**GNSS-DCAT–AP: an extension of the DCAT Application Profile**

**for GNSS observation data**

**Version 0.4**

## **Basic document metadata**

## **Document history**

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|  |  |  |
| --- | --- | --- |
| **Version** | **Date** | **Description** |
| 0.1 | March 2022 | First draft version |
| 0.2 | May 2022 | Including additional optional properties for Dataset |
| 0.3 | April 2024 | Additional recommended properties for Dataset and Distribution and updated gnss namespace |
| 0.4 | July 2025 | Alignment with DCAT-AP 3.0.0, use of registered PIDs (w3id), information on schema and API versions, fixes and updates in the documentation |

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# Glossary

|  |  |
| --- | --- |
| ***DCAT*** | The Data Catalogue Vocabulary (DCAT) is an RDF v*ocabulary* designed to facilitate interoperability between data catalogues published on the web. Developed by W3C. |
| ***AP*** | An *application profile (AP)* re-uses terms from one or more *metadata standard elements*, but adds more specificity by identifying mandatory, recommended, and optional elements to be used for a particular application. |
| ***DCAT-AP*** | DCAT-AP provides a common specification for describing datasets in Europe and enables the exchange of dataset descriptions among data portals. |
| ***GeoDCAT-AP*** | GeoDCAT-AP is an extension of DCAT-AP for representing geographic metadata. |

For a complete glossary of the terms used in this document the [online version](https://fair-gnss.oma.be/glossary.php).

# 1 Introduction

## 1.1 Scope of this *metadata application profile* proposal

The proposal for the *application profile* GNSS-DCAT-AP specified in this document concerns the metadata that will accompany the exchange of GNSS RINEX observation data in order to increase their Findability, Accessibility, Interoperability, and Re-usability (FAIR). GNSS-DCAT-AP is based on the specifications of the [DCAT application profile](https://joinup.ec.europa.eu/sites/default/files/distribution/access_url/2021-12/5bf41792-1a2f-4851-aee2-6ecf43815bc1/dcat-ap_2.1.0.pdf) (DCAT-AP).

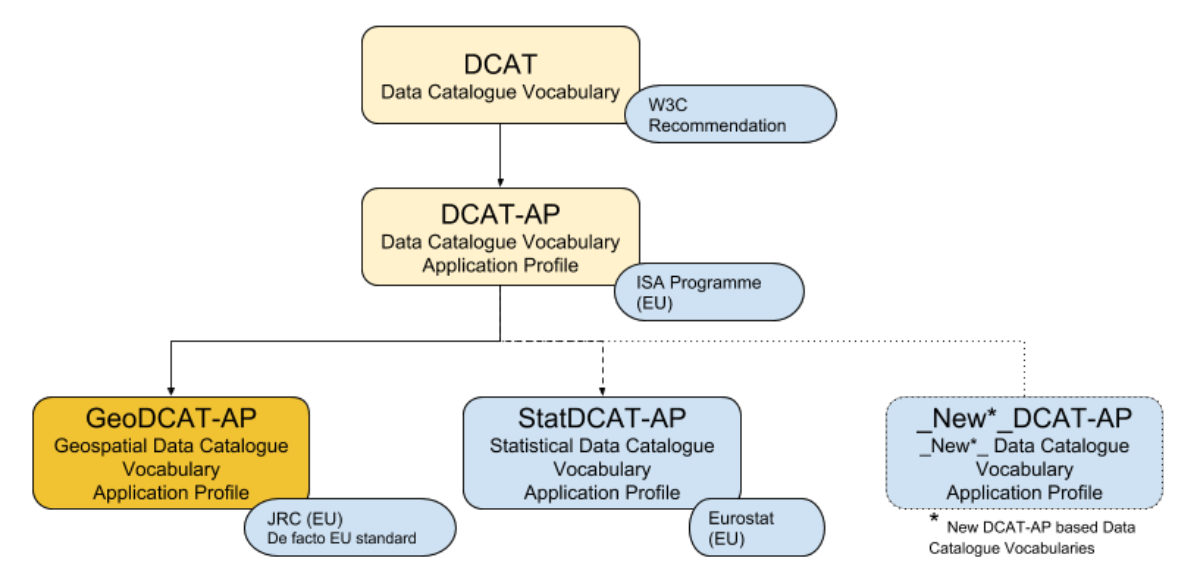
The Data Catalog Vocabulary (DCAT) is an RDF[[1]](#footnote-1) *vocabulary* and therefore, by design, it facilitates the interoperability between data portals (supporting DCAT-based RDF documents) and enables publishing *metadata* directly on the web by using different formats e.g., JSON-LD. 

Figure 1:Overview of DCAT and related initiatives (picture from [GeoDCAT-AP documentation](http://www.opengis.net/doc/dp/GeoDCAT-AP)).

In particular, DCAT-AP has been developed as a generic core set of *metadata* that can be extended to more specific uses (see Fig. 1) and is in practice the EU standard metadata interchange format.

The building blocks of DCAT-AP are DCAT classes: [Catalogue](#_Catalogue), [Data Service](#_Data_service), [Dataset](#_Dataset) and [Distribution](#_Distribution) where the catalogue consists of one or more data services and datasets, and one or more distributions for each dataset, see Fig. 2. A data service is essentially and endpoint (API), which provides access to that dataset (see <https://github.com/SEMICeu/DCAT-AP/blob/master/releases/2.1.0/usageguide-dataset-distribution-dataservice.md>).

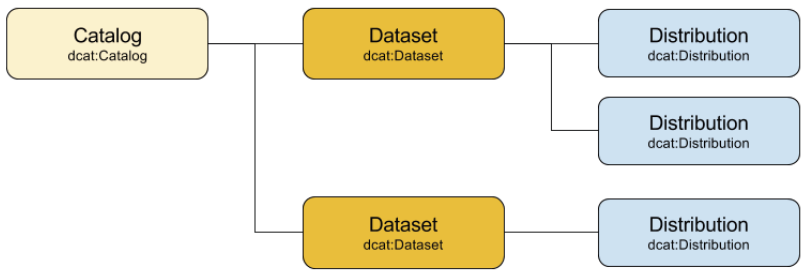


Figure 2: DCAT data structure (picture from [GeoDCAT-AP documentation](http://www.opengis.net/doc/dp/GeoDCAT-AP))

This document conforms to the specifications in Section 6 of [DCAT-AP v2.1.0](https://joinup.ec.europa.eu/sites/default/files/distribution/access_url/2021-12/5bf41792-1a2f-4851-aee2-6ecf43815bc1/dcat-ap_2.1.0.pdf) on how to extend the DCAT *application profile*, and follows in broad terms the structure of the [DCAT-AP v2.1.0](https://joinup.ec.europa.eu/sites/default/files/distribution/access_url/2021-12/5bf41792-1a2f-4851-aee2-6ecf43815bc1/dcat-ap_2.1.0.pdf) document.

Additional classes and properties from other *vocabularies* are re-used or created (domain specific vocabulary) where necessary. There are no requirements for communication systems except for being able to export/import data in RDF in compliance with this DCAT-AP extension.

The scope of this *application profile* (here indicated as GNSS-DCAT-AP) is to facilitate GNSS RINEX observation data exchange and therefore the classes and properties relevant for the data to be exchanged are defined in this document.

The GNSS-DCAT-AP schema describes in a standardized and structured way the daily RINEX files, the GNSS stations' datasets and the GNSS data repositories. Each of these digital objects corresponds to a DCAT-AP class (see Figure 3):

|  |  |
| --- | --- |
| **GNSS-DCAT-AP hierarchical levels** | |
| **DCAT-AP class** | **Corresponding digital object** |
| [Catalog](#_Catalogue) | GNSS data repository |
| [Dataset](#_Dataset) | GNSS station dataset |
| [Distribution](#_Distribution) | Daily RINEX file |

As illustrated in Section [1.4](#_1.4_Class_Diagram), together with DCAT-AP classes such as the [Dataset](#_Dataset) (to describe the GNSS station dataset), new recommended *metadata* classes are proposed to describe the specific characteristics of GNSS RINEX observation files (i.e. the [Distribution](#_Distribution)): the [type of RINEX file](#_GNSS_observation_data) (e.g., compression format, frequency, etc.); the [RINEX file header](#_GNSS_observation_data_1) and the information regarding the [GNSS station](#_GNSS_station), the [GNSS antenna](#_GNSS_station_antenna) and [receiver](#_GNSS_station_receiver) associated with the station; the [software](#_GNSS_observation_data_2) used to generate the RINEX observation file. Three additional optional classes allow the inclusion of information regarding the [GNSS antenna](#_GNSS_station_antenna_1), [receiver](#_GNSS_station_receiver_1) and [monument](#_GNSS_station_monument) associated with the GNSS station and extracted from the IGS site log or GeodesyML files.

## 1.2 Terminology

In the following sections, metadata classes and properties are grouped as “Mandatory”, “Recommended” and “Optional” (red indicates classes and/properties set to a higher priority with respect to [DCAT-AP v3.0](https://interoperable-europe.ec.europa.eu/collection/semic-support-centre/solution/dcat-application-profile-data-portals-europe/release/300) in order to be in line with FAIR principles and/or GNSS user needs e.g., DCAT-AP v3.0 recommended properties that we promoted to be mandatory).

“Mandatory”, “Recommended” and “Optional” are defined in Section 2 of [DCAT-AP v2.1.0](https://joinup.ec.europa.eu/sites/default/files/distribution/access_url/2021-12/5bf41792-1a2f-4851-aee2-6ecf43815bc1/dcat-ap_2.1.0.pdf).

The proposed application profile (GNSS-DCAT-AP) introduces new classes and properties and 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#](http://www.w3.org/ns/adms)
* dcat: [http://www.w3.org/ns/dcat#](http://www.w3.org/ns/dcat)
* dcatap: <http://data.europa.eu/r5r/>
* dct: <http://purl.org/dc/terms/>
* dctype: <http://purl.org/dc/dcmitype/>
* dqv: [http://www.w3.org/ns/dqv#](http://www.w3.org/ns/dqv)
* foaf: <http://xmlns.com/foaf/0.1/>
* geo: [https://www.fair-gnss.oma.be/gnss-dcat-ap/vocabulary/geo#](https://www.fair-gnss.oma.be/gnss-dcat-ap/vocabulary/geo)[[2]](#footnote-2) - to be defined
* gml: <http://www.opengis.net/gml/3.2>
* gnss: [https://w3id.org/gnss-dcat-ap/gnss#](https://w3id.org/gnss-dcat-ap/gnss)
* locn: [http://www.w3.org/ns/locn#](http://www.w3.org/ns/locn)
* odrl: <http://www.w3.org/ns/odrl/2/>
* owl: [http://www.w3.org/2002/07/owl#](http://www.w3.org/2002/07/owl)
* prov: <http://www.w3.org/ns/prov>
* rdf: [http://www.w3.org/1999/02/22-rdf-syntax-ns#](http://www.w3.org/1999/02/22-rdf-syntax-ns)
* rdfs: [http://www.w3.org/2000/01/rdf-schema#](http://www.w3.org/2000/01/rdf-schema)
* schema: <https://schema.org/>
* skos: [http://www.w3.org/2004/02/skos/core#](http://www.w3.org/2004/02/skos/core)
* spdx: [http://spdx.org/rdf/terms#](http://spdx.org/rdf/terms)
* time: [http://www.w3.org/2006/time#](http://www.w3.org/2006/time)
* vann: <http://purl.org/vocab/vann/>
* vcard: [http://www.w3.org/2006/vcard/ns#](http://www.w3.org/2006/vcard/ns)
* voaf: [http://purl.org/vocommons/voaf#](http://purl.org/vocommons/voaf)
* xsd: [http://www.w3.org/2001/XMLSchema#](http://www.w3.org/2001/XMLSchema)

## 1.3 Revision history

### 1.3.1 Alignment with DCAT-AP 3.0.0

GNSS-DCAT-AP is an extension of DCAT-AP and therefore inherits the changes introduced in [DCAT-AP Version 3.0](https://semiceu.github.io/DCAT-AP/releases/3.0.0/) (due to the aligment with [DCAT Version 3](https://www.w3.org/TR/vocab-dcat-3/)).

|  |  |  |  |
| --- | --- | --- | --- |
| **Class name** | **Property** | **DCAT-AP v3.0** | **GNSS-DCAT-AP v0.4** |
| Dataset | Deprecated properties:  dct:hasVersion,  dct:isVersionOf ,  owl:isVersionOf. | Replaced the URI with:  dcat:hasVersion,  dcat:isVersionOf,  dcat:version. | Aligned |
| Distribution | dcat:bytesize | The range is now fixed by xsd:nonNegativeInteger | Aligned |
| DataService | dct:publisher | Added | Aligned |
| Dataset | dct:accessRights | New definition, more generic | Aligned |
| DatasetSeries | dct:title  dct:description  dcat:contactPoint  dct:publisher dct:spatial  dct:temporal  dct:accrualPeriodicity  dct:issued  dct:modified | Added new class and its properties | Aligned |

### 1.3.2 Additional properties

The following new properties were added in this version of the schema:

* the [Distribution](#_Distribution) class has now the properties:
  + dct:temporal to account for the temporal period covered by the (daily RINEX) file,
  + dct:temporalResolution to represent its temporal resolution e.g. 30s
  + dcat:mediaType to describe the format, as defined by IANA
  + dqv:hasQualityMeasurement to represent a quality measurement such, for example, the ratio of the number of GPS observations, on at least two frequencies, in the daily RINEX file with respect to the number of expected observations
  + dcat:version to identify the version of both the metadata schema and the API used to output the Distribution metadata
* the [DataService](#_Data_service) class has now the properties:
  + dct:publisher to store information on the entity (organisation) responsible for making the Data Service available
  + dcat:version to identify the version of the API
* the [Catalogue](#_Catalogue) and the [Dataset](#_Dataset) have now the properties:
  + owl:versionIRI to inform on the metadata schema (latest version) used
  + dcat:version to identify the version of both the metadata schema and the API used to output the Catalogue and Dataset metadata

### 1.3.3 Additional changes

The property dqv:hasQualityMeasurement of class [Dataset](#_Dataset) now stores quality information regarding the GNSS station’s coordinates i.e. the repeatability of the estimated station coordinates (measure of how stable are the station coordinates in time).

The links to the GeodesyML files and site log of a given GNSS station (stored in the class [gnss:Station](#_GNSS_station)) are now expressed using as value schema:DataDownload instead of dcat:Distribution.

The [gnss namespace](https://w3id.org/gnss-dcat-ap/gnss), together with most of the internal identifiers (PIDs) used in the metadata are now registered Permanent Identifiers for the Web (w3id).

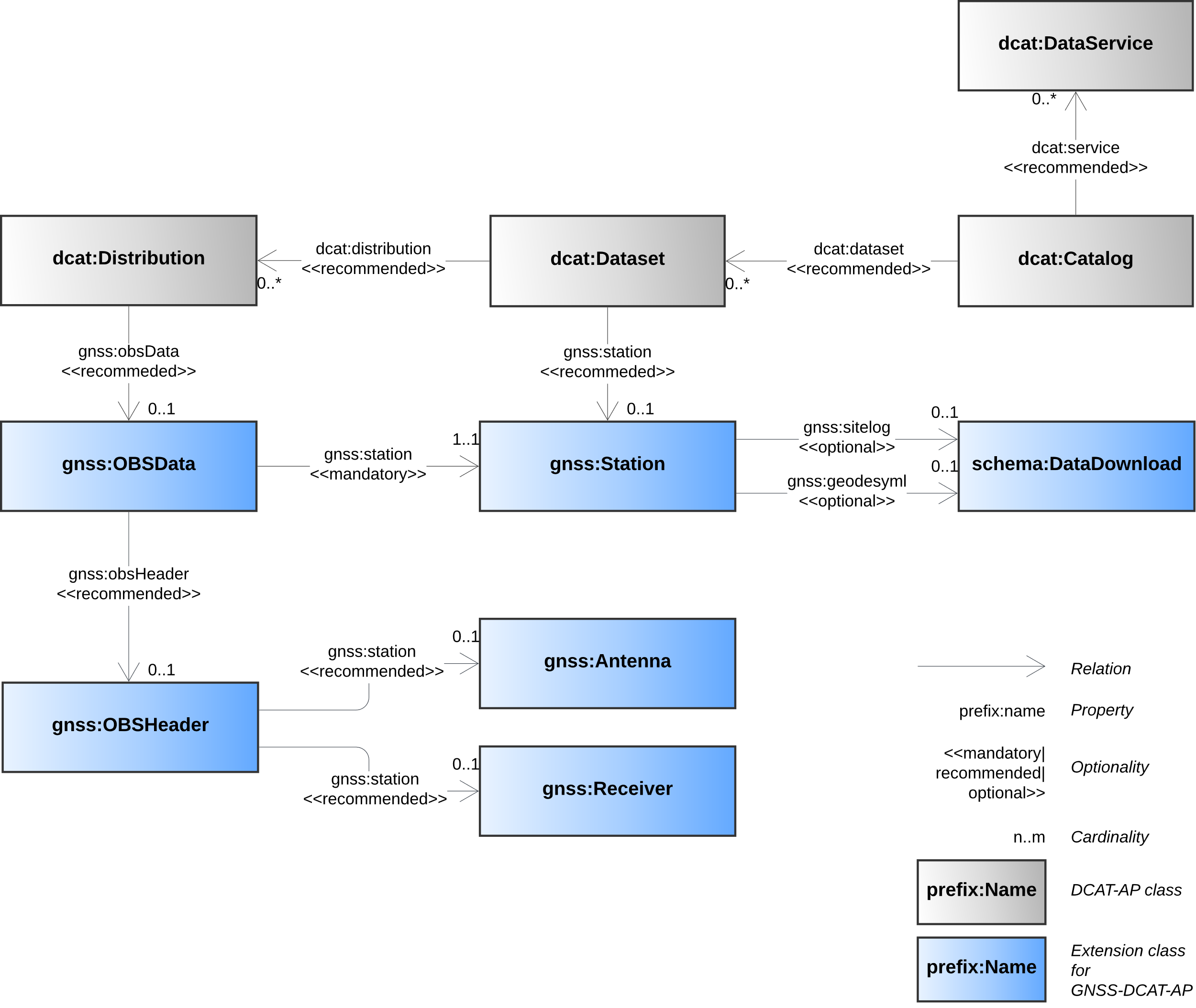
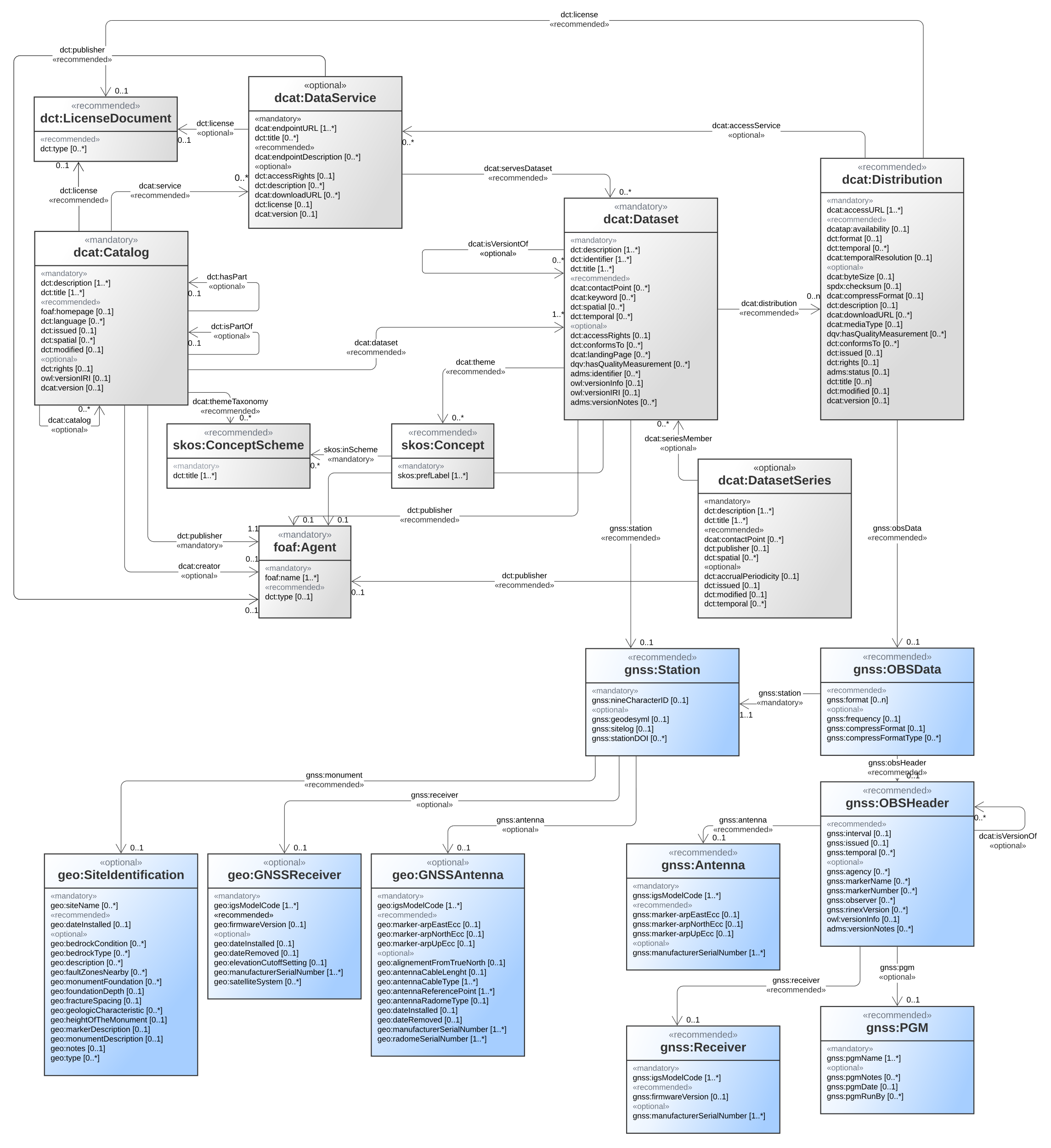


Figure 3: Simplified ULM class diagram providing a partial view of GNSS-DCAT-AP, which extends DCAT-AP 2.1.0 by adding new classes (in blue) and properties. For example, *dcat:Dataset* can be linked to one *gnss:Station* instance via the *gnss:station* property. Only the GNSS-DCAT-AP classes populated so far are shown**.**

## 1.4 Class Diagram

Below, a UML diagram of all relevant classes and properties for the proposed GNSS-DCAT application profile (additional classes in blue).



# 2 Classes

## 2.1 Mandatory classes

### 2.1.1 DCAT-AP mandatory classes

|  |  |  |  |
| --- | --- | --- | --- |
| **Class name** | **URI** | **Mandatory/**  **Recommended/Optional** | **Description** |
| Agent | [foaf:Agent](#_Agent) | Mandatory | An agent/organization/entity associated with [Catalogues](#_Catalogue) and or with [Datasets.](#_Dataset) |
| Catalogue | [dcat](#_rdc3hblnry5w)[:Catalog](#_Catalogue) | Mandatory | Repository that hosts the [Datasets.](#_Dataset) |
| Dataset | [dcat:Dataset](#_Dataset) | Mandatory | A conceptual entity that represents the data itself. |
| Literal | [rdfs:Literal](#_Literal) | Mandatory | A literal value such as a string or integer; literals may be typed, e.g. as a date according to xsd:date. |

## 2.2 Recommended classes

### 2.2.1 DCAT-AP recommended classes

|  |  |  |  |
| --- | --- | --- | --- |
| **Class name** | **URI** | **Mandatory/**  **Recommended/Optional** | **Description** |
| Category | [skos:Concept](#_Category) | Recommended | Internal subject/vocabulary |
| Category scheme | [skos:ConceptScheme](#_Category_scheme) | Recommended | A concept collection (e.g. controlled vocabulary) in which the [Categor](#_Category)y is defined. |
| Data service | [dcat:DataService](#_Data_service) | Recommended | A collection of operations that provides access to one or more datasets or data processing functions. |
| Distribution | [dcat:Distribution](#_Distribution) | Recommended | A physical embodiment of the [Dataset](#_Dataset) in a particular format. |
| License document | [dct:](#_tcev4o5vxfu5)[LicenseDocument](#_License_document) | Recommended | A legal document giving official permission to use the dataset. |

### 2.2.2 GNSS-DCAT-AP recommended classes

|  |  |  |  |
| --- | --- | --- | --- |
| **Class name** | **URI** | **Mandatory/**  **Recommended/Optional** | **Description** |
| GNSS station antenna | [gnss:Antenna](#_GNSS_station_antenna) | Recommended | Domain specific vocabulary for the antenna associated with [gnss:Station](#_GNSS_station) |
| GNSS observation data | [gnss:](#_ajqt5g8dqcot)[OBSData](#_GNSS_observation_data) | Recommended | Domain specific vocabulary for RINEX observation files |
| GNSS observation data header | [gnss:](#_6np5i7819c1a)[OBSHeader](#_GNSS_observation_data_1) | Recommended | Domain specific vocabulary for the information in the RINEX observation file header associated with [gnss:](#_ajqt5g8dqcot)[OBSData](#_GNSS_observation_data) |
| GNSS observation data generating software | [gnss:PGM](#_GNSS_observation_data_2) | Recommended | Domain specific vocabulary for software used to generate the RINEX file associated with [gnss:](#_ajqt5g8dqcot)[OBSData](#_GNSS_observation_data) |
| GNSS station receiver | [gnss:Receiver](#_GNSS_station_receiver) | Recommended | Domain specific vocabulary for the receiver associated with [gnss:Station](#_GNSS_station) |
| GNSS station | [gnss:Station](#_GNSS_station) | Recommended | Domain specific vocabulary for station information |

## 2.3 Optional classes

### 2.3.1 GNSS-DCAT-AP optional classes

|  |  |  |  |
| --- | --- | --- | --- |
| **Class name** | **URI** | **Mandatory/**  **Recommended/Optional** | **Description** |
| GNSS station antenna from GeodesyML | [geo:](#_3t66ny5mc5kz)[GNSSAntenna](#_GNSS_station_antenna_1) | Optional | Antenna info from GeodesyML installed on gnss:temporal (associated with [gnss:Station](#_GNSS_station)) |
| GNSS station monument from GeodesyML | [geo:Monument](#_GNSS_station_monument) | Optional | Monument info from GeodesyML (associated with [gnss:Station](#_GNSS_station)) |
| GNSS station receiver from GeodesyML | [geo:](#_h2hi4hw94n1k)[GNSSReceiver](#_GNSS_station_receiver_1) | Optional | Receiver info from GeodesyML installed on gnss:temporal (associated with [gnss:Station](#_GNSS_station)) |
| Data series | [dcat:DataSeries](#_Data_series) | Optional | A collection of Datasets that are published separately, but share some characteristics. |

# 3 Properties per class

The following list of included properties contains a selection of the properties from DCAT-AP as well as new recommended or optional additional properties. DCAT-AP properties that are not mentioned are considered out of scope for GNSS-DCAT-AP. For a quick reference table of properties per class, see Section [4](#_4_Quick_reference).

## 3.1 Mandatory classes

### 3.1.1 DCAT-AP mandatory classes

##### Agent

**foaf:Agent**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Property** | **URI** | **Range & Cardinality** | **Mandatory/**  **Recommended/Optional** | **Description** |
| name | foaf:name | rdfs:Literal [1..n] | Mandatory | Name of the agent. It can be repeated for different versions of the name (e.g. in different languages) |
| type | dc:type | skos:Concept [0..1] | Recommended | Type of the agent that makes the [Catalogue](#_Catalogue) or [Dataset](#_Dataset) available |

##### Catalogue

**dcat:Catalog**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Property** | **URI** | **Range & Cardinality** | **Mandatory/**  **Recommended/Optional** | **Description** |
| description | dct:description | rdfs:Literal [1..n] | Mandatory | Free-text account of the Catalogue. |
| publisher | dct:publisher | foaf:Agent [1..1] | Mandatory | Entity (organisation) responsible for making the Catalogue available. |
| title | dct:title | rdfs:Literal [1..n] | Mandatory | Name given to the Catalogue. |
| dataset | dcat:dataset | dcat:Dataset [1..n] | Recommended | Link to the [Dataset](#_Dataset) that is part of the Catalogue. |
| homepage | foaf:homepage | foaf:Document [0..1] | Recommended | Web page that acts as the main page for the Catalogue. |
| language | dct:language | dct:LinguisticSystem [0..n] | Recommended | Language used in the textual metadata describing titles |
| licence | dct:license | dct:LicenseDocument[0..1] | Recommended | Licence under which the Catalogue can be used or reused |
| release date | dct:issued | xsd:date or xsd:dateTime [0..1] | Recommended | Publication date of the Catalogue |
| service | dcat:service | dcat:DataService [0..n] | Recommended | A site or end-point that is listed in the catalog. |
| spatial/geographic | dct:spatial | dct:Location [0..n] | Recommended | Geographical area covered by the Catalogue |
| themes | dcat:themeTaxonomy | skos:ConceptScheme [0..n] | Recommended | Knowledge organization system used to classify the Catalogue's [Datasets](#_Dataset) |
| update/modification date | dct:modified | xsd:date or xsd:dateTime [0..1] | Recommended | Most recent date on which the Catalogue was modified. |
| catalogue | dcat:catalog | dcat:catalog [0..n] | Optional | Catalog whose contents are of interest in the context of this catalog (e.g. GNSS metadata catalogue) |
| creator | dct:creator | foaf:Agent [0..1] | Optional | Entity primarily responsible for producing the Catalogue |
| has part | dct:hasPart | dcat:Catalog [0..1] | Optional | Related Catalogue  that is part of the described Catalogue |
| is part of | dct:isPartOf | dcat:Catalog [0..1] | Optional | Related Catalogue in  which the described Catalogue is physically or  logically included |
| ontology version | owl:versionIRI | xsd:anyURI [0..1] | Optional | IRI which resolves to a source file corresponding to the ontology version |
| rights | dct:rights | dct:RightsStatement [0..1] | Optional | Statement that specifies rights associated with the Catalogue. |
| version | dcat:version | rdfs:Literal [0..1] | Optional | Version number or other version designation of the Catalogue e.g. information on the version of the metadata schema and the API used to output the Catalogue metadata |

##### Dataset

**dcat:Dataset**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Property** | **URI** | **Range & Cardinality** | **Mandatory/**  **Recommended/**  **Optional** | **Description** |
| creator | dct:creator | foaf:Agent [0..1] | Mandatory | Entity primarily responsible for producing the Dataset |
| description | dct:description | rdfs:Literal [1..n] | Mandatory | Free-text account of the Dataset. |
| title | dct:title | rdfs:Literal [1..n] | Mandatory | Name given to the Dataset. |
| contact point | dcat:contactPoint | vcard:Kind [0..n] | Recommended | Contact information that can be used for sending comments about the Dataset. |
| dataset distribution | dcat:distribution | dcat:Distribution [0..n] | Recommended | Link to an available Distribution. |
| identifier | dct:identifier | rdfs:Literal [0..n] | Recommended | Identifier for the Dataset, e.g. the URI or other unique identifier in the context of the [Catalogue](#_Catalogue). |
| keyword/ tag | dcat:keyword | rdfs:Literal [0..n] | Recommended | Keyword or tag describing the Dataset. |
| publisher | dct:publisher | foaf:Agent [0..1] | Recommended | Entity (organisation) responsible for making the Dataset available. |
| station description | gnss:station | gnss:Station | Recommended | Description of the station. |
| spatial/geographic | dct:spatial | dct:Location [0..n] | Recommended | Geographic region that is covered by the Dataset. |
| temporal coverage | dct:temporal | dct:PeriodOfTime [0..n] | Recommended | Temporal period that the Dataset covers. |
| theme/ category | dcat:theme, subproperty of dct:subject | skos:Concept[0..n] | Recommended | Category of the Dataset. A Dataset may be associated with multiple themes. |
| access rights | dct:accessRights | dct:RightsStatement[0..1] | Optional | Information that indicates whether the Dataset is publicly accessible, has access restrictions or is not public. |
| conforms to | dct:conformsTo | dct:Standard [0..n] | Optional | Implementation rule or other specification. (e.g. RINEX 2/ RINEX 3 standards) |
| has quality measurement | dqv:hasQualityMeasurement | dqv:QualityMeasurement [0..n] | Optional | Repeatability of the estimated station coordinates (measure of how stable are the station coordinates in time) |
| is version of | dcat:isVersionOf | dcat:Dataset [0..n] | Optional | Related Dataset of which the described Dataset is a version, edition, or adaptation. |
| landing page | dcat:landingPage | foaf:Document[0..n] | Optional | Web page that provides access to the Dataset |
| other identifier | adms:identifier | adms:Identifier [0..n] | Optional | Secondary identifier of the Dataset, such as MAST/ADS, DataCite, DOI, EZID or W3ID. |
| ontology version | owl:versionIRI | xsd:anyURI [0..1] | Optional | IRI which resolves to a source file corresponding to the ontology version |
| version | dcat:version | rdfs:Literal [0..1] | Optional | Version number or other version designation of the Dataset e.g. information on the version of the metadata schema and the API used to output the Dataset metadata |
| version note | adms:versionNotes | rdfs:Literal [0..n] | Optional | Description of the differences between this version and a previous version of the Dataset. |

##### Literal

**rdfs:Literal**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Property** | **URI** | **Range & Cardinality** | **Mandatory/**  **Recommended/Optional** | **Description** |
| dataset | dcat:dataset | dcat:Dataset [1..n] | Mandatory | Link to the [Dataset](#_Dataset) that is part of the [Catalogue](#_Catalogue). |
| description | dct:description | rdfs:Literal [1..n] | Recommended | Free-text account of the [Catalogue.](#_rdc3hblnry5w) |

## 3.2 Recommended classes

### 3.2.1 DCAT-AP recommended classes

##### Category

**skos:Concept**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Property** | **URI** | **Range & Cardinality** | **Mandatory/**  **Recommended/Optional** | **Description** |
| Preferred label | skos:prefLabel | rdfs:Literal [1..n] | Mandatory | Preferred label of the Category. It can be repeated for parallel language versions of the label. |

##### Category scheme

**skos:ConceptScheme**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Property** | **URI** | **Range & Cardinality** | **Mandatory/**  **Recommended/Optional** | **Description** |
| Title | dc:title | rdfs:Literal [1..n] | Mandatory | Name of the Category scheme. May be repeated for different versions of the name |

##### Data service

**dcat:DataService**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Property** | **URI** | **Range & Cardinality** | **Mandatory/**  **Recommended/**  **Optional** | **Description** |
| endpoint URL | dcat:endpointURL | rdfs:Resource [1..n] | Mandatory | The root location or primary endpoint of the service (an IRI). |
| title | dct:title | rdfs:Literal [0..n] | Mandatory | Name of the Data Service. |
| endpoint description | dcat:endpointDescription | rdfs:Resource [0..n] | Recommended | 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 dct:conformsTo is used to indicate the general standard or specification that the endpoints implement. |
| serves dataset | dcat:servesDataset | dcat:Dataset [0..n] | Recommended | Collection of data that this data service can distribute |
| publisher | dct:publisher | foaf:Agent [0..1] | Recommended | An entity (organisation) responsible for making the Data Service available. |
| access rights | dct:accessRights | dct:RightsStatement[0..1] | Optional | Information regarding access or restrictions based on privacy, security, or other policies.. |
| description | dct:description | dfs:Literal [0..n] | Optional | Free-text account of the Data Service |
| download URL | dcat:downloadURL | rdfs:Resource [0..n] | Optional | URL that is a direct link to a downloadable file in a given format. |
| licence | dct:license | dct:LicenseDocument [0..1] | Optional | Licence under which the Data service is made available. |
| version | dcat:version | rdfs:Literal [0..1] | Optional | Version number or other version designation of the Data service |

##### Distribution

**dcat:Distribution**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Property** | **URI** | **Range & Cardinality** | **Mandatory/**  **Recommended/**  **Optional** | **Description** |
| access URL | dcat:accessURL | rdfs:Resource [1..n] | Mandatory | URL that gives access to a Distribution of the [Dataset.](#_qtas4db8qre) |
| availability | dcatap:availability | skos:Concept [0..1] | Recommended | Planned availability of the Distribution of the [Dataset](#_qtas4db8qre) |
| description | dct:description | rdfs:Literal [1..n] | Recommended | Free-text account of the Distribution |
| format | dct:format | dct:MediaTypeOrExtent [0..1] | Recommended | File format of the Distribution. |
| licence | dct:license | dct:LicenseDocument [0..1] | Recommended | Licence under which the Distribution is made available. |
| GNSS observation data | gnss:obsData | gnss:OBSData [0..1] | Recommended | [GNSS observation data](#_GNSS_observation_data) |
| temporal coverage | dct:temporal | dct:PeriodOfTime [0..n] | Recommended | Temporal period covered by the Distribution. |
| temporal resolution | dcat:temporalResolution | xsd:duration [0.1] | Recommended | Temporal resolution of the Distribution e.g. 30 sec |
| access service | dcat:accessService | dcat:DataService [0..n] | Optional | A data service that gives access to the distribution of the dataset |
| byte size | dcat:byteSize | xsd:nonNegativeInteger [0..1] | Optional | Size of a Distribution in bytes. |
| checksum | spdx:checksum | spdx:Checksum [0..1] | Optional | Mechanism that can be used to verify that the contents of a Distribution have not changed. |
| compression format | dcat:compressFormat | dct:MediaType[0..1] | Optional | Format of the file in which the data is contained in a compressed form. |
| download URL | dcat:downloadURL | rdfs:Resource [0..n] | Optional | URL that is a direct link to a downloadable file in a given format. |
| format | dcat:mediaType | dct:MediaType[0..1] | Optional | Media type of the Distribution as defined by [IANA](https://www.iana.org/assignments/media-types/media-types.xhtml) |
| has quality measurement | dqv:hasQualityMeasurement | dqv:QualityMeasurement [0..n] | Optional | A quality measurement performed on the Distribution (e.g. ratio of the number of GPS observations, on at least two frequencies, in the daily RINEX file with respect to the number of expected observations)” |
| linked schemas | dct:conformsTo | dct:Standard [0..n] | Optional | Established schema to which the described Distribution conforms. (RNX2/RNX3 documentation) |
| release date | dct:issued | rdfs:Literal typed as xsd:date or xsd:dateTime[0..1] | Optional | Date of formal issuance (e.g., publication) of the Distribution. |
| rights | dct:rights | dct:RightsStatement[0..1] | Optional | Statement that specifies rights associated with the Distribution. |
| status | adms:status | skos:Concept [0..1] | Optional | Status of the Distribution in the context of the publication process e.g. RINEX file no longer meant to be published |
| title | dct:title | rdfs:Literal [0..n] | Optional | Name given to the Distribution. |
| update/modification date | dct:modified | rdfs:Literal typed as xsd:date or xsd:dateTime [0..1] | Optional | Most recent date on which the Distribution was changed or modified. |
| version | dcat:version | rdfs:Literal [0..1] | Optional | Version number or other version designation of the Distribution e.g. information on the version of the metadata schema and the API used to output the Distribution metadata |

##### License document

**dct:LicenseDocument**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Property** | **URI** | **Range & Cardinality** | **Mandatory/**  **Recommended/Optional** | **Description** |
| License type | dct:type | skos:Concept [0..n] | Recommended | Type of licence, e.g. indicating ‘public domain’ or ‘royalties required’. |

### 3.2.2 GNSS-DCAT-AP recommended classes

##### GNSS station antenna

**gnss:Antenna**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Property** | **URI** | **Range & Cardinality** | **Mandatory/**  **Recommended/Optional** | **Description** |
| IGS model code | gnss:igsModelCode | rdfs:Literal[1..n] | Mandatory | Antenna and radome name (e.g. TRM57971.00 NONE) |
| distance ARP-marker (east) | gnss:marker-arpEast  Ecc | xsd:float[0..1] | Recommended | Distance from the ARP[[3]](#footnote-3) to the marker - East component |
| distance ARP-marker (north) | gnss:marker-arpNorthEcc | xsd:float[0..1] | Recommended | Distance from the ARP to the marker - North component |
| distance ARP-marker (up) | gnss:marker-arpUpEcc | xsd:float [0..1] | Recommended | Distance from the ARP to the marker - Up component |
| manufacturer serial number | gnss:manufacturerSerialNumber | rdfs:Literal[1..n] | Optional | Serial number of the antenna |

##### GNSS observation data

**gnss:OBSData**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Property** | **URI** | **Range & Cardinality** | **Mandatory/**  **Recommended/**  **Optional** | **Description** |
| station | gnss:station | gnss:Station[1..1] | Mandatory | [Station description](#_GNSS_station) |
| file format | gnss:format | rdfs:Literal [0..n] | Recommended | RINEX 2 / RINEX 3/ RINEX 4 |
| header | gnss:obsHeader | gnss:OBSHeader[0..1] | Recommended | Metadata for the RINEX header |
| frequency | gnss:frequency | dct:Frequency[0..1] | Optional | Daily/hourly RINEX files |
| CRX compression | gnss:compressFormat | dct:Standard[0..1] | Optional | Compression Format (e.g. Hatanaka) |
| CRX version | gnss:compressFormatType | rdfs:Literal [0..n] | Optional | Crinex Version (e.g. 3.0) |

##### GNSS observation data header

**gnss:OBSHeader**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Property** | **URI** | **Range & Cardinality** | **Mandatory/**  **Recommended/**  **Optional** | **Description** |
| antenna | gnss:antenna | gnss:Antenna [0..1] | Recommended | Antenna information from the RINEX header |
| interval | gnss:interval | xsd:nonNegativeInteger [0..1] | Recommended | 30 sec / 15 sec/1 sec |
| receiver | gnss:receiver | gnss:Receiver [0..1] | Recommended | Receiver information from RINEX header |
| release date | gnss:issued | xsd:date or xsd:dateTime [0..1] | Recommended | Publication date of the header |
| temporal coverage | gnss:temporal | dct:PeriodOfTime [0..n] | Recommended | Temporal coverage from the RINEX header (start time/date-end time/date). |
| agency | gnss:agency | rdfs:Literal[0..n] | Optional | Agency as in the RINEX header (e.g., ROB) |
| is version of | gnss:isVersionOf | gnss:OBSHeader [0..n] | Optional | Related gnss:OBSHeader of which the described header is a version, edition or adaptation. |
| marker name | gnss:markerName | rdfs:Literal [0..n] | Optional | Marker name in the RINEX header (4-char/9-char id) |
| marker number | gnss:markerNumber | rdfs:Literal[0..n] | Optional | DOMES number |
| observer | gnss:observer | rdfs:Literal[0..n] | Optional | Observer as in the RINEX header (e.g., John Smith) |
| pgm | gnss:pgm | gnss:PGM [0..1] | Optional | Info regarding the software used to generate the file as from the RINEX header |
| rinex version | gnss:rinexVersion | rdfs:Literal[0..n] | Optional | RINEX sub-version (text e.g 3.04) |
| version | owl:versionInfo | rdfs:Literal [0..1] | Optional | Version number or other version designation of the RINEX Header. |
| version note | adms:versionNotes | rdfs:Literal [0..n] | Optional | Description of the differences between current and a previous version of the RINEX header. |

##### GNSS observation data generating software

**gnss:PGM**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Property** | **URI** | **Range & Cardinality** | **Mandatory/**  **Recommended/**  **Optional** | **Description** |
| name | gnss:pgmName | rdfs:Literal[1..n] | Mandatory | Name of the software used to generate the RINEX file (e.g. Spider V7.1.1.7438 ) |
| comment | gnss:pgmNotes | rdfs:Literal[0..n] | Optional | Comment (e.g. THIS RINEX FILE IS CREATED FROM LB2 DATA) |
| date | gnss:pgmDate | as xsd:date or xsd:dateTime[0..1] | Optional | PGM generation date as from the RINEX header |
| run by | gnss:pgmRunBy | rdfs:Literal[0..n] | Optional | Name of the agency operating the software generating the RINEX file |

##### GNSS station receiver

**gnss:Receiver**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Property** | **URI** | **Range & Cardinality** | **Mandatory/**  **Recommended/**  **Optional** | **Description** |
| IGS model code | gnss:igsModelCode | rdfs:Literal[1..n] | Mandatory | Receiver name (e.g. TRIMBLE NETR9) |
| firmware version | gnss:firmwareVersion | rdfs:Literal[0..1] | Recommended | Firmware version (e.g. 5.37) |
| manufacturer serial number | gnss:manufacturerSerialNumber | rdfs:Literal[1..n] | Optional | Serial number for the receiver (e.g. 5608R50231) |

##### GNSS station

**gnss:Station**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Property** | **URI** | **Range & Cardinality** | **Mandatory/**  **Recommended/**  **Optional** | **Description** |
| station long marker name | gnss:nineCharacterID | rdfs:Literal[0..1] | Mandatory | 9-char id of the station |
| Station monument | gnss:monument | geo:Monument[0..1] | Recommended | Station monument |
| antenna | gnss:antenna | geo:GNSSAntenna[0..1] | Optional | Station antenna from GeodesyML |
| GeodesyML link | gnss:geodesyml | schema:DataDownload[0..1] | Optional | URL Resource for the GeodesyML file |
| receiver | gnss:receiver | geo:GNSSReceiver[0..1] | Optional | Station receiver from GeodesyML |
| station identifier | gnss:stationDOI | adms:Identifier [0..n] | Optional | Identifier of the station (e.g. MAST/ADS, DataCite, DOI, EZID or W3ID. |
| site log | gnss:sitelog | schema:DataDownload[0..1] | Optional | URL resource for the sitelog file |

## 3.3 Optional classes

### 3.3.1 GNSS-DCAT-AP optional classes

##### GNSS station antenna from GeodesyML

**geo:GNSSAntenna**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Property** | **URI** | **Range & Cardinality** | **Mandatory/**  **Recommended/**  **Optional** | **Description** |
| IGS model code | geo:igsModelCode | rdfs:Literal[1..n] | Mandatory | Antenna name (e.g. TRM57971.00 NONE) |
| distance ARP-marker (east) | geo:marker-arpEastEcc | xsd:float[0..1] | Recommended | Distance from the ARP to the marker - East component |
| distance ARP-marker (north) | geo:marker-arpNorthEcc | xsd:float[0..1] | Recommended | Distance from the ARP to the marker - North component |
| distance ARP-marker (up) | geo:marker-arpUpEcc | xsd:float[1] | Recommended | Distance from the ARP to the marker - Up component |
| alignment from true north | geo:alignmentFromTrueNorth | xsd:double[0..1] | Optional | Alignment from true north |
| antenna cable length | geo:antennaCableLength | xsd:double[0..1] | Optional | Length of the antenna cable (e.g. 70.0) |
| antenna cable type | geo:antennaCableType | rdfs:Literal[1..n] | Optional | Type of cable of the antenna (e.g. CNT-400 50 Ohm) |
| antenna reference point | geo:antennaReferencePoint | gml:CodeType[1..n] | Optional | ARP type (e.g. BPA) |
| antenna radome type | geo:antennaRadomeType | geo:igsRadomeModelCodeType[0..1] | Optional | Radome Type (e.g. : NONE) |
| date installed | geo:dateInstalled | gml:TimePositionType[0..1] | Optional | Installation date (e.g. 2009-08-05T02:00:00Z) |
| date removed | geo:dateRemoved | gml:TimePositionType[0..1] | Optional | Removal date (e.g. 2010-05-03T01:30:00Z) |
| manufacturer serial number | geo:manufacturerSerialNumber | rdfs:Literal[1..n] | Optional | Serial number for the antenna (e.g. 103320) |
| radome serial number | geo:radomeSerialNumber | rdfs:Literal[1..n] | Optional | Serial number of the radome (e.g. N/A) |

##### GNSS station monument from GeodesyML

**geo:Monument**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Property** | **URI** | **Range & Cardinality** | **Mandatory/**  **Recommended/**  **Optional** | **Description** |
| site names/identifiers | geo:name | gml:CodeType[0..n] | Mandatory | GNSS site names, (e.g. 4-char id, site-name, iers-DOMES, cdp-number) |
| installed Date | geo:installedDate | gml:TimePositionType[0..1] | Recommended | Station installation date (e.g. 2002-09-15Z) |
| bedrock condition | geo:bedrockCondition | rdfs:Literal[0..n] | Optional | Bedrock conditions (e.g., FRESH) |
| bedrock type | geo:bedrockType | rdfs:Literal[0..n] | Optional | Bedrock Type (e.g. SEDIMENTARY) |
| site description | geo:description | rdfs:Literal[0..n] | Optional | Site Description |
| fault zones nearby | geo:faultZonesNearby | rdfs:Literal[0..n] | Optional | Fault zones nearby (e.g. NO) |
| monument foundation | geo:foundation | gml:CodeType[0..n] | Optional | Monument foundation (e.g. CONCRETE BLOCK) |
| foundation depth | geo:foundationDepth | xsd:double[0..1] | Optional | Depth of monument foundation (e.g. : 3 m) |
| fracture spacing | geo:fractureSpacing | xsd:double[0..1] | Optional | Fracture spacing (e.g. 0 cm) |
| geologic characteristic | geo:geologicCharacteristic | rdfs:Literal[0..n] | Optional | Geologic characteristic (e.g. SAND) |
| height of the Monument | geo:height | xsd:double[0..1] | Optional | Height of the monument (e.g. 8 m) |
| marker description | geo:markerDescription | gml:TimePositionType[0..1] | Optional | Marker description  (e.g. CENTER OF HOLE IN STEEL PLATE) |
| monument Description | geo:monumentDescription | rdfs:Literal[0..1] | Optional | Monument description (e.g. STEEL MAST) |
| notes | geo:notes | rdfs:Literal[0..1] | Optional | Additional information |
| type | geo:type | rdfs:Literal[0..n] | Optional | Monument-type (e.g. CORS) |

##### GNSS station receiver from GeodesyML

**geo:GNSSReceiver**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Property** | **URI** | **Range & Cardinality** | **Mandatory/**  **Recommended/Optional** | **Description** |
| igs Model Code | geo:igsModelCode | rdfs:Literal[1..n] | Mandatory | Receiver name (e.g.TRIMBLE NETR9) |
| firmware version | geo:firmwareVersion | rdfs:Literal[0..1] | Recommended | Firmware version (e.g. 5.37) |
| date installed | geo:dateInstalled | gml:TimePositionType[0..1] | Optional | Receiver installation date e.g. 2020-05-01T00:00Z |
| date removed | geo:dateRemoved | gml:TimePositionType[0..1] | Optional | Receiver removal date e.g.2021-04-11T12:00Z |
| elevation cutoff setting | geo:elevationCutoffSetting | xsd:double[0..1] | Optional | Elevation cut off settings (e.g. 0) |
| manufacturer serial number | geo:manufacturerSerialNumber | rdfs:Literal[1..n] | Optional | Serial number for the receiver (e.g. 5608R50231) |
| satellite system | geo:satelliteSystem | gml:CodeType[0..n] | Optional | Satellite system (e.g GPS+GLO+GAL) |

##### Data series

**dcat:DataSeries**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Property** | **URI** | **Range & Cardinality** | **Mandatory/**  **Recommended/**  **Optional** | **Description** |
| title | dct:title | rdfs:Literal [1..n] | Mandatory | Name of the Data Service. |
| description | dct:description | dfs:Literal [1..n] | Mandatory | Free-text account of the Data series |
| publisher | dct:publisher | foaf:Agent [0..1] | Recommended | An entity (organisation) responsible for making the Data Service available. |
| spatial/geographic | dct:spatial | dct:Location [0..n] | Recommended | Geographic region that is covered by the Data series |
| contact point | dcat:contactPoint | vcard:Kind [0..n] | Recommended | Contact information that can be used for sending comments about the Data series |
| update frequency | dct:accrualPeriodicity | dct:Frequency [0..1] | Optional | Frequency at which the Dataset series is updated. |
| release date | dct:issued | rdfs:Literal typed as xsd:date or xsd:dateTime[0..1] | Optional | Date of formal issuance (e.g., publication) of the Distribution. |
| update/modification date | dct:modified | rdfs:Literal typed as xsd:date or xsd:dateTime [0..1] | Optional | Most recent date on which the Distribution was changed or modified. |
| temporal coverage | dct:temporal | dct:PeriodOfTime [0..n] | Optional | Temporal period that the Data series covers. |
| member of the series | dcat:seriesMember | dcat:Dataset [0..n] | Optional | To indicate a Dataset which is a member of the Dataset Series. |

# 4 Quick reference of classes and properties

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Class** | **URI** | **Mandatory**  **properties** | **Recommended properties** | **Optional**  **properties** |
| **Mandatory classes** | | | | |
| Agent | foaf:Agent | foaf:name | dct:type |  |
| Catalogue | dcat:Catalog | dct:description  dct:publisher  dct:title | dcat:dataset  foaf:homepage  dct:language  dct:license  dct:issued  dcat:service  dct:spatial  dcat:themeTaxonomy  dct:modified | dcat:catalog  dct:creator  dct:rights  dcat:version  owl:versionIRI |
| Dataset | dcat:Dataset | dct:creator  dct:description  dct:title | gnss:Station  dcat:contactPoint  dcat:distribution  dct:identifier  dcat:keyword  dct:publisher  dct:spatial  dct:temporal  dcat:theme, subproperty of dct:subject | dct:accessRights  dct:conformsTo  dcat:isVersionOf  dcat:landingPage  dqv:hasQualityMeasurement  dcat:version  adms:identifier  owl:versionInfo  owl:versionIRI  adms:versionNotes |
| Literal | rdfs:Literal |  |  |  |
| **Recommended classes** | | | | |
| Category | skos:Concept | skos:prefLabel |  |  |
| Category scheme | skos:ConceptScheme | dct:title |  |  |
| Data service | dcat:DataService | dcat:endpointURL  dct:title  dct:publisher | dcat:endpointDescription  dcat:servesDataset | dct:accessRights  dct:description  dcat:downloadURL  dct:license  dcat:version |
| Distribution | dcat:Distribution | dcat:accessURL | gnss:obsData  dcatap:availability  dct:format  dct:license  dct:temporal  dcat:temporalResolution | dcat:accessService  dcat:byteSize  spdx:checksum  dcat:compressFormat  dcat:downloadURL  dcat:mediaType  dqv:hasQualityMeasurement  dct:conformsTo  dct:issued  dct:rights  adms:status  dct:title  dct:modified  dcat:version |
| GNSS station antenna | gnss:Antenna | gnss:igsModelCode | gnss:marker-arpEastEcc  gnss:marker-arpNorthEcc  gnss:marker-arpUpEcc | gnss:manufacturerSerialNumber |
| GNSS observation data | gnss:OBSData | gnss:station | gnss:format  gnss:obsHeader | gnss:frequency  gnss:compressFormat  gnss:compressFormatType |
| GNSS observation data header | gnss:OBSHeader |  | gnss:antenna  gnss:interval  gnss:issued  gnss:receiver  gnss:temporal | gnss:agency  gnss:isVersionOf  gnss:markerName  gnss:markerNumber  gnss:observer  gnss:pgm  gnss:rinexVersion  owl:versionInfo  adms:versionNotes |
| GNSS observation data processing | gnss:PGM | gnss:pgmName |  | gnss:pgmNotes  gnss:pgmDate  gnss:pgmRunBy |
| GNSS station receiver | gnss:Receiver | gnss:igsModelCode | gnss:firmwareVersion | gnss:manufacturerSerialNumber |
| License document | dct:LicenseDocument |  | dct:type |  |
| GNSS station | gnss:Station | gnss:nineCharacterID | gnss:monument | gnss:geodesyml  gnss:stationDOI  gnss:sitelog |
| **Optional classes** | | | | |
| GNSS station antenna from GeodesyML | geo:GNSSAntenna | geo:igsModelCode | geo:marker-arpEastEcc  geo:marker-arpNorthEcc  geo:marker-arpUpEcc | geo:alignmentFromTrueNorth  geo:antennaCableLength  geo:antennaCableType  geo:antennaReferencePoint  geo:antennaRadomeType  geo:dateInstalled  geo:dateRemoved  geo:manufacturerSerialNumber  geo:radomeSerialNumber |
| GNSS station monument from GeodesyML | geo:Monument | geo:name | geo:installedDate | geo:bedrockCondition  geo:bedrockType  geo:description  geo:faultZonesNearby  geo:foundation  geo:foundationDepth  geo:fractureSpacing  geo:geologicCharacteristic  geo:height  geo:markerDescription  geo:monumentDescription  geo:notes  geo:type |
| GNSS station receiver from GeodesyML | geo:GNSSReceiver | geo:igsModelCode | geo:firmwareVersion | geo:dateInstalled  geo:dateRemoved  geo:elevationCutoffSetting  geo:manufacturerSerialNumber  geo:satelliteSystem |
|  |  |  |  |  |

# 

1. Resource Description Framework (RDF) <http://www.w3.org/RDF/> [↑](#footnote-ref-1)
2. Use of the ”geo” prefix as in geo:urn:xml-gov-au:icsm:egeodesy:0.5, mainly to name the three optional classes (and their properties) related to station information encoded in GeodesyML i.e., geo:GNSSAntenna, geo:Monument, geo:GNSSReceiver (Section [3.3](#_3.3_Optional_classes)) [↑](#footnote-ref-2)
3. ARP: Antenna Reference Point [↑](#footnote-ref-3)