",
        "description": "Reference identifier of any NGSI entity of type Resource."
      }
    ]
  }
},
"required": [
  "type",
  "@id"
],
"additionalProperties": false
},
"keyword": {
  "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. This
property contains a keyword or tag describing the Dataset. This property can contain as many
keywords as necessary",
  "type": "object",
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "Property"
      ]
    },
    "value": {
      "type": "array",
      "items": {
        "anyOf": [
          {
            "type": "string"
          },
          {
            "type": "object",
            "properties": {
              "@language": {
                "type": "string",
                "pattern":
"^http:\\\\\\.\\./publications\\.europa\\.eu\\/resource\\/authority\\/language\\/\\[A-Z\\]{3}$"
              },
              "@value": {
                "type": "string"
              }
            }
          }
        ],
        "required": [
          "@value",
          "@language"
        ],
        "additionalProperties": false
      }
    },
    "description": "Property. Title in different languages"
  }
},
"required": [
  "type",
  "value"
],
"additionalProperties": false
},
"landingPage": {
  "description": "Property. Model:'http://xmlns.com/foaf/0.1/homepage'. This property refers
to a web page that provides access to the Dataset, its Distributions and/or additional
information.",
  "type": "object",
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "Property"
      ]
    },
    "value": {
      "type": "string",
      "enum": [
        "Property"
      ]
    }
  },
  "required": [
    "type",
    "value"
  ],
  "additionalProperties": false
},
"@id": {

```



```

        "type": "string",
        "format": "uri"
    },
    },
    "required": [
        "type",
        "@id"
    ],
    "additionalProperties": false
},
"language": {
    "description": "Property. Model:'http://purl.org/dc/terms/LinguisticSystem'. This property
refers to a language of the Dataset. This property can be repeated if the metadata is provided in
multiple languages. The EU Vocabularies Languages Named Authority List is the recommended
vocabulary provided at http://publications.europa.eu/resource/authority/language",
    "type": "object",
    "properties": {
        "type": {
            "type": "string",
            "enum": [
                "Property"
            ]
        },
        "value": {
            "type": "array",
            "items": {
                "description": "Individual identifier of the language",
                "type": "string",
                "pattern":
"^[http:\\/\\/\\publications\\.europa\\.eu\\/resource\\/authority\\/language\\/[A-Z]{3}$"
            }
        }
    },
    "required": [
        "type",
        "value"
    ],
    "additionalProperties": false
},
"modificationDate": {
    "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. This
property contains the most recent date on which the Catalogue was modified",
    "type": "object",
    "properties": {
        "type": {
            "type": "string",
            "enum": [
                "Property"
            ]
        },
        "@value": {
            "type": "string",
            "format": "date-time"
        }
    },
    "required": [
        "type",
        "@value"
    ],
    "additionalProperties": false
},
"otherIdentifier": {
    "description": "A secondary identifier of the Dataset. Examples are MAST/ADS, DataCite, DOI,
EZID or W3ID.",
    "type": "object",
    "properties": {
        "type": {
            "type": "string",
            "enum": [
                "Property"
            ]
        },
        "@id": {
            "type": "string",
            "minLength": 1,
            "maxLength": 256
        }
    },
    },

```

```

    "required": [
      "type",
      "@id"
    ],
    "additionalProperties": false
  },
  "provenance": {
    "description": "Property. Model:'http://purl.org/dc/terms/ProvenanceStatement'. A statement about the lineage of a Dataset. Any changes in ownership and custody of the Dataset since its creation that are significant for its authenticity, integrity, and interpretation.",
    "type": "object",
    "properties": {
      "type": {
        "type": "string",
        "enum": [
          "Property"
        ]
      },
      "value": {
        "type": "array",
        "items": {
          "anyOf": [
            {
              "type": "string"
            },
            {
              "type": "object",
              "properties": {
                "@language": {
                  "type": "string",
                  "pattern":
                    "^http:\\\\\\.\\.\\.publications\\.europa\\.eu\\.\\.\\.resource\\.\\.\\.authority\\.\\.\\.language\\.\\.\\.\\[A-Z\\]{3}$"
                },
                "@value": {
                  "type": "string"
                }
              }
            }
          ],
          "required": [
            "@value",
            "@language"
          ],
          "additionalProperties": false
        }
      },
      "description": "Property. Title in different languages"
    }
  },
  "required": [
    "type",
    "value"
  ],
  "additionalProperties": false
},
"publisher": {
  "description": "Relationship. Model:'http://xmlns.com/foaf/0.1/#term_Agent'. This property links to an entity (organisation) responsible for making the Dataset available",
  "type": "object",
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "Relationship"
      ]
    },
    "@id": {
      "type": "string",
      "minLength": 1,
      "maxLength": 256,
      "pattern": "^[\\w\\-\\.\\{\\}\\$\\+\\*\\[\\]\\`~^@!,:\\\\\\\\]+$",
      "description": "Reference identifier of an entity primarily responsible for making the Catalogue available"
    }
  },
  "required": [
    "type",
    "@id"
  ],

```

```

    "additionalProperties": false
  },
  "qualifiedAttribution": {
    "description": "Relationship. Model:'http://www.w3.org/ns/prov#Attribution'.Used to link to
an Agent having some form of responsibility for the resource, but where the nature of the
relationship is known but does not match one of the standard [DCTERMS] properties (dct:creator,
dct:publisher).",
    "type": "object",
    "properties": {
      "type": {
        "type": "string",
        "enum": [
          "Relationship"
        ]
      }
    },
    "@id": {
      "type": "array",
      "items": {
        "anyOf": [
          {
            "type": "string",
            "minLength": 1,
            "maxLength": 256,
            "pattern": "^[\\w\\-\\.\\{\\}\\$\\+\\*\\[\\]\\`~^@!,:\\\\\\\\]+$",
            "description": " Identifier format of any NGSI entity of type Agent."
          },
          {
            "type": "string",
            "format": "uri",
            "description": "Reference identifier of any NGSI entity of type Agent."
          }
        ]
      }
    }
  },
  "required": [
    "type",
    "@id"
  ],
  "additionalProperties": false
},
"qualifiedRelation": {
  "description": "Relationship. Model:'http://www.w3.org/ns/dcat#Relationship'.Used to link to
another resource where the nature of the relationship is known but does not match one of the
standard [DCTERMS] properties or [PROV-O] properties",
  "type": "object",
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "Relationship"
      ]
    }
  },
  "@id": {
    "type": "array",
    "items": {
      "anyOf": [
        {
          "type": "string",
          "minLength": 1,
          "maxLength": 256,
          "pattern": "^[\\w\\-\\.\\{\\}\\$\\+\\*\\[\\]\\`~^@!,:\\\\\\\\]+$",
          "description": " Identifier format of any NGSI entity of type Relationship."
        },
        {
          "type": "string",
          "format": "uri",
          "description": "Reference identifier of any NGSI entity of type Relationship."
        }
      ]
    }
  }
},
"required": [
  "type",
  "@id"
],
"additionalProperties": false

```

```

    },
    "relatedResource": {
      "description": "Relationship. Model:'http://www.w3.org/2000/01/rdf-schema#Resource'. A
related resource.",
      "type": "object",
      "properties": {
        "type": {
          "type": "string",
          "enum": [
            "Relationship"
          ]
        },
      },
      "@id": {
        "type": "array",
        "items": {
          "anyOf": [
            {
              "type": "string",
              "minLength": 1,
              "maxLength": 256,
              "pattern": "^[\\w\\-\\.\\{\\}\\$\\+\\*\\[\\]\\`|~^@!,:\\\\\\\\]+$",
              "description": " Identifier format of any NGSI entity of type Resource."
            },
            {
              "type": "string",
              "format": "uri",
              "description": "Reference identifier of any NGSI entity of type Resource."
            }
          ]
        }
      }
    },
    "required": [
      "type",
      "@id"
    ],
    "additionalProperties": false
  },
  "releaseDate": {
    "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. This
property contains the date of formal issuance (e.g., publication) of the Dataset",
    "type": "object",
    "properties": {
      "type": {
        "type": "string",
        "enum": [
          "Property"
        ]
      },
    },
    "@value": {
      "type": "string",
      "format": "date-time"
    }
  },
  "required": [
    "type",
    "@value"
  ],
  "additionalProperties": false
},
"sample": {
  "description": "Relationship. Model:'http://www.w3.org/ns/dcat#dataset'. This property links
to sample Distribution(s) of the Dataset.",
  "type": "object",
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "Relationship"
      ]
    },
  },
  "@id": {
    "type": "array",
    "items": {
      "anyOf": [
        {
          "type": "string",
          "minLength": 1,

```

```

        "maxLength": 256,
        "pattern": "^[\\w\\-\\.\\{\\}\\$\\+\\*\\[\\]\\`|~^@!,:\\\\\\\\]+$",
        "description": "Identifier format of any NGSI entity of type Distribution."
    },
    {
        "type": "string",
        "format": "uri",
        "description": "Reference identifier of any NGSI entity of type Distribution."
    }
]
}
},
"required": [
    "type",
    "@id"
],
"additionalProperties": false
},
"source": {
    "description": "Relationship. Model:'http://www.w3.org/ns/dcat#Catalog'. This property refers to a related Dataset from which the described Dataset is derived.",
    "type": "object",
    "properties": {
        "type": {
            "type": "string",
            "enum": [
                "Relationship"
            ]
        },
        "@id": {
            "type": "array",
            "items": {
                "anyOf": [
                    {
                        "type": "string",
                        "minLength": 1,
                        "maxLength": 256,
                        "pattern": "^[\\w\\-\\.\\{\\}\\$\\+\\*\\[\\]\\`|~^@!,:\\\\\\\\]+$",
                        "description": " Identifier format of any NGSI entity of type Catalogue."
                    },
                    {
                        "type": "string",
                        "format": "uri",
                        "description": "Reference identifier of any NGSI entity of type Catalogue."
                    }
                ]
            }
        }
    }
},
"required": [
    "type",
    "@id"
],
"additionalProperties": false
},
"spatialResolution": {
    "description": "Property. Model:'http://www.w3.org/2001/XMLSchema#decimal'. This property refers to the minimum spatial separation resolvable in a dataset, measured in meters.",
    "type": "object",
    "properties": {
        "type": {
            "type": "string",
            "enum": [
                "Property"
            ]
        },
        "value": {
            "type": "number"
        }
    },
    "required": [
        "type",
        "value"
    ],
    "additionalProperties": false
},
"temporalCoverage": {

```

```

    "description": "Property. Model:'http://purl.org/dc/terms/PeriodOfTime'. This property
refers to the temporal period that the Dataset covers",
    "type": "object",
    "properties": {
      "type": {
        "type": "string",
        "enum": [
          "Property"
        ]
      },
      "@value": {
        "type": "array",
        "items": {
          "type": "object",
          "properties": {
            "beginning": {
              "type": "string",
              "description": "The beginning of a period or interval."
            },
            "end": {
              "type": "string",
              "description": "The end of a period or interval."
            },
            "startDate": {
              "type": "string",
              "format": "date-time",
              "description": "The start of the period."
            },
            "endDate": {
              "type": "string",
              "format": "date-time",
              "description": "The end of the period."
            }
          }
        }
      },
      "additionalProperties": false
    }
  },
  "required": [
    "type",
    "@value"
  ],
  "additionalProperties": false
},
"temporalResolution": {
  "description": "Property. Model:'http://www.w3.org/2001/XMLSchema#duration'. This property
refers to the minimum time period resolvable in the dataset.",
  "type": "object",
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "Property"
      ]
    },
    "value": {
      "type": "string",
      "format": "duration"
    }
  },
  "required": [
    "type",
    "value"
  ],
  "additionalProperties": false
},
"theme": {
  "description": "Property. Model:'http://www.w3.org/2004/02/skos/core#ConceptScheme'. This
property refers to a knowledge organization system used to classify the Catalogue's Datasets. The
Dataset Theme Vocabulary is the recommended vocabulary provided at
http://publications.europa.eu/resource/authority/data-theme ,
  "type": "object",
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "Property"
      ]
    }
  }
}
]

```

```

    },
    "value": {
      "type": "array",
      "items": {
        "description": "Individual identifiers of the themes",
        "type": "object",
        "properties": {
          "@id": {
            "type": "string",
            "pattern": "^http:\\\\\\.\\.\\.\\/publications\\.\\.\\.eu\\.\\.\\.\\/resource\\.\\.\\.\\/authority\\.\\.\\.\\/data-
theme\\.\\.\\.\\/[A-Z]{4}$"
          }
        },
        "required": [
          "@id"
        ],
        "additionalProperties": false
      }
    },
    "required": [
      "type",
      "value"
    ],
    "additionalProperties": false
  },
  "title": {
    "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. This
property contains a name given to the Dataset. This property can be repeated for parallel language
versions of the title",
    "type": "object",
    "properties": {
      "type": {
        "type": "string",
        "enum": [
          "Property"
        ]
      }
    },
    "value": {
      "type": "array",
      "items": {
        "anyOf": [
          {
            "type": "string"
          },
          {
            "type": "object",
            "properties": {
              "@language": {
                "type": "string",
                "pattern":
"^http:\\\\\\.\\.\\.\\/publications\\.\\.\\.eu\\.\\.\\.\\/resource\\.\\.\\.\\/authority\\.\\.\\.\\/language\\.\\.\\.\\/[A-Z]{3}$"
              },
              "@value": {
                "type": "string"
              }
            }
          }
        ],
        "required": [
          "@value",
          "@language"
        ],
        "additionalProperties": false
      }
    },
    "description": "Property. Title in different languages"
  }
},
"required": [
  "type",
  "value"
],
"additionalProperties": false
},
"datasetType": {
  "description": "Property. Model:'http://www.w3.org/2004/02/skos/core#Concept'. This property
contains the nature or genre of the resource. The Dataset-type authority table is the recommended
vocabulary provided at http://publications.europa.eu/resource/dataset/dataset-type",

```

```

    "type": "object",
    "properties": {
      "type": {
        "type": "string",
        "enum": [
          "Property"
        ]
      },
      "value": {
        "type": "string"
      }
    },
    "required": [
      "type",
      "value"
    ],
    "additionalProperties": false
  },
  "version": {
    "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. The version indicator (name or identifier) of a resource.",
    "type": "object",
    "properties": {
      "type": {
        "type": "string",
        "enum": [
          "Property"
        ]
      },
      "value": {
        "type": "string"
      }
    },
    "required": [
      "type",
      "value"
    ],
    "additionalProperties": false
  },
  "versionNotes": {
    "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. A description of the differences between this version and a previous version of the Dataset. This property can be repeated for parallel language versions of the version notes.",
    "type": "object",
    "properties": {
      "type": {
        "type": "string",
        "enum": [
          "Property"
        ]
      },
      "value": {
        "type": "array",
        "items": {
          "anyOf": [
            {
              "type": "string"
            },
            {
              "type": "object",
              "properties": {
                "@language": {
                  "type": "string",
                  "pattern":
"^[http:\\\\\\.\\/publications\\.europa\\.eu\\/resource\\/authority\\/language\\/\\/[A-Z]{3}$"
                },
                "@value": {
                  "type": "string"
                }
              }
            }
          ]
        },
        "required": [
          "@value",
          "@language"
        ],
        "additionalProperties": false
      }
    },
    "description": "Property. Version notes in different languages"
  }

```



```

    }
  },
  "required": [
    "type",
    "value"
  ],
  "additionalProperties": false
},
"wasGeneratedBy": {
  "description": "Relationship. Model: 'http://www.w3.org/ns/prov#Activity'. An activity that
generated, or provides the business context for, the creation of the dataset",
  "type": "object",
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "Relationship"
      ]
    },
    "@id": {
      "type": "array",
      "items": {
        "anyOf": [
          {
            "type": "string",
            "minLength": 1,
            "maxLength": 256,
            "pattern": "^[\\w\\-\\.\\{\\}\\$\\+\\*\\[\\]\\`|~^@!,:\\\\\\\\]+$",
            "description": " Identifier format of any NGSI entity of type DataService."
          },
          {
            "type": "string",
            "format": "uri",
            "description": "Endpoint of the Data Service."
          }
        ]
      }
    }
  }
},
"required": [
  "type",
  "@id"
],
"additionalProperties": false
},
"@context": {
  "type": "array"
}
},
"required": [
  "id",
  "type",
  "description",
  "publisher",
  "title"
],
"additionalProperties": false
}

```

B.3 Dataset Series entity JSON Schema

Listing B-3: JSON Schema for the NGSI-LD Dataset Series entity

```

{
  "$schema": "https://json-schema.org/draft/2020-12/schema",
  "$schemaVersion": "1.0.1",
  "$id": "DCAT-AP_NGSI-LD_Mapping/DatasetSeries/schema.json",
  "title": "Dataset DCAT-AP",
  "description": "Dataset Series compliant with DCAT-AP specification version 3.0.0.",
  "type": "object",
  "properties": {
    "type": {

```

```

    "type": "string",
    "enum": [
      "DatasetSeries"
    ],
    "description": "Property. Model:'https://schema.org/Text'. It has to be Dataset"
  },
  "id": {
    "type": "string",
    "minLength": 1,
    "maxLength": 256,
    "pattern": "^[\\w\\-\\.\\{\\}\\$\\+\\*\\[\\]\\`|~^@!,:\\\\\\\\]+$",
    "description": " Identifier format of any NGSI entity of type Dataset."
  },
  "applicableLegislation": {
    "description": "Property. Model:'http://data.europa.eu/eli/ontology#LegalResource'. The
    legislation that mandates the creation or management of the Dataset. It is aligned with the
    ontology included in Council conclusions inviting the introduction of the European Legislation
    Identifier (ELI). In this data specification the use is restricted to instances of this class that
    follow the (ELI) URI guidelines.",
    "type": "object",
    "properties": {
      "type": {
        "type": "string",
        "enum": [
          "Property"
        ]
      },
      "@id": {
        "type": "array",
        "items": {
          "type": "string",
          "format": "uri",
        }
      }
    },
    "required": [
      "type",
      "@id"
    ],
    "additionalProperties": false
  },
  "contactPoint": {
    "description": "Relationship. Model:'vcard\\thttp://www.w3.org/2006/vcard/ns#Kind'. Contact
    information that can be used for sending comments about the Dataset Series. Note that the class
    Kind is the parent class for the four explicit types of vCard (Individual, Organization, Location,
    Group).",
    "type": "object",
    "properties": {
      "type": {
        "type": "string",
        "enum": [
          "Relationship"
        ]
      },
      "@id": {
        "type": "string",
        "format": "uri"
      }
    },
    "required": [
      "type",
      "@id"
    ],
    "additionalProperties": false
  },
  "description": {
    "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. This
    property contains a free-text account of the Dataset Series. This property can be repeated for
    parallel language versions of the description.",
    "type": "object",
    "properties": {
      "type": {
        "type": "string",
        "enum": [
          "Property"
        ]
      }
    },
    "value": {

```

```

        "type": "array",
        "items": {
          "anyOf": [
            {
              "type": "string"
            },
            {
              "type": "object",
              "properties": {
                "@language": {
                  "type": "string",
                  "pattern":
"^[http:\\\\\\.\\/publications\\.europa\\.eu\\/resource\\/authority\\/language\\/][A-Z]{3}$"
                },
                "@value": {
                  "type": "string"
                }
              },
              "required": [
                "@value",
                "@language"
              ],
              "additionalProperties": false
            }
          ],
          "description": "Dataset description in different languages."
        }
      },
      "required": [
        "type",
        "value"
      ],
      "additionalProperties": false
    },
    "frequency": {
      "description": "Property. Model:'http://purl.org/dc/terms/Frequency'. This property refers
to the frequency at which the Dataset Series is updated. The EU Vocabularies Frequency Named
Authority List is the recommended vocabulary provided at
http://publications.europa.eu/resource/authority/frequency",
      "type": "object",
      "properties": {
        "type": {
          "type": "string",
          "enum": [
            "Property"
          ]
        },
        "value": {
          "type": "string",
          "pattern":
"^[http:\\\\\\.\\/publications\\.europa\\.eu\\/resource\\/authority\\/frequency\\/]"
        }
      },
      "required": [
        "type",
        "value"
      ],
      "additionalProperties": false
    },
    "geographicalCoverage": {
      "description": "Relationship. Model:'http://purl.org/dc/terms/Location'. This relationship
refers to a geographical area covered by the Dataset Series",
      "type": "object",
      "properties": {
        "type": {
          "type": "string",
          "enum": [
            "Relationship"
          ]
        },
        "@id": {
          "type": "string",
          "minLength": 1,
          "maxLength": 256,
          "pattern": "^[\\w\\-\\.\\{\\}\\$\\+\\*\\[\\]\\`~^@!,:\\\\\\\\]+$",
          "description": "Reference identifier of any NGSI entity of type Location."
        }
      }
    }
  }

```

```

    },
    "required": [
      "type",
      "@id"
    ],
    "additionalProperties": false
  },
  "modificationDate": {
    "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. This
property contains the most recent date on which the Catalogue was modified",
    "type": "object",
    "properties": {
      "type": {
        "type": "string",
        "enum": [
          "Property"
        ]
      },
      "@value": {
        "type": "string",
        "format": "date-time"
      }
    },
    "required": [
      "type",
      "@value"
    ],
    "additionalProperties": false
  },
  "publisher": {
    "description": "Relationship. Model:'http://xmlns.com/foaf/0.1/#term_Agent'. This property
links to an entity (organisation) responsible for making the Dataset available",
    "type": "object",
    "properties": {
      "type": {
        "type": "string",
        "enum": [
          "Relationship"
        ]
      },
      "@id": {
        "type": "string",
        "minLength": 1,
        "maxLength": 256,
        "pattern": "^[\\w\\-\\.\\{\\}\\$\\+\\*\\[\\]\\`|~^@!,:\\|\\|]+$",
        "description": " Reference identifier of an entity primarily responsible for making the
Catalogue available"
      }
    },
    "required": [
      "type",
      "@id"
    ],
    "additionalProperties": false
  },
  "releaseDate": {
    "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. This
property contains the date of formal issuance (e.g., publication) of the Dataset",
    "type": "object",
    "properties": {
      "type": {
        "type": "string",
        "enum": [
          "Property"
        ]
      },
      "@value": {
        "type": "string",
        "format": "date-time"
      }
    },
    "required": [
      "type",
      "@value"
    ],
    "additionalProperties": false
  },
  "temporalCoverage": {

```

```

"description": "Property. Model:'http://purl.org/dc/terms/PeriodOfTime'. This property
refers to the temporal period that the Dataset covers",
"type": "object",
"properties": {
  "type": {
    "type": "string",
    "enum": [
      "Property"
    ]
  },
  "@value": {
    "type": "array",
    "items": {
      "type": "object",
      "properties": {
        "beginning": {
          "type": "string",
          "description": "The beginning of a period or interval."
        },
        "end": {
          "type": "string",
          "description": "The end of a period or interval."
        },
        "startDate": {
          "type": "string",
          "format": "date-time",
          "description": "The start of the period."
        },
        "endDate": {
          "type": "string",
          "format": "date-time",
          "description": "The end of the period."
        }
      }
    },
    "additionalProperties": false
  }
},
"required": [
  "type",
  "@value"
],
"additionalProperties": false
},
"title": {
  "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. This
property contains a name given to the Dataset Series. This property can be repeated for parallel
language versions of the title",
"type": "object",
"properties": {
  "type": {
    "type": "string",
    "enum": [
      "Property"
    ]
  }
},
"value": {
  "type": "array",
  "items": {
    "anyOf": [
      {
        "type": "string"
      },
      {
        "type": "object",
        "properties": {
          "@language": {
            "type": "string",
            "pattern":
"^http:\\\\\\.\\./publications\\.europa\\.eu\\.\\.resource\\.\\.authority\\.\\.language\\.\\.\\/[A-Z]{3}$"
          },
          "@value": {
            "type": "string"
          }
        }
      }
    ],
    "required": [
      "@value",
      "@language"
    ]
  }
}

```

```

    ],
    "additionalProperties": false
  }
},
],
"description": "Property. Title in different languages"
}
},
},
"required": [
  "type",
  "value"
],
"additionalProperties": false
},
"@context": {
  "type": "array"
}
},
"required": [
  "id",
  "type",
  "description",
  "title"
],
"additionalProperties": false
}
}

```

B.4 Distribution entity JSON Schema

Listing B-4: JSON Schema for the NGSI-LD Distribution entity

```

{
  "$schema": "https://json-schema.org/draft/2020-12/schema",
  "$schemaVersion": "1.0.1",
  "$id": "DCAT-AP_NGSI-LD_Mapping/Distribution/schema.json",
  "title": "Distribution DCAT-AP",
  "description": "Distribution of data compliant with DCAT-AP specification version 3.0.0.",
  "type": "object",
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "Distribution"
      ],
      "description": "Property. Model:'https://schema.org/Text'. It has to be Dataset"
    },
    "id": {
      "type": "string",
      "minLength": 1,
      "maxLength": 256,
      "pattern": "^[\\w\\-\\.\\{\\}\\$\\+\\*\\[\\]\\`|~^@!,:\\\\\\\\]+$",
      "description": " Identifier format of any NGSI entity of type Dataset."
    },
    "accessService": {
      "description": "Relationship. Model:'http://www.w3.org/ns/dcat#DataService'. This property links to a data service that gives access to the distribution of the dataset.",
      "type": "object",
      "properties": {
        "type": {
          "type": "string",
          "enum": [
            "Relationship"
          ]
        }
      },
      "@id": {
        "type": "array",
        "items": {
          "anyOf": [
            {
              "type": "string",
              "minLength": 1,
              "maxLength": 256,
              "pattern": "^[\\w\\-\\.\\{\\}\\$\\+\\*\\[\\]\\`|~^@!,:\\\\\\\\]+$",

```

```

        "description": "Identifier format of any NGSI entity of type Distribution."
      },
      {
        "type": "string",
        "format": "uri",
        "description": "Reference identifier of any NGSI entity of type Distribution."
      }
    ]
  }
},
"required": [
  "type",
  "@id"
],
"additionalProperties": false
},
"accessURL": {
  "description": "Property. Model:'https://www.w3.org/ns/dcat#endpointURL'. A URL that gives
access to a Distribution of the Dataset. The resource at the access URL may contain information
about how to get the Dataset.",
  "type": "object",
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "Property"
      ]
    },
    "@id": {
      "type": "string",
      "format": "url"
    }
  },
  "required": [
    "type",
    "@id"
  ],
  "additionalProperties": false
},
"applicableLegislation": {
  "description": "Property. Model:'http://data.europa.eu/eli/ontology#LegalResource'. The
legislation that mandates the creation or management of the Dataset. It is aligned with the
ontology included in Council conclusions inviting the introduction of the European Legislation
Identifier (ELI). In this data specification the use is restricted to instances of this class that
follow the (ELI) URI guidelines.",
  "type": "object",
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "Property"
      ]
    },
    "@id": {
      "type": "array",
      "items": {
        "type": "string",
        "format": "uri",
      }
    }
  },
  "required": [
    "type",
    "@id"
  ],
  "additionalProperties": false
},
"availability": {
  "description": "Property. Model:'http://www.w3.org/2004/02/skos/core#Concept'. An indication
how long it is planned to keep the Distribution of the Dataset available.",
  "type": "object",
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "Property"
      ]
    }
  }
}
]

```

```

    },
    "value": {
      "type": "string",
      "format": "duration"
    }
  },
  "required": [
    "type",
    "value"
  ],
  "additionalProperties": false
},
"byteSize": {
  "description": "Property. Model:'https://www.w3.org/2001/XMLSchema#nonNegativeInteger'. The size of a Distribution in bytes. ",
  "type": "object",
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "Property"
      ]
    },
    "value": {
      "type": "integer",
      "minimum": 0
    }
  },
  "required": [
    "type",
    "value"
  ],
  "additionalProperties": false
},
"checksum": {
  "description": "Relationship. Model:'https://spdx.org/rdf/terms/#checksum'. A mechanism that can be used to verify that the contents of a distribution have not changed.",
  "type": "object",
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "Relationship"
      ]
    },
    "@id": {
      "type": "string",
      "minLength": 1,
      "maxLength": 256,
      "pattern": "^[\\w\\-\\.\\|\\{\\}\\$\\+\\*\\[\\]\\`~^@!,:\\\\\\\\]+$",
      "description": " Identifier format of any NGSI entity of type Checksum"
    }
  },
  "required": [
    "type",
    "@id"
  ],
  "additionalProperties": false
},
"compressionFormat": {
  "description": "Property. Model:'http://purl.org/dc/terms/MediaType'. The format of the file in which the data is contained in a compressed form, e.g. to reduce the size of the downloadable file. It SHOULD be expressed using a media type as defined in the official register of media types managed by IANA.",
  "type": "object",
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "Property"
      ]
    },
    "@id": {
      "type": "string"
    }
  },
  "required": [
    "type",

```



```

    "@id"
  ],
  "additionalProperties": false
},
"description": {
  "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. This
property contains a free-text account of the Distribution. This property can be repeated for
parallel language versions of the description.",
  "type": "object",
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "Property"
      ]
    },
    "value": {
      "type": "array",
      "items": {
        "anyOf": [
          {
            "type": "string"
          },
          {
            "type": "object",
            "properties": {
              "@language": {
                "type": "string",
                "pattern":
"^http:\\/\\/\\/publications\\.europa\\.eu\\/resource\\/authority\\/language\\/\\/[A-Z]{3}$"
              },
              "@value": {
                "type": "string"
              }
            }
          },
          {
            "required": [
              "@value",
              "@language"
            ],
            "additionalProperties": false
          }
        ]
      },
      "description": "Distribution description in different languages."
    }
  },
  "required": [
    "type",
    "value"
  ],
  "additionalProperties": false
},
"documentation": {
  "description": "Property. Model:'http://xmlns.com/foaf/0.1/homepage'. This property refers
to a page or document about this Distribution. ",
  "type": "object",
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "Property"
      ]
    },
    "@id": {
      "type": "string",
      "format": "uri"
    }
  },
  "required": [
    "type",
    "@id"
  ],
  "additionalProperties": false
},
"downloadURL": {
  "description": "Property. Model:'https://www.w3.org/ns/dcat#downloadURL'. A URL that is a
direct link to a downloadable file in a given format.",
  "type": "object",

```

```

    "properties": {
      "type": {
        "type": "string",
        "enum": [
          "Property"
        ]
      },
      "@id": {
        "type": "string",
        "format": "uri"
      }
    },
    "required": [
      "type",
      "@id"
    ],
    "additionalProperties": false
  },
  "format": {
    "description": "Property. Model:'http://purl.org/dc/terms/MediaTypeOrExtent'. The file format of the Distribution.",
    "type": "object",
    "properties": {
      "type": {
        "type": "string",
        "enum": [
          "Property"
        ]
      },
      "@id": {
        "type": "string"
      }
    },
    "required": [
      "type",
      "@id"
    ],
    "additionalProperties": false
  },
  "hasPolicy": {
    "description": "Relationship. Model:'http://www.w3.org/ns/odrl/2/Policy'. This property refers to the policy(ies) expressing the rights associated with the distribution if using the [ODRL] vocabulary.",
    "type": "object",
    "properties": {
      "type": {
        "type": "string",
        "enum": [
          "Relationship"
        ]
      },
      "@id": {
        "type": "string",
        "description": "Identifier of any NGSI entity of type odrl:Policy."
      }
    },
    "required": [
      "type",
      "@id"
    ],
    "additionalProperties": false
  },
  "language": {
    "description": "Property. Model:'http://purl.org/dc/terms/LinguisticSystem'. This property refers to a language of the Dataset. This property can be repeated if the metadata is provided in multiple languages. The EU Vocabularies Languages Named Authority List is the recommended vocabulary provided at http://publications.europa.eu/resource/authority/language",
    "type": "object",
    "properties": {
      "type": {
        "type": "string",
        "enum": [
          "Property"
        ]
      },
      "value": {
        "type": "array",
        "items": {

```

```

        "description": "Individual identifier of the language",
        "type": "string",
        "pattern":
"^http:\\\\\\.\\publications\\.europa\\.eu\\.resource\\.authority\\.language\\\[A-Z\]{3}$"
    }
},
"required": [
    "type",
    "value"
],
"additionalProperties": false
},
"license": {
    "description": "Property. Model:'http://purl.org/dc/terms/LicenseDocument'. This property
links to the licence under which the Catalogue can be used or reused",
    "type": "object",
    "properties": {
        "type": {
            "type": "string",
            "enum": [
                "Property"
            ]
        },
        "@id": {
            "type": "string",
            "format": "uri"
        }
    },
    "required": [
        "type",
        "@id"
    ],
    "additionalProperties": false
},
"linkedSchemas": {
    "description": "Property. Model:'http://purl.org/dc/terms/Standard'. An established schema
to which the described Distribution conforms. ",
    "type": "object",
    "properties": {
        "type": {
            "type": "string",
            "enum": [
                "Property"
            ]
        },
        "@id": {
            "type": "array",
            "items": {
                "anyOf": [
                    {
                        "type": "string",
                        "minLength": 1,
                        "maxLength": 256,
                        "pattern": "^[\\w\\-\\.\\{\\}\\$\\+\\*\\[\\]\\`|~^@!,:;\\\\\\\\]+$",
                        "description": " Reference identifier of an Standard"
                    },
                    {
                        "type": "string",
                        "format": "uri"
                    }
                ]
            }
        }
    },
    "required": [
        "type"
    ],
    "additionalProperties": false
},
"mediaType": {
    "description": "Property. Model:'http://purl.org/dc/terms/MediaType'. The media type of the
Distribution as defined in the official register of media types managed by IANA.",
    "type": "object",
    "properties": {
        "type": {
            "type": "string",
            "enum": [
                "Property"
            ]
        }
    }
},

```

```

    "@id": {
      "type": "string"
    },
    "required": [
      "type",
      "@id"
    ],
    "additionalProperties": false
  },
  "modificationDate": {
    "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. This
property contains the most recent date on which the Catalogue was modified",
    "type": "object",
    "properties": {
      "type": {
        "type": "string",
        "enum": [
          "Property"
        ]
      },
      "@value": {
        "type": "string",
        "format": "date-time"
      }
    },
    "required": [
      "type",
      "@value"
    ],
    "additionalProperties": false
  },
  "packagingFormat": {
    "description": "Property. Model:'http://purl.org/dc/terms/MediaType'. The format of the file
in which one or more data files are grouped together, e.g. to enable a set of related files to be
downloaded together. It SHOULD be expressed using a media type as defined in the official register
of media types managed by IANA.",
    "type": "object",
    "properties": {
      "type": {
        "type": "string",
        "enum": [
          "Property"
        ]
      },
      "@id": {
        "type": "string"
      }
    },
    "required": [
      "type",
      "@id"
    ],
    "additionalProperties": false
  },
  "releaseDate": {
    "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. This
property contains the date of formal issuance (e.g., publication) of the Dataset",
    "type": "object",
    "properties": {
      "type": {
        "type": "string",
        "enum": [
          "Property"
        ]
      },
      "@value": {
        "type": "string",
        "format": "date-time"
      }
    },
    "required": [
      "type",
      "@value"
    ],
    "additionalProperties": false
  },
  "rights": {

```

```

    "description": "Property. Model:'http://purl.org/dc/terms/RightsStatement'. This property
refers to a statement that specifies rights associated with the Catalogue. The Access Rights Named
Authority List is the recommended vocabulary provided at
http://publications.europa.eu/resource/authority/access-right",
    "type": "object",
    "properties": {
      "type": {
        "type": "string",
        "enum": [
          "Property"
        ]
      },
      "@id": {
        "type": "string",
        "pattern": "^http:\\\\\\.\\.\\.publications\\.\\.eu\\.\\.\\.resource\\.\\.\\.authority\\.\\.\\.access-
right\\.\\.\\.\\[A-Z\\]{6,12}\\$"
      }
    },
    "required": [
      "type",
      "@id"
    ],
    "additionalProperties": false
  },
  "spatialResolution": {
    "description": "Property. Model:'http://www.w3.org/2001/XMLSchema#decimal'. This property
refers to the minimum spatial separation resolvable in a dataset, measured in meters.",
    "type": "object",
    "properties": {
      "type": {
        "type": "string",
        "enum": [
          "Property"
        ]
      },
      "value": {
        "type": "number"
      }
    },
    "required": [
      "type",
      "value"
    ],
    "additionalProperties": false
  },
  "status": {
    "description": "Property. Model:'http://www.w3.org/ns/adms#status'. The status of the
distribution in the context of maturity lifecycle. \tIt HAS TO take one of the values Completed,
Deprecated, Under Development, Withdrawn",
    "type": "object",
    "properties": {
      "type": {
        "type": "string",
        "enum": [
          "Property"
        ]
      },
      "value": {
        "type": "string",
        "enum": [
          "Completed",
          "Deprecated",
          "Under Development",
          "Withdrawn"
        ]
      }
    },
    "required": [
      "type",
      "value"
    ],
    "additionalProperties": false
  },
  "temporalResolution": {
    "description": "Property. Model:'http://www.w3.org/2001/XMLSchema#duration'. This property
refers to the minimum time period resolvable in the dataset.",
    "type": "object",
    "properties": {

```

```

    "type": {
      "type": "string",
      "enum": [
        "Property"
      ]
    },
    "value": {
      "type": "string",
      "format": "duration"
    }
  },
  "required": [
    "type",
    "value"
  ],
  "additionalProperties": false
},
"title": {
  "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. This
property contains a name given to the Distribution. This property can be repeated for parallel
language versions of the title",
  "type": "object",
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "Property"
      ]
    }
  },
  "value": {
    "type": "array",
    "items": {
      "anyOf": [
        {
          "type": "string"
        },
        {
          "type": "object",
          "properties": {
            "@language": {
              "type": "string",
              "pattern":
"^http:\\\\\\.\\./publications\\.europa\\.eu\\.\\.resource\\.\\.authority\\.\\.language\\.\\.\\/[A-Z]{3}$"
            },
            "@value": {
              "type": "string"
            }
          }
        }
      ],
      "required": [
        "@value",
        "@language"
      ],
      "additionalProperties": false
    }
  },
  "description": "Property. Title in different languages"
}
},
"required": [
  "type",
  "value"
],
"additionalProperties": false
},
"@context": {
  "type": "array"
}
},
"required": [
  "id",
  "type",
  "accessURL"
],
"additionalProperties": false
}

```

B.5 Data Service entity JSON Schema

Listing B-5: JSON Schema for the NGSI-LD Data Service entity

```
{
  "$schema": "https://json-schema.org/draft/2020-12/schema",
  "$schemaVersion": "1.0.1",
  "$id": "DCAT-AP_NGSI-LD_Mapping/DataService/schema.json",
  "title": "Data Service DCAT-AP",
  "description": "Data Services compliant with DCAT-AP specification version 3.0.0.",
  "type": "object",
  "properties": {
    "type": {
      "type": {
        "type": "string",
        "enum": [
          "DataService"
        ],
        "description": "Property. Model:'https://schema.org/Text'. It has to be Dataset"
      },
      "id": {
        "type": "string",
        "minLength": 1,
        "maxLength": 256,
        "pattern": "^[\\w\\-\\.\\{\\}\\$\\+\\*\\[\\]\\`~^@!,:\\\\\\\\]+$",
        "description": " Identifier format of any NGSI entity of type Dataset."
      },
      "accessRights": {
        "description": "Property. Model:'http://purl.org/dc/terms/RightsStatement'. This property refers to a statement that specifies rights associated with the Data Service. The Access Rights Named Authority List is the recommended vocabulary provided at http://publications.europa.eu/resource/authority/access-right",
        "type": "object",
        "properties": {
          "type": {
            "type": "string",
            "enum": [
              "Property"
            ]
          },
          "@id": {
            "type": "string",
            "pattern": "^http:\\\\\\\\\\\\publications\\\\\\\\.europa\\\\\\\\.eu\\\\\\\\resource\\\\\\\\authority\\\\\\\\access-right\\\\\\\\/[A-Z]{6,12}$"
          }
        },
        "required": [
          "type",
          "@id"
        ],
        "additionalProperties": false
      },
      "applicableLegislation": {
        "description": "Property. Model:'http://data.europa.eu/eli/ontology#LegalResource'. The legislation that mandates the creation or management of the Data Service. It is aligned with the ontology included in Council conclusions inviting the introduction of the European Legislation Identifier (ELI). In this data specification the use is restricted to instances of this class that follow the (ELI) URI guidelines.",
        "type": "object",
        "properties": {
          "type": {
            "type": "string",
            "enum": [
              "Property"
            ]
          },
          "@id": {
            "type": "array",
            "items": {
              "type": "string",
              "format": "uri",
            }
          }
        },
        "required": [
          "type",
          "@id"
        ]
      }
    }
  }
}
```

```

    ],
    "additionalProperties": false
  },
  "applicationProfile": {
    "description": "Property. Model:'http://purl.org/dc/terms/Standard'. An established
(technical) standard to which the Data Service conforms. \tThe standards referred here SHOULD
describe the Data Service and not the data it serves. The latter is provided by the dataset with
which this Data Service is connected. For instance the data service adheres to the OGC WFS API
standard, while the associated dataset adheres to the INSPIRE Address data model.",
    "type": "object",
    "properties": {
      "type": {
        "type": "string",
        "enum": [
          "Property"
        ]
      },
      "@id": {
        "type": "array",
        "items": {
          "anyOf": [
            {
              "type": "string",
              "minLength": 1,
              "maxLength": 256,
              "pattern": "^[\\w\\-\\.\\{\\}\\$\\+\\*\\[\\]\\`~^@!,:\\\\\\\\]+$",
              "description": " Reference identifier of an Standard"
            },
            {
              "type": "string",
              "format": "uri"
            }
          ]
        }
      }
    }
  },
  "required": [
    "type",
    "@id"
  ],
  "additionalProperties": false
},
"contactPoint": {
  "description": "Relationship. Model:'vcard\\thttp://www.w3.org/2006/vcard/ns#Kind'. Contact
information that can be used for sending comments about the Data Service. Note that the class Kind
is the parent class for the four explicit types of vCard (Individual, Organization, Location,
Group).",
  "type": "object",
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "Relationship"
      ]
    },
    "@id": {
      "type": "string",
      "format": "uri"
    }
  },
  "required": [
    "type",
    "@id"
  ],
  "additionalProperties": false
},
"description": {
  "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. This
property contains a free-text account of the Data Service. This property can be repeated for
parallel language versions of the description.",
  "type": "object",
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "Property"
      ]
    }
  }
},

```



```

    "value": {
      "type": "array",
      "items": {
        "anyOf": [
          {
            "type": "string"
          },
          {
            "type": "object",
            "properties": {
              "@language": {
                "type": "string",
                "pattern":
"^http:\\\\\\.\\.\\.publications\\.europa\\.eu\\.\\.\\.resource\\.\\.\\.authority\\.\\.\\.language\\.\\.\\.\\[A-Z\\]\\{3\\}$"
              },
              "@value": {
                "type": "string"
              }
            },
            "required": [
              "@value",
              "@language"
            ],
            "additionalProperties": false
          }
        ],
        "description": "Dataset description in different languages."
      }
    },
    "required": [
      "type",
      "value"
    ],
    "additionalProperties": false
  },
  "endpointDescription": {
    "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Resource'. A
description of the services available via the end-points, including their operations, parameters
etc. \tThe property gives specific details of the actual endpoint instances, while the property
application profile (dct:conformsTo) is used to indicate the general standard or specification
that the endpoints implement.",
    "type": "object",
    "properties": {
      "type": {
        "type": "string",
        "enum": [
          "Property"
        ]
      },
      "@id": {
        "type": "array",
        "items": {
          "anyOf": [
            {
              "type": "string",
              "minLength": 1,
              "maxLength": 256,
              "pattern": "^[[\\w\\-\\.\\{\\}\\$\\+\\*\\[\\]\\`|~^@!,:\\\\\\\\]+$$",
              "description": " Identifier format of any NGSI entity of type Resource."
            },
            {
              "type": "string",
              "format": "uri",
              "description": "Reference identifier of any NGSI entity of type Resource."
            }
          ]
        }
      }
    },
    "required": [
      "type",
      "@id"
    ],
    "additionalProperties": false
  },
  "endpointURL": {

```

```

    "description": "Property. Model:'https://www.w3.org/ns/dcat#accessURL'. The root location or
primary endpoint of the service (an IRI).",
    "type": "object",
    "properties": {
      "type": {
        "type": "string",
        "enum": [
          "Property"
        ]
      },
      "@id": {
        "type": "string",
        "format": "uri"
      }
    },
    "required": [
      "type",
      "@id"
    ],
    "additionalProperties": false
  },
  "format": {
    "description": "Property. Model:'http://purl.org/dc/terms/MediaTypeOrExtent'. The structure
that can be returned by querying the endpointURL.",
    "type": "object",
    "properties": {
      "type": {
        "type": "string",
        "enum": [
          "Property"
        ]
      },
      "@id": {
        "type": "string"
      }
    },
    "required": [
      "type",
      "@id"
    ],
    "additionalProperties": false
  },
  "keyword": {
    "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. This
property contains a keyword or tag describing the Data Service. This property can contain as many
keywords as necessary",
    "type": "object",
    "properties": {
      "type": {
        "type": "string",
        "enum": [
          "Property"
        ]
      },
      "value": {
        "type": "array",
        "items": {
          "anyOf": [
            {
              "type": "string"
            },
            {
              "type": "object",
              "properties": {
                "@language": {
                  "type": "string",
                  "pattern":
"http://\\/\\/publications\\.europa\\.eu\\/resource\\/authority\\/language\\/\\[A-Z\\]{3}$"
                }
              }
            }
          ]
        },
        "@value": {
          "type": "string"
        }
      },
      "required": [
        "@value",
        "@language"
      ],
      "additionalProperties": false
    }
  }

```

```

    },
    "description": "Property. Title in different languages"
  }
},
"required": [
  "type",
  "value"
],
"additionalProperties": false
},
"landingPage": {
  "description": "Property. Model:'http://xmlns.com/foaf/0.1/homepage'. This property refers
to a web page that provides access to the Data Service and/or additional information.",
  "type": "object",
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "Property"
      ]
    },
    "@id": {
      "type": "string",
      "format": "uri"
    }
  },
  "required": [
    "type",
    "@id"
  ],
  "additionalProperties": false
},
"license": {
  "description": "Property. Model:'http://purl.org/dc/terms/LicenseDocument'. A licence under
which the Data service is made available. ",
  "type": "object",
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "Property"
      ]
    },
    "@id": {
      "type": "string",
      "format": "uri"
    }
  },
  "required": [
    "type",
    "@id"
  ],
  "additionalProperties": false
},
"publisher": {
  "description": "Relationship. Model:'http://xmlns.com/foaf/0.1/#term_Agent'. This property
links to an entity (organisation) responsible for making the Data Service available",
  "type": "object",
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "Relationship"
      ]
    },
    "@id": {
      "type": "string",
      "minLength": 1,
      "maxLength": 256,
      "pattern": "^[\\w\\-\\.\\{\\}\\$\\+\\*\\[\\]\\`~^@!,:\\\\\\\\]+$",
      "description": " Reference identifier of an entity primarily responsible for making the
Catalogue available"
    }
  },
  "required": [
    "type",

```

```

    "@id"
  ],
  "additionalProperties": false
},
"servesDataset": {
  "description": "Relationship. Model:'http://www.w3.org/ns/dcat#Dataset'. This property
refers to a collection of data that this data service can distribute.",
  "type": "object",
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "Relationship"
      ]
    },
    "@id": {
      "type": "array",
      "items": {
        "anyOf": [
          {
            "type": "string",
            "minLength": 1,
            "maxLength": 256,
            "pattern": "^[\\w\\-\\.\\|\\{\\}\\$\\+\\*\\[\\]\\`|~^@!,:\\\\\\\\]+$",
            "description": "Identifier format of any NGSI entity of type Dataset."
          },
          {
            "type": "string",
            "format": "uri",
            "description": "Reference identifier of any NGSI entity of type Dataset."
          }
        ]
      }
    }
  ]
},
"required": [
  "type",
  "@id"
],
"additionalProperties": false
},
"theme": {
  "description": "Property. Model:'http://www.w3.org/2004/02/skos/core#ConceptScheme'. This
property refers to a knowledge organization system used to classify the Catalogue's Datasets. The
Dataset Theme Vocabulary is the recommended vocabulary provided at
http://publications.europa.eu/resource/authority/data-theme",
  "type": "object",
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "Property"
      ]
    },
    "value": {
      "type": "array",
      "items": {
        "description": "Individual identifiers of the themes",
        "type": "object",
        "properties": {
          "@id": {
            "type": "string",
            "pattern": "^http:\\\\\\.\\.\\.\\.publications\\.\\.eu\\.\\.resource\\.\\.authority\\.\\.data-
theme\\/[A-Z]{4}$"
          }
        },
        "required": [
          "@id"
        ],
        "additionalProperties": false
      }
    }
  ],
  "required": [
    "type",
    "value"
  ],
  "additionalProperties": false
}

```

```

    },
    "title": {
      "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. This
property contains a name given to the Data Service. This property can be repeated for parallel
language versions of the title",
      "type": "object",
      "properties": {
        "type": {
          "type": "string",
          "enum": [
            "Property"
          ]
        },
        "value": {
          "type": "array",
          "items": {
            "anyOf": [
              {
                "type": "string"
              },
              {
                "type": "object",
                "properties": {
                  "@language": {
                    "type": "string",
                    "pattern":
"^http:\\\\\\.\\.\\.publications\\.\\.europa\\.\\.eu\\.\\.resource\\.\\.authority\\.\\.language\\.\\.\\/[A-Z]{3}$"
                  },
                  "@value": {
                    "type": "string"
                  }
                },
                "required": [
                  "@value",
                  "@language"
                ],
                "additionalProperties": false
              }
            ],
            "description": "Property. Title in different languages"
          }
        }
      },
      "required": [
        "type",
        "value"
      ],
      "additionalProperties": false
    },
    "@context": {
      "type": "array"
    }
  },
  "required": [
    "id",
    "type",
    "endpointURL",
    "title"
  ],
  "additionalProperties": false
}

```

B.6 Agent entity JSON Schema

Listing B-6: JSON Schema for the NGSI-LD Agent entity

```

{
  "$schema": "https://json-schema.org/draft/2020-12/schema",
  "$schemaVersion": "1.0.1",
  "$id": "DCAT-AP_NGSI-LD_Mapping/Agent/schema.json",
  "title": "DCAT-AP Agent",
  "description": "Agents compliant with DCAT-AP specification version 3.0.0.",
  "type": "object",

```

```

"properties": {
  "type": {
    "type": "string",
    "enum": [
      "Agent"
    ],
    "description": "Property. Model:'https://schema.org/Text'. It has to be Agent"
  },
  "id": {
    "type": "string",
    "minLength": 1,
    "maxLength": 256,
    "pattern": "^[\\w\\-\\.\\{\\}\\$\\+\\*\\[\\]\\`|~^@!,:\\\\\\\\]+$",
    "description": " Identifier format of any NGSI entity of type DataService."
  },
  "name": {
    "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. This
property contains a name of the agent. This property can be repeated for different versions of the
name (e.g. the name in different languages).",
    "type": "object",
    "properties": {
      "type": {
        "type": "string",
        "enum": ["Property"]
      },
      "value": {
        "type": "array",
        "items": {
          "anyOf": [
            {
              "type": "string"
            },
            {
              "type": "object",
              "properties": {
                "@language": {
                  "type": "string",
                  "pattern":
"^[http:\\/\\/\\/publications\\.europa\\.eu\\/resource\\/authority\\/language\\/][A-Z]{3}$"
                },
                "@value": {
                  "type": "string"
                }
              },
              "required": ["@value", "@language"],
              "additionalProperties": false
            }
          ],
          "description": "Dataset description in different languages."
        }
      },
      "required": ["type", "value"],
      "additionalProperties": false
    },
    "agentType": {
      "description": "Property. http://www.w3.org/2004/02/skos/core#Concept'. The nature of the
agent.",
      "type": "object",
      "properties": {
        "type": {
          "type": "string",
          "enum": [
            "Property"
          ]
        },
        "value": {
          "type": "string"
        }
      },
      "required": [
        "type",
        "value"
      ],
      "additionalProperties": false
    },
    "@context": {
      "type": "array"
    }
  }
}

```

```

    },
    "required": [
      "id",
      "type",
      "name"
    ],
    "additionalProperties": false
  }
}

```

B.7 Location entity JSON Schema

Listing B-7: JSON Schema for the NGSI-LD Location entity

```

{
  "$schema": "https://json-schema.org/draft/2020-12/schema",
  "$schemaVersion": "1.0.1",
  "$id": "DCAT-AP_NGSI-LD_Mapping/Location/schema.json",
  "title": "DCAT-AP Location",
  "description": "Location compliant with DCAT-AP specification version 3.0.0.",
  "type": "object",
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "Location"
      ],
      "description": "Property. Model:'https://schema.org/Text'. It has to be Location"
    },
    "id": {
      "description": " Identifier format of any NGSI entity of type Location.",
      "type": "string",
      "minLength": 1,
      "maxLength": 256,
      "pattern": "^[\\w\\-\\.\\{\\}\\$\\+\\*\\[\\]\\`|~^@!,:\\\\\\\\]+ $"
    },
    "bbox": {
      "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. The geographic bounding box of a resource. The EU Vocabularies Name Authority Lists have to be used for continents, countries and places that are in those lists; if a particular location is not in one of the mentioned Named Authority Lists, Geonames URIs have to be used. The EU Vocabularies Continents Named Authority List, EU Vocabularies Countries Named Authority List, EU Vocabularies Places Named Authority List and Geonames are provided at http://publications.europa.eu/resource/authority/continent, http://publications.europa.eu/resource/authority/country, http://publications.europa.eu/resource/authority/place and http://sws.geonames.org/",
      "type": "object",
      "properties": {
        "type": {
          "type": "string",
          "enum": [
            "VocabProperty"
          ]
        },
        "vocab": {
          "type": "string",
          "description": "The EU Vocabularies Name Authority Lists have to be used for continents, countries and places that are in those lists. If a particular location is not in one of the mentioned Named Authority Lists, Geonames URIs have to be used."
        }
      },
      "required": [
        "type",
        "vocab"
      ],
      "additionalProperties": false
    },
    "centroid": {
      "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. The geographic center (centroid) of a resource. The EU Vocabularies Name Authority Lists have to be used for continents, countries and places that are in those lists; if a particular location is not in one of the mentioned Named Authority Lists, Geonames URIs have to be used. The EU Vocabularies Continents Named Authority List, EU Vocabularies Countries Named Authority List, EU Vocabularies

```

```

Places Named Authority List and Geonames are provided at
http://publications.europa.eu/resource/authority/continent,
http://publications.europa.eu/resource/authority/country,
http://publications.europa.eu/resource/authority/place and http://sws.geonames.org/",
  "type": "object",
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "VocabProperty"
      ]
    },
    "vocab": {
      "type": "string",
      "description": "The EU Vocabularies Name Authority Lists have to be used for continents,
countries and places that are in those lists. If a particular location is not in one of the
mentioned Named Authority Lists, Geonames URIs have to be used."
    }
  },
  "required": [
    "type",
    "vocab"
  ],
  "additionalProperties": false
},
"geometry": {
  "description": "GeoProperty. Model: ' http://www.w3.org/ns/locn#Geometry'. This property
refers to a geographic region that is covered by the corresponding resource (i.e. Catalogue,
Dataset or DatasetSeries).",
  "type": "object",
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "GeoProperty"
      ]
    }
  },
  "value": {
    "$ref": "https://geojson.org/schema/GeoJSON.json"
  }
},
"required": [
  "type",
  "value"
],
"additionalProperties": false
},
"@context": {
  "type": "array"
}
},
"required": [
  "id",
  "type"
],
"additionalProperties": false
}

```

B.8 Catalogue Record entity JSON Schema

Listing B-8: JSON Schema for the NGSI-LD Catalogue Record entity

```

{
  "$schema": "https://json-schema.org/draft/2020-12/schema",
  "$schemaVersion": "1.0.1",
  "$id": "DCAT-AP_NGSI-LD_Mapping/CatalogueRecord/schema.json",
  "title": "DCAT-AP Catalogue Record",
  "description": "Catalogue Record compliant with DCAT-AP specification version 3.0.0.",
  "type": "object",
  "properties": {
    "type": {
      "type": "string",
      "enum": [

```



```

    "CatalogueRecord"
  ],
  "description": "Property. Model:'https://schema.org/Text'. It has to be CatalogueRecord"
},
"id": {
  "type": "string",
  "minLength": 1,
  "maxLength": 256,
  "pattern": "^[\\w\\-\\.\\{\\}\\$\\+\\*\\[\\]\\`|~^@!,:\\\\\\\\]+$",
  "description": " Identifier format of any NGSI entity of type CatalogueRecord."
},
"applicationProfile": {
  "description": "Property. Model:'http://purl.org/dc/terms/Standard'. An Application Profile
that the Catalogued Resource's metadata conforms to.",
  "type": "object",
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "Property"
      ]
    },
    "@id": {
      "type": "array",
      "items": {
        "anyOf": [
          {
            "type": "string",
            "minLength": 1,
            "maxLength": 256,
            "pattern": "^[\\w\\-\\.\\{\\}\\$\\+\\*\\[\\]\\`|~^@!,:\\\\\\\\]+$",
            "description": " Reference identifier of an Standard"
          },
          {
            "type": "string",
            "format": "uri"
          }
        ]
      }
    }
  }
},
"required": [
  "type",
  "@id"
],
"additionalProperties": false
},
"changeType": {
  "description": "Property. Model:'http://www.w3.org/ns/adms#status'. The status of the
catalogue record in the context of editorial flow of the dataset and data service descriptions.",
  "type": "object",
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "Property"
      ]
    },
    "value": {
      "type": "string"
    }
  }
},
"required": [
  "type",
  "value"
],
"additionalProperties": false
},
"description": {
  "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. A free-text
account of the record. This property can be repeated for parallel language versions of the
description. ",
  "type": "object",
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "Property"
      ]
    }
  }
}

```

```

    ]
  },
  "value": {
    "type": "array",
    "items": {
      "anyOf": [
        {
          "type": "string"
        },
        {
          "type": "object",
          "properties": {
            "@language": {
              "type": "string",
              "pattern":
"^http:\\\\\\.\\publications\\.europa\\.eu\\.\\.resource\\.\\.authority\\.\\.language\\.\\.\\[A-Z\\]{3}\\$"
            },
            "@value": {
              "type": "string"
            }
          },
          "required": [
            "@value",
            "@language"
          ],
          "additionalProperties": false
        }
      ],
      "description": "Distribution description in different languages."
    }
  },
  "required": [
    "type",
    "value"
  ],
  "additionalProperties": false
},
"language": {
  "description": "Property. Model:'http://purl.org/dc/terms/LinguisticSystem'. A language used
in the textual metadata describing titles, descriptions, etc. of the Catalogued Resource. This
property can be repeated if the metadata is provided in multiple languages.",
  "type": "object",
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "Property"
      ]
    },
    "value": {
      "type": "array",
      "items": {
        "description": "Individual identifier of the language",
        "type": "string",
        "pattern":
"^http:\\\\\\.\\publications\\.europa\\.eu\\.\\.resource\\.\\.authority\\.\\.language\\.\\.\\[A-Z\\]{3}\\$"
      }
    }
  },
  "required": [
    "type",
    "value"
  ],
  "additionalProperties": false
},
"listingDate": {
  "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. The date on
which the description of the Resource was included in the Catalogue.",
  "type": "object",
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "Property"
      ]
    },
    "@value": {

```

```

        "type": "string",
        "format": "date-time"
    }
},
"required": [
    "type",
    "@value"
],
"additionalProperties": false
},
"modificationDate": {
    "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. The most
recent date on which the Catalogue entry was changed or modified.",
    "type": "object",
    "properties": {
        "type": {
            "type": "string",
            "enum": [
                "Property"
            ]
        },
        "@value": {
            "type": "string",
            "format": "date-time"
        }
    },
    "required": [
        "type",
        "@value"
    ],
    "additionalProperties": false
},
"primaryTopic": {
    "description": "Relationship. Model:'http://www.w3.org/ns/dcat#Resource'. A link to the
Dataset, Data service or Catalogue described in the record. A catalogue record will refer to one
entity in a catalogue. This can be either a Dataset or a Data Service. To ensure an unambiguous
reading of the cardinality the range is set to Catalogued Resource. However it is not the intend
with this range to require the explicit use of the class Catalogued Record. As abstract class, an
subclass should be used.",
    "type": "object",
    "properties": {
        "type": {
            "type": "string",
            "enum": [
                "Relationship"
            ]
        },
        "@id": {
            "type": "string",
            "minLength": 1,
            "maxLength": 256,
            "pattern": "^[\\w\\-\\.\\{\\}\\$\\+\\*\\[\\]\\`~^@!,:\\\\\\\\]+$",
            "description": " Identifier format of any NGSI entity of type Dataset, DataService or
DatasetSeries."
        }
    },
    "required": [
        "type",
        "@id"
    ],
    "additionalProperties": false
},
"sourceMetadata": {
    "description": "Relationship. Model:'http://www.w3.org/ns/dcat#CatalogueRecord'. The
original metadata that was used in creating metadata for the Dataset.",
    "type": "object",
    "properties": {
        "type": {
            "type": "string",
            "enum": [
                "Relationship"
            ]
        },
        "@id": {
            "type": "string",
            "minLength": 1,
            "maxLength": 256,
            "pattern": "^[\\w\\-\\.\\{\\}\\$\\+\\*\\[\\]\\`~^@!,:\\\\\\\\]+$",

```

```

    "description": " Identifier format of any NGSI entity of type CatalogueRecord."
  },
  "required": [
    "type",
    "@id"
  ],
  "additionalProperties": false
},
"title": {
  "description": "Property. Model:'http://www.w3.org/2000/01/rdf-schema#Literal'. This
property contains a name given to the Catalogue Record. This property can be repeated for parallel
language versions of the name.",
  "type": "object",
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "Property"
      ]
    },
    "value": {
      "type": "array",
      "items": {
        "anyOf": [
          {
            "type": "string"
          },
          {
            "type": "object",
            "properties": {
              "@language": {
                "type": "string",
                "pattern":
"^http:\\\\\\.\\./publications\\.europa\\.eu\\.\\.resource\\.\\.authority\\.\\.language\\.\\.\\/[A-Z]{3}$"
              },
              "@value": {
                "type": "string"
              }
            }
          }
        ],
        "required": [
          "@value",
          "@language"
        ],
        "additionalProperties": false
      }
    },
    "description": "Property. Title in different languages"
  }
},
"required": [
  "type",
  "value"
],
"additionalProperties": false
},
"@context": {
  "type": "array"
}
},
"required": [
  "id",
  "type",
  "primaryTopic",
  "modificationDate"
],
"additionalProperties": false
}

```

B.9 Checksum entity JSON Schema

Listing B-9: JSON Schema for the NGSI-LD Checksum entity

```
{
  "$schema": "https://json-schema.org/draft/2020-12/schema",
  "$schemaVersion": "1.0.1",
  "$id": "DCAT-AP_NGSI-LD_Mapping/Checksum/schema.json",
  "title": "DCAT-AP Checksum",
  "description": "Checksum compliant with DCAT-AP specification version 3.0.0.",
  "type": "object",
  "properties": {
    "type": {
      "type": "string",
      "enum": [
        "Checksum"
      ],
      "description": "Property. Model:'https://schema.org/Text'. It has to be Checksum"
    },
    "id": {
      "description": "Identifier format of any NGSI entity of type Checksum.",
      ...
    },
    "algorithm": {
      "description": "Property. Model:'http://spdx.org/rdf/terms#algorithm'. The algorithm used to produce the subject Checksum. Checksum algorithm members. The members listed are considered a controlled vocabulary of supported checksum algorithms.",
      "type": "object",
      "properties": {
        "type": {
          "type": "string",
          "enum": [
            "Property"
          ]
        },
        "@id": {
          "type": "string",
          "format": "uri",
          "description": "Identifier format of the checksum algorithm from the members of the class defined in http://spdx.org/rdf/terms#ChecksumAlgorithm."
        }
      },
      "required": [
        "type",
        "@id"
      ],
      "additionalProperties": false
    },
    "checksumValue": {
      "description": "Property. Model:'https://www.w3.org/2001/XMLSchema#hexBinary'. A lower case hexadecimal encoded digest value produced using a specific algorithm. ",
      "type": "object",
      "properties": {
        "type": {
          "type": "string",
          "enum": [
            "Property"
          ]
        },
        "@value": {
          "type": "string",
          "pattern": "^[0-9a-f]+$"
        }
      },
      "required": [
        "type",
        "@value"
      ],
      "additionalProperties": false
    },
    "@context": {
      "type": "array"
    }
  },
  "required": [
    "id",

```

```
"type",  
  "primaryTopic",  
  "modificationDate"  
],  
"additionalProperties": false  
}
```

Annex C: Change history

Date	Version	Information about changes
August 2024	V1.1.1	Technical Officer review for EditHelp Publication Preprocessing after TB Approval
September 2024	V1.1.1	First published version

History

Document history		
V1.1.1	September 2024	Publication