“spsDCAT-AP”

A DCAT-AP extension for Metadata for Smart Parking Systems

Monitoring and Harmonisation of National Access Points in Europe

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# Introduction

## Context

This project is about a draft Metadata specification to describe data and information offered by Smart Parking Systems (SPS). It particular, it is elaborated as an extension to the DCAT-AP Metadata specification. The working title for such an extension is “spsDCAT-AP” (DCAT-AP extension for Metadata for Smart Parking Systems ).

This work has been produced in the context of a research paper: "A Metadata Model to describe Data and Information of Smart Parking Systems" Peter Lubrich, Federal Highway Research Institute (BASt), Germany (to be published during 2020).

Abstract from this paper:

*Smart Parking Systems (SPS) represent an evolving and heterogeneous field of approaches and applications in parking management. One commonality is that all present systems deal with digital data related to the parking domain, such as data about parking infrastructure, parking demand, transactions and similar. One way to capture and categorise the data of SPS in a comprehensive and comparable manner is to look on metadata, i.e. structured descriptions about the data of SPS. This paper presents an approach to model metadata in the field of SPS. This metadata model intends to systematically describe the data offerings of such systems, e.g. their contents, coverage and technical representation. This work aims to set a baseline to improving the interoperability between actors in Parking Space Management, which currently rather rely on isolated data environments. A metadata model, enabling a common description of data offerings of individual SPS, may eventually foster an integrated ecosystem of data exchange in the parking sector. The model is built upon established frameworks for describing metadata, namely the Resource Description Framework (RDF). For reasons of re-usability and interoperability, it is also adopting metadata vocabularies from the domains of Intelligent Transport Systems (ITS) and governmental data catalogues. Such a modelling has not been initiated for the domain of parking data, as the author can see.*

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## Purpose

The elements of this metadata specification, such as classes and relationships, are made compatible to DCAT-AP, as a specification for metadata records on European data portals.

DCAT-AP is an Application Profile (AP) based on the Data Catalogue Vocabulary (DCAT), developed by W3C[[1]](#footnote-1). According to W3C definitions, *“DCAT is an RDF vocabulary designed to facilitate interoperability between data catalogues published on the Web, was originally developed in the context of government data catalogues […] but it is also applicable and has been used in other contexts”.*

An AP is an adaptation of a vocabulary to meet the needs of a particular application or implementation. Technically, it is a set of metadata elements, policies, and guidelines defined for a particular application. It mainly consists of vocabulary terms, including their definitions and usage rules (such as cardinalities)[[2]](#footnote-2).

DCAT-AP is an AP for data portals in Europe, developed by a joint initiative of the EU organizations DG DIGIT, DG CONNECT and the Publications Office of the EU[[3]](#footnote-3). According to its definitions, DCAT-AP is a *“specification for metadata records to meet the specific application needs of data portals in Europe while providing semantic interoperability with other applications on the basis of reuse of established controlled vocabularies […] and mappings to existing metadata vocabularies […].”*

There are many arguments to build up the SPS metadata specification upon DCAT-AP:

* The specification is used in a wide range of data portals in Europe, in particular, European data portals for open data.
* This specification provides standard serialization formats for metadata in XML and JSON, making metadata machine-readable.
* The specification is extensible. Examples of established extension are GeoDCAT-AP for describing geospatial data, and DQV (Data Quality Vocabulary) for describing data quality.
* The specification allows linking between distributed metadata catalogues, making metadata searchable and discoverable across catalogues using standard query facilities. This way, interoperability of metadata with data portals in Europe, also outside the transportation domain, will be fostered.
* The specification allows content aggregators (like the European Data Portal) to aggregate metadata into a single point of access.
* The specification (and its extensions) are developed and maintained in a well-defined process by established organisations, including W3C and EU.
* The specification supported by available software products –including Open Source products (like CKAN)

Following these arguments, a DCAT-AP extension for the domain of SPS metadata is developed: “spsDCAT-AP”. The following figure indicates how such an extension is related to DCAT-AP and other, existing extensions.



Figure 1: Relation of DCAT-AP and its extensions

It is noted, that the presented work is a draft of “spsDCAT-AP”, to be proposed to and discussed with SPS stakeholders. Further, no governance processes and structures for maintaining and updating of “spsDCAT-AP” have been established. Such additional works (as being done for other DCAT-AP extensions) are out the scope and need to be established as a future, follow-up work.

It is also noted, that a parallel DCAT-AP extension named “napDCAT-AP” is being drafted, as a metadata specification in the domain of National Access Points (NAPs). A NAP is an intermediary digital platform in the domain of Intelligent Tranposrt Systems (ITS). NAPS are mandated by European law in eeach Eu member state. One of the main functions is to enable access and exchange of traffic and mobility data. As NAP data can be seen as a superset of SPS data, some metadata elements from “napDCAT-AP” have been taken over to “spsDCAT-AP”.

In the following sections, the contents and characteristics, and usage notes of “spsDCAT.AP” are described.

# Terminology and Definitions

The following definitions are based on the original DCAT-AP specification[[4]](#footnote-4) and adopted to the NAP context. Further, explanations on “Classes” and “Properties”, as basic elements of the DCAT-AP data model, are added.

An **Application Profile** is a specification that re-uses terms from one or more base standards, adding more specificity by identifying mandatory, recommended and optional elements to be used for a particular application, as well as recommendations for controlled vocabularies to be used.

A **Dataset** is a collection of data, published or curated by a single source, and available for access or download in one or more formats.

A **Catalogue** is a repository that hosts the Datasets.

A **Data Portal** is a Web-based system that contains a data catalogue with descriptions of datasets and provides services enabling discovery and re-use of the datasets.

A **Catalogue Record** is a description of a Dataset’s entry in the Catalogue.

A **Distribution** is a physical embodiment of the Dataset in a particular format.

DCAT-AP is expressed as a RDF schema[[5]](#footnote-5). A RDF schema provides a data-modelling vocabulary for RDF data. It provides mechanisms for describing groups of related resources and the relationships between these resources. This is done via a class and property system,

A **Class** is a group of resources. Classes are themselves resources. They are often identified by IRIs and may be described using properties.

A **Property** is a relation between subject resources and object resources.

In the following sections, classes and properties are grouped under headings ‘mandatory’, ‘recommended’ and ‘optional’. These terms have the following meaning, relating to potential responsibilities of metadata senders and metadata receivers. Such metadata senders and receivers are important actors for interoperable metadata, i.e. whenever there is an exchange of metadata between IT systems.

**Mandatory class:** a receiver of metadata MUST be able to process information about instances of the class; a sender of metadata MUST provide information about instances of the class.

**Recommended class:** a sender of metadata SHOULD provide information about instances of the class; a sender of metadata MUST provide information about instances of the class, if such information is available; a receiver of metadata MUST be able to process information about instances of the class.

**Optional class:** a receiver MUST be able to process information about instances of the class; a sender MAY provide the information but is not obliged to do so.

**Mandatory property:** a receiver MUST be able to process the information for that property; a sender MUST provide the information for that property.

**Recommended property:** a receiver MUST be able to process the information for that property; a sender SHOULD provide the information for that property if it is available.

**Optional property:** a receiver MUST be able to process the information for that property; a sender MAY provide the information for that property but is not obliged to do so.

The meaning of the terms MUST, MUST NOT, SHOULD and MAY in this section and in the following sections are as defined in RFC 2119 .

In the given context, the term "processing" means that receivers must accept incoming metadata and transparently provide these metadata to applications and services. It does neither imply nor prescribe what applications and services finally do with the data (parse, convert, store, make searchable, display to users, etc.).

The Application Profile reuses terms from various existing specifications. Classes and properties specified in the next sections have been taken from the following namespaces:

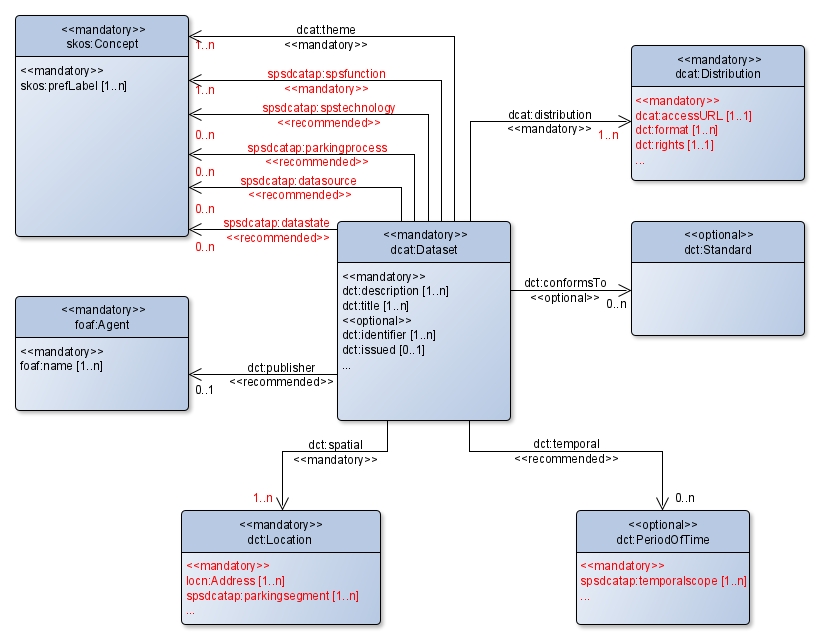
* adms: http://www.w3.org/ns/adms#
* dcat: http://www.w3.org/ns/dcat#
* dcatap: http://data.europa.eu/r5r/
* napdcatap: https://eueip.github.io/napDCAT-AP/
* dct: http://purl.org/dc/terms/
* foaf: http://xmlns.com/foaf/0.1/
* locn: http://www.w3.org/ns/locn#
* owl: http://www.w3.org/2002/07/owl#
* odrl: https://www.w3.org/TR/odrl-vocab/#
* rdfs: http://www.w3.org/2000/01/rdf-schema#
* schema: http://schema.org/
* skos: http://www.w3.org/2004/02/skos/core#
* spdx: [http://spdx.org/rdf/terms#](http://spdx.org/rdf/terms)
* spsdcatap: https://peterlubrich.github.io/spsDCAT-AP/
* xsd: http://www.w3.org/2001/XMLSchema#
* vann: http://purl.org/vocab/vann/
* voaf: http://purl.org/vocommons/voaf#
* vcard: [http://www.w3.org/2006/vcard/ns#](http://www.w3.org/2006/vcard/ns)

As seen above, an additional namespace with an own URL has been established for this spsDCAT-AP extension (“spsdcatap:”), to be able to provide some new properties which are not covered by the other namespaces. This URL has been provisionally stored under a Github repository dedicated to this spsDCAT-AP project[[6]](#footnote-6).

# UML visualisation of the spsDCAT-AP data model

The following UML diagram compiles the most-important classes and properties related to the class “Dataset”, based on the original DCAT-AP data model.

Additions made within this spsDCAT-AP specification, in comparison to the original DCAT-AP specification, are marked in red colour.



# Classes per obligation level

The following tables compile all classes used in spsDCAT-AP per obligation level. The column “Obligation” indicates the following obligation levels: M=Mandatory, R=Recommended, O=Optional.

The following definitions follow mostly the DCAT-AP 2.0.0 specification. No additional classes have been added in spsDCAT-AP, comparing to DCAT-AP 2.0.0. In two cases (class “CatalogueRecord” and “Distribution”), the obligation levels have been raised. In several cases, the “Usage Notes” have been adopted to the SPS domain.

All changes and text additions, comparing to DCAT-AP 2.0.0, are marked below with a red font.

## Mandatory Classes

| **No.** | **Obligation** | **Class Name** | **URI** | **Reference / Type / Range** | **Usage Note** | **Domain** |
| --- | --- | --- | --- | --- | --- | --- |
| 1 | M | Agent | foaf:Agent | <http://xmlns.com/foaf/spec/#term_Agent> ,<http://www.w3.org/TR/vocab-org/> | An entity that is associated with provision of a SPS service and/or SPS Datasets. If the Agent is an organisation, the use of the Organization Ontology is recommended.. | dct:publisher (Catalog), dct:publisher (Dataset) dct:creator (Dataset), napdcatap:contactPoint (CatalogRecord) |
| 2 | M | Catalogue | dcat:Catalog | <http://www.w3.org/TR/2013/WD-vocab-dcat-20130312/#class-catalog> | A catalogue or repository that hosts the Datasets being described, e.g. a web portal, where SPS datasets are discoverable. . |  |
| 3 | M | Dataset | dcat:Dataset | <http://www.w3.org/TR/2013/WD-vocab-dcat-20130312/#class-dataset> | A conceptual entity that represents the information published. | dcat:dataset (Catalog),  foaf:primaryTopic (CatalogRecord) |
| 4 | M | Literal | rdfs:Literal | <http://www.w3.org/TR/rdf-concepts/#section-Literals> | A literal value such as a string or integer; Literals may be typed, e.g. as a date according to xsd:date. Literals that contain human-readable text have an optional language tag as defined by BCP 47. | dcat:keyword (Dataset),  … |
| 5 | M | Resource | rdfs:Resource | <http://www.w3.org/TR/rdf-schema/#ch_resource> | Anything described by RDF. | dct:conformsTo (Catalog Record),  … |
| 6 | M | Distribution | dcat:Distribution | <http://www.w3.org/TR/2013/WD-vocab-dcat-20130312/#class-distribution> | A physical embodiment of the Dataset in a particular format.  The class ‘Distribution’ has been classified in the original DCAT-AP specification as ‘Recommended’, to allow for cases that a particular Dataset does not have a downloadable Distribution. However, for the SPS context, it can be expected that a SPS dataset all have downloadable Distributions, and in such cases the provision of information on the Distribution is raised to mandatory. | dcat:distribution, adms:sample (Dataset) |
| 7 | M | Location | dct:Location | <http://dublincore.org/documents/dcmi-terms/#terms-Location> | A spatial region or named place. It can be represented using a controlled vocabulary or with geographic coordinates. In the latter case, the use of the Core Location Vocabulary[[7]](#footnote-7) is recommended, following the approach described in the GeoDCAT-AP specification.  To make sure that each dataset has actually a geographical reference, the obligation level is raised to “mandatory”. | dct:spatial (Dataset, Catalog) |

## Recommended Classes

| **No.** | **Obligation** | **Class Name** | **URI** | **Reference / Type / Range** | **Usage Note** | **Domain** |
| --- | --- | --- | --- | --- | --- | --- |
| 8 | R | Category | skos:Concept | <http://www.w3.org/TR/2013/WD-vocab-dcat-20130312/#class-category-and-category-scheme> | A subject of a Dataset. | dcat:theme (Dataset) |
| 9 | R | Category scheme | skos:ConceptScheme | <http://www.w3.org/TR/2013/WD-vocab-dcat-20130312/#class-category-and-category-scheme> | A concept collection (e.g. controlled vocabulary) in which the Category is defined. | dcat:themeTaxonomy (Catalog) |
| 10 | R | Licence document | dct:LicenseDocument | <http://dublincore.org/documents/2012/06/14/dcmi-terms/?v=terms#LicenseDocument> | A legal document giving official permission to do something with a resource. | dct:license (Distribution) |

## Optional Classes

| **No.** | **Obligation** | **Class Name** | **URI** | **Reference / Type / Range** | **Usage Note** | **Domain** |
| --- | --- | --- | --- | --- | --- | --- |
| 11 | O | Catalogue Record | dcat:CatalogRecord | <http://www.w3.org/TR/2013/WD-vocab-dcat-20130312/#class-catalog-record> | A description of a Dataset’s entry entry in the Catalogue. | dcat:record (Catalog) |
| 12 | O | Data Service | dcat:DataService | [https://www.w3.org/TR/vocab-dcat-2/#Class:Data\_Service](https://www.w3.org/TR/vocab-dcat-2/%23Class:Data_Service) | A collection of operations that provides access to one or more datasets or data processing functions. | dcat:service(Catalog) |
| 13 | O | Checksum | spdx:Checksum | <http://spdx.org/rdf/terms#Checksum> | 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. | spdx:checksum (Distribution) |
| 14 | O | Document | foaf:Document | <http://xmlns.com/foaf/spec/#term_Document> | A textual resource intended for human consumption that contains information, e.g. a web page about a Dataset. | foaf:page (Distribution), dcat:landingPage (Dataset), foaf:page (Catalog) |
| 15 | O | Frequency | dct:Frequency | <http://dublincore.org/documents/dcmi-terms/#terms-Frequency> | A rate at which something recurs, e.g. the publication of a Dataset. | dct:accrualPeriodicity (Dataset) |
| 16 | O | Other Identifier | adms:Identifier | <http://www.w3.org/TR/vocab-adms/#identifier> | An identifier in a particular context, consisting of the string that is the identifier; an optional identifier for the identifier scheme; an optional identifier for the version of the identifier scheme; an optional identifier for the agency that manages the identifier scheme | adms:identifier (Dataset) |
| 17 | O | Kind | vcard:Kind | <http://www.w3.org/TR/2014/NOTE-vcard-rdf-20140522/#d4e181> | A description following the vCard specification, e.g. to provide telephone number and e-mail address for a contact point. Note that the class Kind is the parent class for the four explicit types of vCards (Individual, Organization, Location, Group). | dcat:contactPoint (Dataset, CatalogRecord) |
| 18 | O | Linguistic system | dct:LinguisticSystem | <http://dublincore.org/documents/dcmi-terms/#terms-LinguisticSystem> | A system of signs, symbols, sounds, gestures, or rules used in communication, e.g. a language | dct:language (Dataset, Catalog, Catalog Record, Distribution) |
| 19 | O | Media type | dct:MediaType | https://www.dublincore.org/specifications/dublin-core/dcmi-terms/#terms-MediaType | A media type, e.g. the format of a computer file | dcat:mediaType (Distribution), dcat:packageFormat (Distribution), dct:format (Distribution) |
| 20 | O | Period of time | dct:PeriodOfTime | <http://dublincore.org/documents/dcmi-terms/#terms-PeriodOfTime> | An interval of time that is named or defined by its start and end dates. | dct:temporal (Dataset) |
| 21 | O | Publisher type | skos:Concept | <http://www.w3.org/TR/vocab-adms/#dcterms-type> | A type of organisation that acts as a publisher |  |
| 22 | O | Relationship | dcat:Relationship | [https://www.w3.org/TR/vocab-dcat-2/#Class:Relationship](https://www.w3.org/TR/vocab-dcat-2/%23Class:Relationship) | An association class for attaching additional information to a relationship between DCAT Resources | prov:qualifiedRelation (Catalog) |
| 23 | O | Rights statement | dct:RightsStatement | <http://dublincore.org/documents/dcmi-terms/#terms-RightsStatement> | A statement about the intellectual property rights (IPR) held in or over a resource, a legal document giving official permission to do something with a resource, or a statement about access rights. | dct:accessRight s (Dataset), dct:rights (Catalog, Distribution) |
| 24 | O | Role | dcat:Role | [https://www.w3.org/TR/vocab-dcat-2/#Class:Role](https://www.w3.org/TR/vocab-dcat-2/%23Class:Role) | A role is the function of a resource or agent with respect to another resource, in the context of resource attribution or resource relationships. | dct:hadRole (Relationship) |
| 25 | O | Standard | dct:Standard | <http://dublincore.org/documents/dcmi-terms/#terms-Standard> | A standard or other specification to which a Dataset or Distribution conforms | dct:conformsTo (Distribution, Dataset) |
| 26 | O | Status | skos:Concept | <http://www.w3.org/TR/vocab-adms/#status> | An indication of the maturity of a Distribution or the type of change of a Catalogue Record. |  |
| 27 | O | Provenance Statement | dct:ProvenanceStatement | <http://dublincore.org/documents/dcmi-terms/#terms-ProvenanceStatement> | A statement of any changes in ownership and custody of a resource since its creation that are significant for its authenticity, integrity, and interpretation | dct:provenance  (Dataset) |

# Properties per Class

The following tables compile all properties used in spsDCAT-AP per class. The numbering corresponds to the above-introduced class numbers, e.g. “no. 1.3” points to class no. 1 and its property no. 3. The column “Obligation” indicates the following obligation levels: M=Mandatory, R=Recommended, O=Optional.

The following definitions follow mostly the DCAT-AP 2.0.0 specification. A couple additional properties have been added in spsDCAT-AP, reflecting Metadata elements from the CMC, which are not covered by DCAT-AP or other vocabularies. Also, for some properties taken over from DCAT-AP 2.0.0, the obligation levels have been raised. In certain cases, the “Usage Notes” have been adopted to the SPS domain. Such changes are summarised later in section 8.

All changes and text additions, comparing to DCAT-AP 2.0.0, are marked in the table below with a red font.

## Class “Catalogue”

| **No.** | **Obligation** | **Property Name** | **URI** | **Reference / Type / Range** | **Usage Note** | **Card.** |
| --- | --- | --- | --- | --- | --- | --- |
| 2.1 | M | dataset | dcat:dataset | dcat:Dataset | This property links the catalogue with a dataset that is part of the catalogue.  This is a direct link from a catalogue to a dataset. To also link the catalogue to a metadata record of a dataset, it is recommended always also to use the property “record” (see below). | 1..n |
| 2.2 | M | description | dct:description | rdfs:Literal | This property contains a free-text account of the catalogue. This property can be repeated for parallel language versions of the description. | 1..n |
| * + 1. 2.3 | * + 1. M | publisher | dct:publisher | foaf:Agent | This property refers to an entity (organisation) responsible for making the catalogue available. | 1..1 |
| * + 1. 2.4 | * + 1. M | title | dct:title | rdfs:Literal | This property contains a name given to the catalogue. This property can be repeated for parallel language versions of the name. | 1..n |
| * + 1. 2.5 | * + 1. R | homepage | foaf:homepage | foaf:Document | This property refers to a web page that acts as the main page for the catalogue. | 0..1 |
| 2.6 | R | language | dct:language | dct: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 be repeated if the metadata is provided in multiple languages. | 0..n |
| 2.7 | R | licence | dct:license | dct:LicenseDocument | This property refers to the licence under which the catalogue can be used or reused. | 0..1 |
| 2.8 | R | release date | dct:issued | rdfs:Literal typed as xsd:date or xsd:dateTime | This property contains the date of formal issuance (e.g., publication) of the catalogue. | 0..1 |
| 2.9 | R | spatial/ geographic | dct:spatial | dct:Location | This property refers to a geographical area covered by the catalogue. | 0..n |
| 2.10 | R | themes | dcat:themeTaxonomy | skos:ConceptScheme | This property refers to a knowledge organization system used to classify the catalogue’s datasets.  A controlled vocabulary by the EU Publications Office must to be applied according to DCAT-AP. The value for this should be set to rdf:resource=" <http://publications.europa.eu/resource/authority/data-theme/TRAN>". | 0..n |
| 2.11 | R | update/ modification date | dct:modified | rdfs:Literal typed as xsd:date or xsd:dateTime | This property contains the most recent date on which the catalogue was modified. | 0..1 |
| 2.12 | O | has part | dct:hasPart | dcat:Catalog | This property refers to a related catalogue that is part of the described catalogue. | 0..n |
| 2.13 | O | is part of | dct:isPartOf | dcat:Catalog | This property refers to a related catalogue in which the described catalogue is physically or logically included. | 0..1 |
| 2.14 | O | record | dcat:record | dcat:CatalogRecord | This property refers to a metadata record that is part of the catalogue. | 0..n |
| 2.15 | O | rights | dct:rights | dct:RightsStatement | This property refers to a statement that specifies rights associated with the catalogue. | 0..1 |
| 2.16 | O | service | dcat:service | dcat:DataService | This property refers to a site or end-point that is listed in the catalogue. | 0..n |
| 2.17 | O | catalogue | dcat:catalog | dcat:Catalog | This property refers to a catalogue whose contents are of interest in the context of this catalogue. | 0..n |

## Class “Catalogue Record”

| **No.** | **Obligation** | **Property Name** | **URI** | **Reference / Type / Range** | **Usage Note** | **Card.** |
| --- | --- | --- | --- | --- | --- | --- |
| 11.1 | M | primary topic | foaf:primaryTopic | dcat:Dataset | This property links the metadata record to the dataset described in the record.  . | 1..1 |
| 11.2 | M | update/ modification date | dct:modified | rdfs:Literal typed as xsd:date or xsd:dateTime | This property contains the most recent date on which the metadata record was created or modified. | 1..1 |
| 11.3 | R | application profile | dct:conformsTo | rdfs:Resource | This property refers to an Application Profile that the dataset’smetadata conforms to.  When following this presented work, the value will be an URI of “spsDCAT-AP version x.x”. | 0..1 |
| 11.4 | R | change type | adms:status | skos:Concept | This property refers to the type of the latest revision of a dataset's entry in the catalogue.  Potential types according to skos:Concept are “Completed”, “Deprecated”, “UnderDevelopment” and “Withdrawn”. | 0..1 |
| 11.5 | R | listing date | dct:issued | rdfs:Literal typed as xsd:date or xsd:dateTime | This property contains the date on which the description of the dataset was included in the catalogue. | 0..1 |
| 11.6 | O | description | dct:description | rdfs:Literal | This property contains a free-text account of the record. This property can be repeated for parallel language versions of the description.  Note that this is NOT the description about the dataset but only about the metadata record. This property could be used if the description varies between the dataset and the metadata record. | 0..n |
| 11.7 | O | language | dct:language | dct:LinguisticSystem | This property refers to a language used in the textual metadata describing titles, descriptions, etc. of the Dataset. This property can be repeated if the metadata is provided in multiple languages.  A controlled vocabulary is to be used, see section 6.2. | 0..n |
| 11.8 | O | source metadata | dct:source | dcat:CatalogRecord | This property refers to the original metadata that was used in creating metadata for the Dataset | 0..1 |
| 11.9 | O | title | dct:title | rdfs:Literal | This property contains a name given to the Catalogue Record. This property can be repeated for parallel language versions of the name.  Note that this is NOT the title of the publication but only of the metadata record. This property could be used if the title varies between the publication and the metadata record. | 0..n |

## Class “Dataset”

| **No.** | **Obligation** | **Property Name** | **URI** | **Reference / Type / Range** | **Usage Note** | **Card.** |
| --- | --- | --- | --- | --- | --- | --- |
| 3.1 | M | description | dct:description | rdfs:Literal | This property contains a free-text account of the Dataset. This property can be repeated for parallel language versions of the description.  The author is encouraged to write a meaningful description. This element is only for a brief overview, because free text fields are unsuitable for searches, due to spelling mistakes, different wordings and other aspects. The categorisation of the data sets is done within other elements. | 1..n |
| 3.2 | M | title | dct:title | rdfs:Literal | This property contains a name given to the Dataset. This property can be repeated for parallel language versions of the name. | 1..n |
| 3.3 | R | contact point | dcat:contactPoint | vcard:Kind | This property contains contact information about an entity (organisation and/or person) that publishes the data sets. This entity is responsible for the given information, can receive comments about the Dataset, and concludes a contract if applicable.  This property is used in addition to the property ““publisher” (see below), to add contact details to the publisher’s name, The “Name” should be mapped from “publisher” (see below). | 0..n |
| 3.4 | M | dataset distribution | dcat:distribution | dcat:Distribution | This property links the Dataset to an available Distribution. | 1..n |
| 3.5 | M | transportation mode | napdcatap:transportationMode | skos:Concept | This property refers to the transportation mode covered by a dataset.  A controlled vocabulary is to be used, see section 6.2. | 1..n |
| 3.6 | R | quality description | napdcatap:qualityDescription | rdfs:Literal | This property describes quality criteria of a data set and (if applicable) methods and results of a quality assessment.  This information shall assist data consumers in determining the value of data for their own services.  The information can be provided by free text and/or an URL to further quality information. | 0..n |
| 3.7 | R | keyword/ tag | dcat:keyword | rdfs:Literal | This property contains a keyword or tag describing the Dataset.  It is not recommended to use keywords, as they might be ambiguous and make data search difficult. Instead, the property “theme/ category” (see below) is recommended, with controlled vocabularies. | 0..n |
| 3.8 | R | publisher | dct:publisher | foaf:Agent | This property refers to an entity (organisation) that publishes the data sets. He or she is responsible for the given information, can receive comments about the Dataset, and concludes a contract if applicable. | 0..1 |
| 3.9 | M | spatial/ geographical coverage | dct:spatial | dct:Location | This property refers to a geographic region that is covered by the Dataset. | 1..n |
| 3.10 | M | network coverage | napdcatap:networkCoverage | skos:Concept | This property describes the part of the transport network (functional road classes or other forms of link-based transport infrastructure) that is covered by a data set. | 1..n |
| 3.11 | R | temporal coverage | dct:temporal | dct:PeriodOfTime | This property refers to a temporal period that the Dataset covers. | 0..n |
| 3.12 | M | theme/ category | dcat:theme, subproperty of dct:subject | skos:Concept | This property refers to a category of the Dataset. A category is important for data seekers who are interested for a particular type of data. A Dataset may be associated with multiple themes.  Following an usage note from GeoDCAT-AP (see section II.8), key words from controlled vocabularies should be expressed with dcat:theme.  The property is expressed via key words from a controlled vocabulary, see section 6.2. The controlled vocabulary contains a two-hierarchy category description:  1. “Dataset category”:  2. “Dataset detailed category”:  This means the data provider would select one generic option of a “Dataset category” (example “parking supply”), and then optionally concretise this with one or more options of “Dataset detailed category” (example: “parking fees”).  The applicable key words are based on definitions from standardisation activities and analytical approaches, as investigated in the “data perspective”, see Section 3 of the research paper cited in the introduction  In addition, another controlled vocabulary by the EU Publications Office must to be applied according to DCAT-AP. The value for this should be set to rdf:resource=" <http://publications.europa.eu/resource/authority/data-theme/TRAN>" for any metadata record.. | 1..n |
| 3.13 | O | access rights | dct:accessRights | dct:RightsStatement | This property refers to the condition of use: whether a free and unrestricted use is possible, a contract has to be concluded or a license has to be agreed on to use a dataset. This should allow potential data consumers to check and prove terms and conditions before getting in touch with the publisher.  A controlled vocabulary is to be used, see section 6.2.  A corresponding property “rights” is mandatory under class “Distribution”. It could be optionally copied for this property. | 0..1 |
| 3.14 | O | creator | dct:creator | foaf:Agent | This property refers to the entity that owns the data set and is responsible for content and quality of the data set. In case that the publisher is also the data owner the value will be copied from the publisher value. | 0..1 |
| 3.15 | O | conforms to | dct:conformsTo | dct:Standard | This property refers to an implementing rule or other specification.  Do not use for information about data formats etc. This should be noted under the class “Distribution” (properties “conforms to” and “media type”. | 0..n |
| 3.16 | O | documentation | foaf:page | foaf:Document | This property refers to a page or document about this Dataset. | 0..n |
| 3.17 | O | frequency | dct:accrualPeriodicity | dct:Frequency | This property refers to the update rate of the data set. If there is a specific time interval or data only provided on occurrence, precise information should be given.  A controlled vocabulary is to be used, see section 6.2. | 0..1 |
| 3.18 | O | has version | dct:hasVersion | dcat:Dataset | This property refers to a related Dataset that is a version, edition, or adaptation of the described Dataset. | 0..n |
| 3.19 | O | identifier | dct:identifier | rdfs:Literal | This property contains the main identifier for the Dataset, e.g. the URI or other unique identifier in the context of the Catalogue. | 0..n |
| 3.20 | O | is referenced by | dct:isReferencedBy | rdfs:Resource | This property provides a link to a description of a relationship with another resource | 0..n |
| 3.21 | O | is version of | dct:isVersionOf | dcat:Dataset | This property refers to a related Dataset of which the described Dataset is a version, edition, or adaptation. | 0..n |
| 3.22 | O | landing page | dcat:landingPage | foaf:Document | This property refers to a web page that provides access to the Dataset, its Distributions and/or additional information. 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..n |
| 3.23 | O | language | dct:language | dct:LinguisticSystem | This property refers to a language of the Dataset. This property can be repeated if there are multiple languages in the Dataset.  A controlled vocabulary is to be used, see section 6.2. | 0..n |
| 3.24 | O | other identifier | adms:identifier | adms:Identifier | This property refers to a secondary identifier of the Dataset, such as MAST/ADS[[8]](#footnote-8), DataCite[[9]](#footnote-9), DOI[[10]](#footnote-10), EZID[[11]](#footnote-11) or W3ID[[12]](#footnote-12). | 0..n |
| 3.25 | O | provenance | dct:provenance | dct:ProvenanceStatement | This property contains a statement about the lineage of a Dataset. | 0..n |
| 3.26 | O | qualified attribution | prov:qualifiedAttribution | prov:Attribution | This property refers to a liink to an Agent having some form of responsibility for the resource | 0..n |
| 3.27 | O | qualified relation | dcat:qualifiedRelation | dcat:Relationship | This property is about a related resource, such as a bibliographic publication, that references, cites, or otherwise points to the dataset. | 0..n |
| 3.28 | O | related resource | dct:relation | rdfs:Resource | This property refers to a related resource.  It may be a link between two individual SPS dataset, which are somehow interlinked, e.g. one publication with static parking data, and one with dynamic parking data. both covering the same parking facilities. | 0..n |
| 3.29 | O | release date | dct:issued | rdfs:Literal typed as xsd:date or xsd:dateTime | This property contains the date of formal issuance of the Dataset. | 0..1 |
| 3.30 | O | sample | adms:sample | dcat:Distribution | This property refers to a sample distribution of the dataset | 0..n |
| 3.31 | O | source | dct:source | dcat:Dataset | This property refers to a related Dataset from which the described Dataset is derived. | 0..n |
| 3.32 | O | spatial resolution | dcat:spatialResolutionInMeters | xsd:decimal | This property refers to the minimum spatial separation resolvable in a dataset, measured in meters. | 0..n |
| 3.33 | O | temporal resolution | dcat:temporalResolution | xsd:duration | This property refers to the minimum time period resolvable in the dataset. | 0..n |
| 3.34 | O | type | dct:type | skos:Concept | This property refers to the type of the Dataset.  It is recommended not to use this property, but rather describe the dataset type via other properties, e.g. theme or format.. | 0..1 |
| 3.35 | O | update/ modification date | dct:modified | rdfs:Literal typed as xsd:date or xsd:dateTime | This property contains the most recent date on which the Dataset was changed or modified. | 0..1 |
| 3.36 | O | version | owl:versionInfo | rdfs:Literal | This property contains a version number or other version designation of the Dataset. | 0..1 |
| 3.37 | O | version notes | adms:versionNotes | rdfs:Literal | This property contains 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..n |
| 3.38 | O | was generated by | prov:wasGeneratedBy | prov:Activity | This property refers to an activity that generated, or provides the business context for, the creation of the dataset. | 0..n |
| 3.41 | R | georeferencing method | napdcatap:geoReferencingMethod | skos:Concept | This property refers to the the georeferencing method which is applied within the dataset.  A controlled vocabulary is to be used, see section 6.2. | 0..n |
| 3.42 | M | SPS function | spsdcatap:spsfunction | skos:Concept | This property refers to an intended functionality of a dataset. This is important to relate a SPS dataset with potential measures of PSM.  The property is expressed via key words from a controlled vocabulary, see section 6.2. The applicable key words are based on functional classifications, as investigated in the “functional perspective”, see Section 3 of the research paper cited in the introduction. | 1..n |
| 3.43 | R | SPS technology | spsdcatap:spstechnology | skos:Concept | This property refers to a SPS technology behind a dataset. This allows data users to assess the technical background of the dataset.  The property is expressed via key words from a controlled vocabulary, see section 6.2. The applicable key words are based on technical classifications, as investigated in the “technical perspective”, see Section 3 of the research paper cited in the introduction. | 0..n |
| 3.44 | R | parking process | spsdcatap:parkingprocess | skos:Concept | This property refers to one or more parking processes, which the SPS addresses. This is important to relate a dataset with roles of a potential PSM actor.  The property is expressed via key words from a controlled vocabulary. The applicable key words are based on existing definitions of parking process, see Section 2 of the research paper cited in the introduction. | 0..n |
| 3.45 | R | data source | spsdcatap:datasource | skos:Concept | This property refers to one or more data sources, which the dataset is based on. This allows data users to assess the technical background and/or quality of the dataset.  The property is expressed via key words from a controlled vocabulary. The applicable key words are based on classifications of data sources, as investigated in the “data perspective”, see Section 3 of the research paper cited in the introduction. | 0..n |
| 3.46 | M | state of data | spsdcatap:datastate | skos:Concept | This property refers to a state of data processing (from raw to aggregated/processed data).  This allows data users to assess the granularity and quality of the dataset.  The property is expressed via key words from a controlled vocabulary The applicable key words are based on classifications of data states, as investigated in the “data perspective”, see Section 3 of the research paper cited in the introduction. | 1..1 |

## Class “Distribution”

| **No.** | **Obligation** | **Property Name** | **URI** | **Reference / Type / Range** | **Usage Note** | **Card.** |
| --- | --- | --- | --- | --- | --- | --- |
| 6.1 | M | access URL | dcat:accessURL | rdfs:Resource | This property contains a URL that gives access to the current data set or a connection link to a service.  The type of this ULR depends on the type of the dataset:  • If the data is accessible for everyone, the URL may be link directly to the data access.  • If some agreements between the data provider and the data user need to be established first, this URL may link to a general web site by the data provider, which explains further steps how to establish the data access. | 1..1 |
| 6.1 | R | availability | dcatap:availability | skos:Concept | This property indicates how long it is planned to keep the Distribution of the Dataset available. It MUST take one of the values: temporary, experimental, available, stable. | 0..1 |
| 6.3 | R | description | dct:description | rdfs:Literal | This property contains a free-text account of the Distribution. This property can be repeated for parallel language versions of the description. | 0..n |
| * + 1. 6.4 | * + 1. M | format | dct:format | dct:MediaType | This property refers to the formatting of a dataset, described on four layers. This way, a data user will be able to learn about how to read and interpret a dataset:  • Encoding, describing a character set standard. Encoding is usually controlled by syntax standards today, see below.  • Syntax, as the base standard that specifies syntactically correct documents. On this level, only base elements of building documents properly are specified and can be proved by syntax checks.  • Grammar, describing the standard on top of the elementary syntax that describe data structures in the dataset.  • Data Model, desctibing concrete data models that use the specification elements to specify specific data models. The NAP should keep references of the concrete data model used for a dataset.  Values on the Syntax and Data Model are mandatory in this property, Encoding and Grammar are optional.  Controlled vocabularies for these layers are to be used, see section 6.2. | 1..n |
| * + 1. 6.5 | M | rights | dct:rights | dct:RightsStatement | This property refers to the condition of use: whether a free and unrestricted use is possible, a contract has to be concluded or a license has to be agreed on to use a dataset. This should allow potential data consumers to check and prove terms and conditions before getting in touch with the publisher.  A controlled vocabulary is to be used, see section 6.2. | 1..1 |
| * + 1. 6.6 | R | condition for use | napdcatap:contitionForUse | rdfs:Literal | This property gives detailed, free-text information about the condition of use, as a free text and in addition to the property “rights“ (see above).If common terms are used, they may be also referenced here (e.g. open data licences such as CC 0, CC BY 4.0, etc.).  If a concrete (sample) contract or terms of are to be provided, e.g. as an URL to a PDF, such documents may be made accessible via the property “licence” (see below). | 0..1 |
| * + 1. 6.7 | * + 1. R | licence | dct:license | dct:LicenseDocument | This property refers to the licence under which the Distribution is made available.  It refers to a concrete (sample) contract or terms, in addition to the property “condition for use” | 0..1 |
| * + 1. 6.8 | * + 1. O | access service | dcat:accessService | dcat:DataService | This property refers to a data service that gives access to the distribution of the dataset | 0..n |
| 6.9 | * + 1. O | byte size | dcat:byteSize | rdfs:Literal typed as xsd:decimal | This property contains the size of a Distribution in bytes. | 0..1 |
| * + 1. 6.10 | * + 1. O | checksum | spdx:checksum | spdx:Checksum | This property provides a mechanism that can be used to verify that the contents of a distribution have not changed | 0..1 |
| * + 1. 6.11 | * + 1. O | compression format | dcat:compressFormat | dct:MediaType | This property refers to 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. | 0..n |
| * + 1. 6.12 | * + 1. O | documentation | foaf:page | foaf:Document | This property refers to a page or document about this Distribution. | 0..n |
| * + 1. 6.13 | * + 1. O | download URL | dcat:downloadURL | rdfs:Resource | This property contains a URL that is a direct link to a downloadable file in a given format. | 1..n |
| * + 1. 6.14 | * + 1. O | has policy | odrl:hasPolicy | odrl:Policy | This property refers to the policy expressing the rights associated with the distribution if using the ODRL vocabulary | 0..1 |
| * + 1. 6.15 | * + 1. O | language | dct:language | dct:LinguisticSystem | This property refers to a language used in the Distribution. This property can be repeated if the metadata is provided in multiple languages. | 0..n |
| * + 1. 6.16 | * + 1. O | linked schemas | dct:conformsTo | dct:Standard | This property refers to an established schema to which the described Distribution conforms. | 0..n |
| * + 1. 6.17 | * + 1. O | media type | dcat:mediaType, subproperty of dct:format | dct:MediaType | This property refers to the media type of the Distribution as defined in the official register of media types managed by IANA. | 0..1 |
| * + 1. 6.18 | * + 1. O | packaging format | dcat:packageFormat | dct:MediaType | This property refers to 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. | 0..n |
| * + 1. 6.19 | * + 1. O | release date | dct:issued | rdfs:Literal typed as xsd:date or xsd:dateTime | This property contains the date of formal issuance (e.g., publication) of the Distribution. | 0..1 |
| * + 1. 6.20 | * + 1. O | spatial resolution | dcat:spatialResolutionInMeters | xsd:decimal | This property refers to the minimum spatial separation resolvable in a dataset distribution, measured in meters. | 0..n |
| * + 1. 6.21 | * + 1. O | status | adms:status | skos:Concept | This property refers to the maturity of the Distribution. It MUST take one of the values Completed, Deprecated, Under Development, Withdrrawn. | 0..1 |
| * + 1. 6.22 | * + 1. O | temporal resolution | dcat:temporalResolution | xsd:duration | This property refers to the minimum time period resolvable in the dataset distribution. | 0..n |
| * + 1. 6.23 | * + 1. O | title | dct:title | rdfs:Literal | This property contains a name given to the Distribution. This property can be repeated for parallel language versions of the description. | 0..n |
| * + 1. 6.24 | * + 1. O | update/ modification date | dct:modified | rdfs:Literal typed as xsd:date or xsd:dateTime | This property contains the most recent date on which the Distribution was changed or modified. | 0..1 |
| * + 1. 6.25 | * + 1. O | data format description | napdcatap:dataFormatDescription | rdfs:Literal | This property can optionally be used to provide additional, free-text information on the data format, in addition to the property “format”. | 0..1 |
| * + 1. 6.26 | * + 1. M | application layer protocol | napdcatap:applicationLayerProtocol | skos:Concept | This property refers to the IT protocol of the data interface that will be used to transfer data.  A controlled vocabulary is to be used, see section 6.2. | 1..1 |
| * + 1. 6.27 | * + 1. R | communication method | napdcatap:communicationMethod | skos:Concept | This property refers to the transmitting procedure from data provider to data receiver. This element gives the service provider the opportunity to check the common data procedure on compatibility.  A controlled vocabulary is to be used, see section 6.2. | 0..n |

## Class “Location”

| **No.** | **Obligation** | **Property Name** | **URI** | **Reference / Type / Range** | **Usage Note** | **Card.** |
| --- | --- | --- | --- | --- | --- | --- |
| 7.1 | M | geographic identifier | locn:Address | skos:Concept | This property describes the geographic area covered by a data set. Data sets can be valid for more than one area,.  A controlled vocabulary is to be used, see section 6.2.  Corresponds to CMC element 2.2.4.1 Area Covered by Publication. | 1..n |
| 7.2 | M | parking segment | spsdcatap:parkingsegment | skos:Concept | This property refers to a parking supply segment which the dataset is covering (on-street vs. off-street, public vs. private).  This allows data users to assess the coverage of the dataset.  The property is expressed via key words from a controlled vocabulary. The applicable key words are based on existing definitions of parking supply segments, see Section 2 of the research paper cited in the introduction. | 1..n |
| 7.3 | R | bounding box | dcat:bbox | rdfs:Literal | This property refers to he geographic bounding box of a resource. | 0..1 |
| * + 1. 7.4 | * + 1. R | centroid | dcat:centoid | rdfs:Literal | This property refers to the geographic center (centroid) of a resource. | 0..1 |
| * + 1. 7.5 | * + 1. O | geometry | locn:geometry | rdfs:Literal | This property associates any resource with the corresponding geometry | 0..1 |

## Class “Period of Time”

| **No.** | **Obligation** | **Property Name** | **URI** | **Reference / Type / Range** | **Usage Note** | **Card.** |
| --- | --- | --- | --- | --- | --- | --- |
| 20.1 | M | temporal scope | spsdcatap:temporalscope | skos:Concept | This property refers to a temporal dimension which the dataset is covering (real-time, historic, predictions.)  This allows data users to assess the temporal dimension of the dataset.  The property is expressed via key words from a controlled vocabulary. The applicable key words are based on classifications of temporal dimensions, as investigated in the “data perspective”, see Section 3 of the research paper cited in the introduction. | 1..n |
| 20.2 | R | start date | dcat:startDate | rdfs:Literal typed as xsd:date or xsd:dateTime | This property describes the starting time from which the data delivery is applicable. The applicability is defined depending on the type of the publication:  • In cases of real-time/dynamic data, this property describes the first time when the data feed is (or will be) delivered technically via the distribution channel.  • In cases of static data, it is assumed that the data delivery is not time-restricted. So, this property will directly describe the time reference of the delivered information. | 0..1 |
| 20.3 | R | end date | dcat:endDate | rdfs:Literal typed as xsd:date or xsd:dateTime | This property describes the ending time from which the data delivery is applicable. How this applicability is defined, see above at “start date.” | 0..1 |
| * + 1. 20.4 | O | beggining | time:hasBeginning | time:Instant | This property contains the beginning of a period or interval. | 0..1 |
| * + 1. 20.5 | * + 1. O | end | time:hasEnd | time:Instant | This property contains the end of a period or interval | 0..1 |

# Controlled Vocabularies

## Requirements for controlled vocabularies

DCT\_AP 2.0.0 introduces is a list of requirements that were identified for the controlled vocabularies.According to this, controlled vocabularies SHOULD:

* Be published under an open licence.
* Be operated and/or maintained by an institution of the European Union, by a recognised standards organisation or another trusted organisation.
* Be properly documented.
* Have labels in multiple languages, ideally in all official languages of the European Union.
* Contain a relatively small number of terms (e.g. 10-25) that are general enough to enable a wide range of resources to be classified.
* Have terms that are identified by URIs with each URI resolving to documentation about the term.
* Have associated persistence and versioning policies.

These criteria do not intend to define a set of requirements for controlled vocabularies in general; they are only intended to be used for the selection of the controlled vocabularies that are proposed for this Application Profile.

It is noted, that some new controlled vocabularies have been introduced specifically for napDCAT-AP. These new controlled vocabularies do not meet all of the requirements above yet, as some further works are pending, such as maintainance structures.

It is further noted, that the concept of controlled vocabularies is seen as beneficial for the context of NAPS: In the Coordinated Metadata Catalogue, some Metadata lements were assigned with predefined elements, being described in one document with all Metadata descriptions.

A major advantage of controlled vocabularies is that they can be maintained and updated independently of the Metadata. This may be a benefit, if some of the vocabularies need to be adopted due to the technological progress. E.g., data formats could be added under the property “format” of the class “Distribution”, when needed.

## Controlled vocabularies to be used

In the table below, a number of properties are listed with controlled vocabularies that MUST be used for the listed properties. The declaration of the following controlled vocabularies as mandatory ensures a minimum level of interoperability.

Again, the basis for this table is the DCAT-AP 2.0.0 specification. However, several new NAP-related, controlled vocabularies are added. These additions are marked in red font.

| **Property Name** | **Used for Class** | **Vocabulary Name** | **Vocabulary URI** | **Usage Note** |
| --- | --- | --- | --- | --- |
| media type | Distribution | IANA Media Types[[13]](#footnote-13) | <http://www.iana.org/assignments/media-types/media-types.xhtml> |  |
| theme/ category | Dataset | Dataset Theme Vocabulary | http://publications.europa.eu/resource/authority/data-theme | The values to be used for this property are the URIs of the concepts in the vocabulary. |
| themes | Catalogue | Dataset Theme Vocabulary | http://publications.europa.eu/resource/dataset/data-theme | The value to be used for this property is the URI of the vocabulary itself, i.e. the concept scheme, not the URIs of the concepts in the vocabulary. |
| frequency | Dataset | EU Vocabularies Frequency Named Authority List[[14]](#footnote-14) | <http://publications.europa.eu/resource/authority/frequency> |  |
| format | Distribution | EU Vocabularies File Type Named Authority List[[15]](#footnote-15) | <http://publications.europa.eu/resource/authority/file-type> |  |
| language | Catalogue, Dataset, CatalogueRecord | EU Vocabularies Languages Named Authority List[[16]](#footnote-16) | <http://publications.europa.eu/resource/authority/language> |  |
| publisher | Catalogue, Dataset | EU Vocabularies Corporate bodies Named Authority List[[17]](#footnote-17) | <http://publications.europa.eu/resource/authority/corporate-body> | The Corporate bodies NAL must be used for European institutions and a small set of international organisations. In case of other types of organisations, national, regional or local vocabularies should be used. |
| spatial/ geographical coverage | Catalogue, Dataset | EU Vocabularies Continents Named Authority List[[18]](#footnote-18), EU Vocabularies Countries Named Authority List[[19]](#footnote-19), EU Vocabularies Places Named Authority List[[20]](#footnote-20), Geonames | <http://publications.europa.eu/resource/authority/continent/>, <http://publications.europa.eu/resource/authority/country>, <http://publications.europa.eu/resource/authority/place/>,  <http://sws.geonames.org/> | The EU Vocabularies Name Authority Lists must 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 URIsmust be used. |
| status | Distribution | ADMS status vocabulary | <http://purl.org/adms/status/> | The list of terms in the ADMS status vocabulary is included in the ADMS specification[[21]](#footnote-21) |
| type | Agent | ADMS publisher type vocabulary | <http://purl.org/adms/publishertype/> | The list of terms in the ADMS publisher type vocabulary is included in the ADMS specification |
| type | Licence Document | ADMS licence type vocabulary | <http://purl.org/adms/licencetype/> | The list of terms in the ADMS licence type vocabulary is included in the ADMS specification |
| theme/ category | Dataset | Categories of dataset types | https://peterlubrich.github.io/spsDCAT-AP/vocabularies/datasetCategories | Predefined options, As investigated in research paper |
| SPS function | Dataset | Categories of SPS functions | https://peterlubrich.github.io/spsDCAT-AP/vocabularies/spsFunction | Predefined options, As investigated in research paper |
| SPS technology | Dataset | Categories of SPS technologies | https://peterlubrich.github.io/spsDCAT-AP/vocabularies/spsTechnology | Predefined options, As investigated in research paper |
| parking process | Dataset | Categories of parking processes | https://peterlubrich.github.io/spsDCAT-AP/vocabularies/parkingProcess | Predefined options, As investigated in research paper |
| data source | Dataset | Categories of data sources | https://peterlubrich.github.io/spsDCAT-AP/vocabularies/dataSource | Predefined options, As investigated in research paper |
| state of data | Dataset | Categories of states of data | https://peterlubrich.github.io/spsDCAT-AP/vocabularies/stateOfdata | Predefined options, As investigated in research paper |
| access rights | Dataset | Categories of access rights | <https://eueip.github.io/napDCAT-AP/vocabularies/accessrights> | Pre-defined options, as defined in CMC |
| frequency | Dataset | Categories of frequencies | <https://eueip.github.io/napDCAT-AP/vocabularies/frequencies> | Pre-defined options, as defined in CMC |
| service type category | Dataset | Categories of service types | <https://eueip.github.io/napDCAT-AP/vocabularies/servicetypes> | Pre-defined options, as defined in CMC |
| georeferencing method | Dataset | Categories of georeferencing methods | <https://eueip.github.io/napDCAT-AP/vocabularies/georeferencingmethods> | Pre-defined options, as defined in CMC |
| transportation mode | Dataset | Categories of transportation modes | <https://eueip.github.io/napDCAT-AP/vocabularies/transportationmodes> | Pre-defined options, as defined in CMC |
| network coverage | Dataset | Categories of functional road classes or other forms of link-based transport infrastructure | <https://eueip.github.io/napDCAT-AP/vocabularies/functionalroadclasses> | Pre-defined options, as defined in CMC |
| type | Dataset | Categories of resource types | <https://eueip.github.io/napDCAT-AP/vocabularies/resourcetypes> | Pre-defined options, as defined in CMC |
| rights | Distribution | Categories of access rights | <https://eueip.github.io/napDCAT-AP/vocabularies/accessrights> | Pre-defined options, as defined in CMC |
| format | Distribution | Character set standards (for the “Encoding” layer) | https://ddialliance.org/Specification/DDI-CV/CharacterSet\_1.0.html | Pre-defined options, as defined in CMC |
| format | Distribution | Categories of data syntax standards | <https://eueip.github.io/napDCAT-AP/vocabularies/datasyntaxstandards> | Pre-defined options, as defined in CMC |
| format | Distribution | Categories of data grammar standards | <https://eueip.github.io/napDCAT-AP/vocabularies/datagrammarstandards> | Pre-defined options, as defined in CMC |
| format | Distribution | Categories of data models | <https://eueip.github.io/napDCAT-AP/vocabularies/datamodels> | Pre-defined options, as defined in CMC |
| application layer protocol | Distribution | Categories of application layer protocols | <https://eueip.github.io/napDCAT-AP/vocabularies/applicationlayerprotocols> | Pre-defined options, as defined in CMC |
| communication method | Distribution | Categories of communication methods | <https://eueip.github.io/napDCAT-AP/vocabularies/communicationmethods> | Pre-defined options, as defined in CMC |
| parking segment | Location | Categories of parking segments | https://peterlubrich.github.io/spsDCAT-AP/vocabularies/parkingSegment | Predefined options, As investigated in research paper |
| geographic identifier | Location | NUTS classification (Nomenclature of territorial units for statistics) i | http://nuts.geovocab.org/ | The CMC recommends to use the NUTS classification, as a standard for territorial units by the European Union is recommended to provide a clear description of the area covered. The “NUTS Levels” define a possible selection of an area level :  NUTS 0: countries  NUTS 1: major socio-economic regions  NUTS 2: basic regions for the application of regional policies  NUTS 3: as small regions for specific diagnoses  NUTS level 0 is mandatory in napDCAT-AP, NUTS levels 1-3 are recommended. |
| temporal scope | Period of Time | Categories of temporal scope | https://peterlubrich.github.io/spsDCAT-AP/vocabularies/temporalScope | Predefined options, As investigated in research paper |

# Conformity Statement to DCAT-AP 2.0.0

Several requirements are formulated when building extensions to DCAT-AP.

First, minimum conformance requirements, as defined in section 6 of the specification of DCAT-AP v2.0.0, need to be respected.

Further policy elements are:

* An extension may only narrow, not widen, usage notes.
* An extension may add classes and properties but not when similar elements already exist in DCAT-AP.
* An extension may change obligations and cardinalities but mandatory must stay mandatory.
* An extension may specify additional controlled vocabularies.

It is stated that the presented spsDCAT-AP extension follows the requirements above.

# Changes to DCAT-AP 2.0.0

The following tables show the changes made for the spsDCAT-AP extension, comparing to the original DCAT-AP 2.0.0 specification. The changes were necessary to consider metadata elements to sufficiently describe SPS data offerings, as identified in the research paper cited in the introduction. This is the case when the existing classes and properties in DCAT-AP 2.0.0 are not sufficient.

| **Class** | **Property** | **Type of change** | **Property URI** | **Range** | **Note** | **Card** | **Obligation** |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Dataset | spatial/ geographical coverage | Obligation changed from “O” to “M” | dct:spatial | dct:Location |  | 1..n | mandatory |
| Dataset | Dataset distribution | Obligation changed from “R” to “M” | dcat:distribution | dcat:Distribution |  | 1..n | mandatory |
| Dataset | georeferencing method | Added property | napdcatap:geoReferencingMethod | skos:Concept | Controlled vocabulary provided | 0..n | recommended |
| Dataset | transportation mode | Added property | napdcatap:transportationMode | skos:Concept | Controlled vocabulary provided | 1..n | mandatory |
| Dataset | quality description | Added property | napdcatap:qualityDescription | rdfs:Literal |  | 1..n | mandatory |
| Dataset | network coverage | Added property | napdcatap:networkCoverage | skos:Concept | Controlled vocabulary provided | 1..n | mandatory |
| Dataset | theme/ category | Added controlled vocabulary | dcat:theme | skos:Concept | Controlled vocabulary provided | 1..n | mandatory |
| Dataset | theme/ category | Obligation changed from “R” to “M” | dcat:theme | skos:Concept | Controlled vocabulary provided | 1..n | mandatory |
| Dataset | access rights | Added controlled vocabulary | dct:accessRights | dct:RightsStatement | Controlled vocabulary provided | 1..1 | mandatory |
| Dataset | frequency | Added controlled vocabulary | dct:accrualPeriodicity | dct:Frequency | Controlled vocabulary provided | 1..1 | mandatory |
| Dataset | SPS function | Added property | spsdcatap:spsfunction | skos:Concept | Controlled vocabulary provided | 1..n | mandatory |
| Dataset | SPS technology | Added property | spsdcatap:spstechnology | skos:Concept | Controlled vocabulary provided | 0..n | recommended |
| Dataset | parking process | Added property | spsdcatap:parkingprocess | skos:Concept | Controlled vocabulary provided | 0..n | recommended |
| Dataset | data source | Added property | spsdcatap:datasource | skos:Concept | Controlled vocabulary provided | 0..n | recommended |
| Dataset | state of data | Added property | spsdcatap:datastate | skos:Concept | Controlled vocabulary provided | 1..1 | mandatory |
| Distribution | condition for use | Added property | napdcatap:contitionForUse | rdfs:Literal |  | 0..1 | recommended |
| Distribution | rights | Obligation changed from “O” to “M” | dct:rights | dct:RightsStatement | Controlled vocabulary provided | 1..1 | mandatory |
| Distribution | format | Obligation changed from “R” to “M | dct:format | dct:MediaType | Controlled vocabulary provided | 1..n | mandatory |
| Distribution | data format description | Added property | napdcatap:dataFormatDescription | rdfs:Literal |  | 0..1 | optional |
| Distribution | application layer protocol | Added property | napdcatap: applicationLayerProtocol | skos:Concept | Controlled vocabulary provided | 1..1 | mandatory |
| Distribution | communication method | Added property | napdcatap:communicationMethod | rdfs:Resource | Controlled vocabulary provided | 0..n | recommended |
| Location | geographic identifier | Added property | locn:Address | rdfs:Resource | Controlled vocabulary provided | 1..n | mandatory |
| Location | parking segment | Added property | spsdcatap:parkingsegment | skos:Concept | Controlled vocabulary provided | 1..n | mandatory |
| Period of Time | temporal scope | Added property | spsdcatap:temporalscope | skos:Concept | Controlled vocabulary provided | 1..n | mandatory |

1. https://www.w3.org/TR/vocab-dcat-2/ [↑](#footnote-ref-1)
2. Karen Coyle, Dublin Core Metadata Initiative (DCMI): Introduction to Metadata Application Profiles, Webinar https://www.youtube.com/watch?v=hEOBRUcfApg [↑](#footnote-ref-2)
3. https://joinup.ec.europa.eu/solution/dcat-application-profile-data-portals-europe/about [↑](#footnote-ref-3)
4. DCAT-AP Version 2.0.0, Copyright © European Union, 2019 Original author: See Section 11 of DCAT-AP 2.0.0 (https://joinup.ec.europa.eu/solution/dcat-application-profile-data-portals-europe/release/200) [↑](#footnote-ref-4)
5. https://www.w3.org/TR/rdf-schema/ [↑](#footnote-ref-5)
6. https://github.com/peterlubrich/spsDCAT-AP [↑](#footnote-ref-6)
7. EuropeanCommission. Joinup. Core Location Vocabulary. <https://joinup.ec.europa.eu/solution/core-location-vocabulary> [↑](#footnote-ref-7)
8. Mikulski Archive for Space Telescopes (MAST). Referencing Data Sets in Astronomical Literature. <http://archive.stsci.edu/pub_dsn.html> [↑](#footnote-ref-8)
9. DataCite. <http://www.datacite.org/> [↑](#footnote-ref-9)
10. DOI. Digital Object Identifier. <http://www.doi.org/> [↑](#footnote-ref-10)
11. EZID. <http://n2t.net/ezid> [↑](#footnote-ref-11)
12. W3C Permanent Identifier Community Group. Permanent Identifiers for the Web. <https://w3id.org/> [↑](#footnote-ref-12)
13. Internet Assigned Numbers Authority (IANA). Media Types <http://www.iana.org/assignments/media-types/> [↑](#footnote-ref-13)
14. EUROPA. Publications Office of the EU. EU Vocabularies. Controlled Vocabularies. Authority tables. Frequency. [https://publications.europa.eu/en/web/eu-vocabularies/at-dataset/-/resource/dataset/frequency](http://publications.europa.eu/mdr/authority/frequency)  [↑](#footnote-ref-14)
15. EUROPA. Publications Office of the EU. EU Vocabularies. Controlled Vocabularies. Authority tables. File type. [https://publications.europa.eu/en/web/eu-vocabularies/at-dataset/-/resource/dataset/file-type](https://publications.europa.eu/en/web/eu-vocabularies/at-dataset/-/resource/dataset/file-type%20)  [↑](#footnote-ref-15)
16. EUROPA. Publications Office of the EU. EU Vocabularies. Controlled Vocabularies. Authority tables. Language. <https://publications.europa.eu/en/web/eu-vocabularies/at-dataset/-/resource/dataset/language/> [↑](#footnote-ref-16)
17. EUROPA. Publications Office of the EU. EU Vocabularies. Controlled Vocabularies. Authority tables. Corporate body. <https://publications.europa.eu/en/web/eu-vocabularies/at-dataset/-/resource/dataset/corporate-body/> [↑](#footnote-ref-17)
18. EUROPA. Publications Office of the EU. EU Vocabularies. Controlled Vocabularies. Authority tables. Continent <https://publications.europa.eu/en/web/eu-vocabularies/at-dataset/-/resource/dataset/continent> [↑](#footnote-ref-18)
19. EUROPA. Publications Office of the EU. EU Vocabularies. Controlled Vocabularies. Authority tables. Country. <https://publications.europa.eu/en/web/eu-vocabularies/at-dataset/-/resource/dataset/country> [↑](#footnote-ref-19)
20. EUROPA. Publications Office of the EU. EU Vocabularies. Controlled Vocabularies. Authority tables. Place. <https://publications.europa.eu/en/web/eu-vocabularies/at-dataset/-/resource/dataset/place> [↑](#footnote-ref-20)
21. European Commission. Joinup. Asset Description Metadata Schema (ADMS). <https://joinup.ec.europa.eu/solution/asset-description-metadata-schema-adms> [↑](#footnote-ref-21)