Horizon 2020 Grant Agreement No 809965
Contract start date: July 1st 2018, Duration: 36 months

LAMBDA Lecture
DCAT-AP for Serbia

Due date of deliverable: 30/06/2021
Actual submission date: 30/06/2021

Revision: Version 1.0

This project has received funding from the European Union's Horizon 2020 Research and Innovation programme, H2020-WIDESPREAD-2016-2017 Spreading Excellence and Widening Participation under grant agreement No 809965.

Workpackage	WP 3 Cooperation for Teacher and Student Training
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Executive Summary

The aim of this work is to present DCAT Application Profile (DCAT-AP) standard which in turn is derived from the W3C DCAT standard. DCAT is an RDF vocabulary designed to facilitate interoperability between data catalogs published on the Web and also represent a way to provide context or metadata for datasets. By using DCAT, everyone can easily find and search across all the datasets published in some country in a unified way which can be important on different levels: (i) it can be used by citizens or enterprises to facilitate the discovery of public services and information; (ii) it provides public administrations with a comprehensive platform through which sharing best practices on services, and building a community; and (iii) it can be used in order to follow the degree of standardization and digitalization of the services of the public sector. Based on specification and also recommendation from some countries which use DCAT-AP, DCAT-AP for Serbia (DCAT-AP-SRB) is proposed.

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1. Introduction

DCAT-AP is an Application Profile based on W3C recommendation of DCAT specification which aim to be used for the exchange of descriptions of datasets between data portals in Europe. DCAT specification is developed under the responsibility of the Government Linked Data Working Group at W3C 2012-2013 and was initiated at the Digital Enterprise Research Institute (DERI) and the Greek National Centre for Public Administration and Decentralization. [1][2] This specification can be defined as an RDF vocabulary designed to facilitate interoperability between data catalogues published on the Web. Its essential thought is to provide cross-data portal search for datasets by the exchange of descriptions of datasets (a collection of data, published by a unique source, and available for access or download in one or more formats) among data portals (web-based systems that contains a data catalogue with descriptions of datasets and provides services enabling discovery and re-use of the datasets). By using this kind of specification and standard can be achieved that public sector data are better searchable across borders and sectors. [3] By using DCAT to describe datasets in data catalogues, publishers increase discoverability and enable applications easily to consume metadata from multiple catalogues. It further enables decentralized publishing of catalogues and in that way DCAT is widely used as a metadata specification in Open Data portals.[4]
Based on objectives of DCAT, Application Profile is defined as a specification for describing public sector datasets in Europe which can be used for the exchange of descriptions of datasets among data portals. [5] Aim of this specification is to re-use 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. The Application Profile also is intended to facilitate data exchange and only requirement is that the systems can export and import data in RDF in conformance with Application Profile. Based on this particular aims, the charter of the Working Group that is developing this Application Profile is defined general objectives: (i) Identification of essential elements and attributes of DCAT in the European context, (ii) Identification of controlled vocabularies to be used in the European context and (iii) Identification of the strict minimum description metadata to be exchanged between data portals in Europe.

DCAT-AP was developed by the SEMIC activity under the interoperability solutions for European Public Administrations (ISA) programme in 2013 and revised in 2015 for specific use in Europe, among others to support the European Data Portal. In February 2015 ISA programme of the European Commission based on experience gained since its development in 2013 launched an activity to revise DCAT-AP aiming to release a new version in July 2015. ISA programme aims that all of administrative procedures with a reputation of being lengthy, time-consuming and costly, as electronic collaboration between Public administrations for example, makes quicker, simpler and cheaper for all parties concerned, in particular when transactions need to be done cross-border and/or cross-sector. ISA supports such electronic collaboration and through more than 40 actions it provides tools, services and frameworks for the modernization of public sector administrations in Europe, across e-borders and sectors. Revision of DCAT-AP is one of ISA initiative with main objectives: (i) improvement of the discovery of datasets, (ii) insurance of agreement with DCAT, (iii) insurance of simplicity and (iv) insurance of application domain neutrality. The application profile 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 (e.g. EuroVoc) and mappings to existing metadata vocabularies (e.g. Dublin Core, SDMX, INSPIRE metadata, etc.). The DCAT-AP is freely reusable under the ISA Open Metadata License v1.1.
The paper is organized as follows: Section 2 describes the background of DCAT-AP and provides use-cases and benefits of using application profile specification. Section 3 describes terminology used in the DCAT Application Profile for better understanding of specification. This section also provides description of classes and properties from which application profiles consists. Based on

implementations and modification in countries which uses DCAT-AP, section 4 proposes application profile for Serbia. Section 5 concludes the paper.

2. Background and use cases

Important part of every kind of specification which aims to be widely used is to provide some benefits compared to the existing solutions. In order to explain why DCAT-AP can be right choice, it is important to consider some of related facts: (i) data users can be very difficult to find which datasets exist and where they can be obtained, (ii) when datasets are based in another countries, language barriers can be insurmountable and also the structure of government can be unfamiliar, (iii) data publishers, on the other hand, often use ad-hoc descriptions for their datasets, which results in non-interoperable open data portals.

To avoid this situation, it is necessary to provide a common specification for describing public sector datasets in Europe to enable the exchange and reusability of datasets through data portals. The DCAT-AP makes the following possible: (i) data catalogues can describe their dataset collections using a standardized description, while keeping their own system for documenting and storing them, (ii) content aggregators, such as the pan-European data portal, can aggregate such descriptions into a single point of access, (iii) data consumers can more easily find datasets from a single point of access. The DCAT-AP is a joint initiative of two Directorates General of the European Commission, namely DG CONNECT and DG Informatics, and the EU Publications Office which led the development of the specification. Benefits which provide DCAT-AP are: (i) harmonized descriptions of data catalogues and datasets, (ii) exchange of high-value dataset collections through data catalogues, (iii) provision of cross-data catalogue and cross-lingual search for datasets and (iv) more searchable and more reused open public sector data.[4]

As mentioned, the basic use case that this specification aims to provide is a cross-data portal search for datasets which can be achieved by the exchange of descriptions of datasets among data portals by following actors and systems: (i) **data providers** which includes a description of their datasets on one or more data portals, so that the datasets can be more easily found, (ii) **data portals** maintain catalogue of data including a collection of datasets made available by data publishers. Also, data portals can make collections of relevant datasets of other data portals searchable via their user interface, (iii) **metadata brokers** facilitate the exchange of description metadata between data portals by ensuring conformance to the DCAT Application Profile by providing metadata harvesting, transformation, validation, harmonization, and publication services, (iv) **data consumers** use the data portal of their choice to search through various collections of datasets from a single point of access and can more easily find datasets from a single point of access. The data portal allows the user to explore, find, identify and select datasets coming from different EU Member States, different portals and different organizations. Data consumers could also be systems (machines). Figure 1 shown basic use case with appropriate actors and systems.

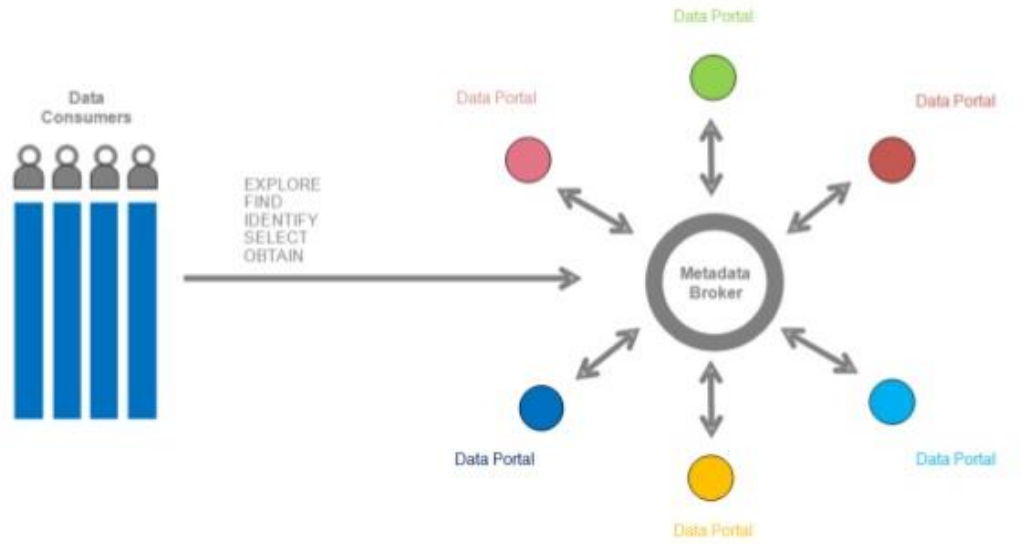


Figure 1 - Basic use case: enable a search for datasets across various data portals

User Scenario example

This example aims to show cross-data portal search for datasets on employment rates, immigration, and immigration control legislation. For example Julie works for a university and is looking for datasets on migration in the European Union and wants to carry out a study to analyze the evolution of migration flows from 1950 to 2013, as compared to the variation of employment rate in different Member States. Therefore, she will not only need to look for statistics at national and European level but also at legislation on immigration control. This process without a DCAT Application Profile Julie has to identify relevant legislative datasets reporting legislation on the specific matter of immigration control in the EU and in different Member States, as well as datasets on employment rates, distributed among several actors. Once Julie has identified such datasets, nevertheless the management of such data is difficult for the variety of user interfaces, metadata and languages. That is very difficult, but if Julie use DCAT Application Profile as a common metadata vocabulary describing datasets, and by the support of a Metadata Broker service, Julie is able to query such service as unique point of access to identify relevant datasets on immigration control legislation, as well as about statistics on migration and the variation of employment rates in the EU and different Member States in specific periods of time. Starting from such information Julie can easily access to the different datasets, select the information of interest, and collect such information. This can be the starting point to develop facilities for data transformation into a common language allowing Julie to mash data up and visualize the variations of employment rates in different geographical EU regions, as well as to compare such data with the legislation on immigration control in force in each specific country and at EU level.[3] This and a lot others user scenario is enabled by the DCAT Application Profile specification, which plays the role of the common metadata vocabulary.

3. Terminology used in the DCAT Application Profile and classes

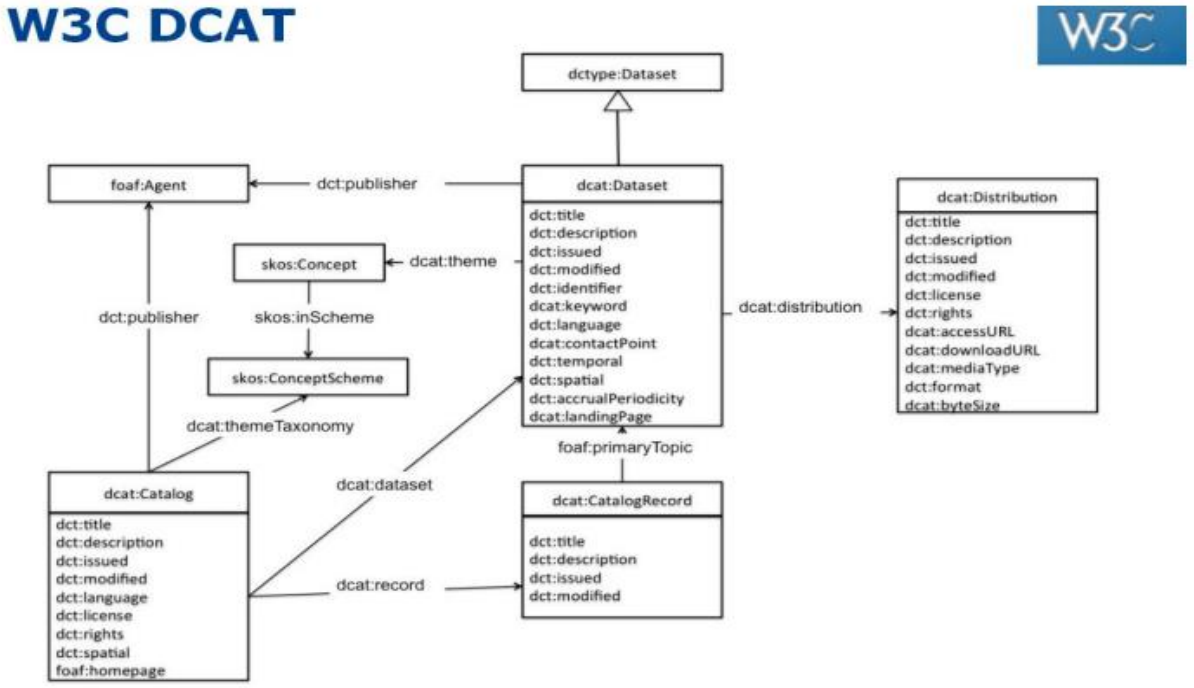
Common and shared classifications are key elements for enabling semantic interoperability and linking among different types of data. For better understanding of specification it is important to define some of terms which specification were used:

- Mandatory class which represents that a receiver of data MUST be able to process information about instances of the class and also a sender of data MUST provide information about instances of the class. Classes are classified as 'Mandatory' if they appear as the range of one of the mandatory properties.
- Recommended class which represents that a receiver of data MUST be able to process information about instances of the class and sender of data MUST provide information about instances of the class, if it is available
- Optional class defines that a receiver MUST be able to process information about instances of the class but also that a sender MAY provide the information but is not obliged to do so
- Mandatory property represents that a receiver MUST be able to process the information for that property and sender MUST provide the information for that property
- Recommended property defines that a receiver MUST be able to process the information for that property but also a sender SHOULD provide the information for that property if it is available
- Optional property represents that a receiver MUST be able to process the information for that property and sender MAY provide the information for that property but is not obliged to do so.

In many standards track documents several words are used to signify the requirements in the specification and these words are often capitalized. The meaning of the terms MUST, MUST NOT, SHOULD and MAY are as defined in RFC 211944. [6] Force of these words is modified by the requirement level of the document in which they are used: (i) MUST means that the definition is an absolute requirement of the specification, (ii) MUST NOT phrase, means that the definition is an absolute prohibition of the specification, (iii) SHOULD means that there may exist valid reasons in particular circumstances to ignore a particular item, but the full implications must be understood and carefully weighed before choosing a different course, (iv) MAY means that an item is truly optional. One vendor may choose to include the item because a particular marketplace requires it or because the vendor feels that it enhances the product while another vendor may omit the same item. An implementation which does not include a particular option MUST be prepared to interoperate with another implementation which does include the option, though perhaps with reduced functionality. In the same vein an implementation which does include a particular option MUST be prepared to interoperate with another implementation which does not include the option (except, of course, for the feature the option provides).
In the given context, the term "processing" means those receivers must accept incoming data and transparently provide these data 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#
• dct: http://purl.org/dc/terms/
• foaf: http://xmlns.com/foaf/0.1/
• owl: http://www.w3.org/2002/07/owl#
• 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#
• xsd: http://www.w3.org/2001/XMLSchema#
• vcard: http://www.w3.org/2006/vcard/ns#

Figure 2 shows a UML diagram of all classes and properties included in the DCAT Application Profile.



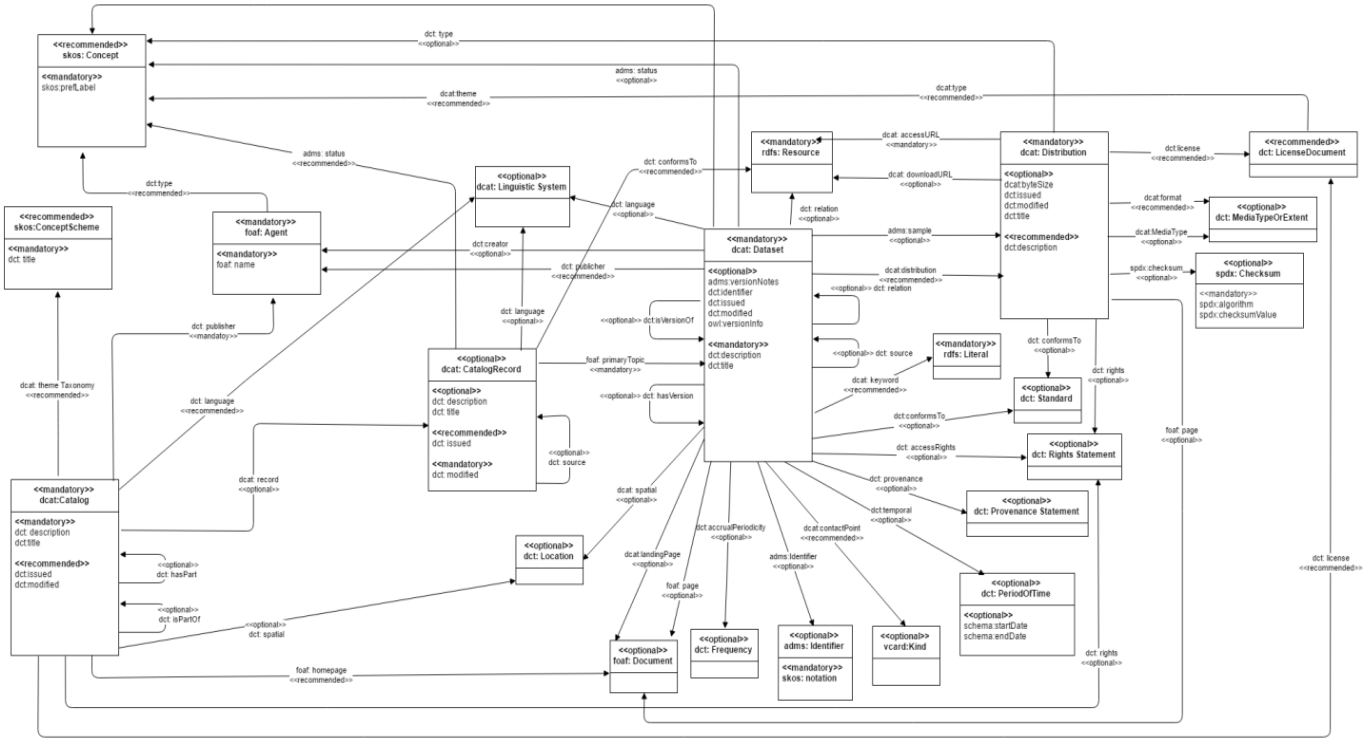


Figure 2 – DCAT and DCAT-AP UML

As we can see on figure 2, DCAT-AP makes some fields as mandatory, recommended and optional compared to DCAT which schema aims to standardize the description of catalogues and catalogue records for public sector information. The fields (mandatory, recommended and optional) have been defined by a working group coordinated by the European Commission in a way that standardizes the implementation of this metadata schema. This metadata schema can be used in different ways; it can describe a catalogue (dcat:catalogue) of datasets maintained and published by an organisation, but equally it can be used to describe in fine detail each of the component parts of that catalogue, namely the datasets (dcat:dataset), descriptions of the files (dcat:resource) which have been made accessible by different actors (foaf:agent) involved in the process of making them available. It is also recommended to use controlled vocabularies (skos:ConceptScheme), i.e. closed lists of terms that allow the categorization of the datasets, which are published on the internet in a way that allows the discovery and merging of datasets described in other catalogues. [3]

Mandatory classes and properties

- Agent (foaf:Agent) represent an entity that is associated with Catalogues and/or Datasets
    - Mandatory property *name* (foaf:name) in range rdfs:Literal and with cardinality 1..n represent property which contains a name of the agent. This property can be repeated for different versions of the name, for example name in different languages.
    - Recommended property *type(dct:type)* in range skos:Concept and with cardinality 0..1 refers to a type of the agent that makes the Catalogue or Dataset available.
- Catalogue (dcat:Catalog) or repository that hosts the Datasets being described.

- Mandatory property dataset (dcat:dataset) in range dcat:Dataset with cardinality 1..n links the Catalogue with a Dataset that is part of the Catalogue.
- Mandatory property description (dcat:description) in range rdfs:Literal with cardinality 1..n contains a free-text account of the Catalogue. This property can be repeated for parallel the description.
- Mandatory property publisher (dct:publisher) in range foaf:Agent with cardinality 1..1 refers to an entity (organisation) responsible for making the Catalogue available.
- Mandatory property title (dct:titleCatalogue) in range rdfs:Literal with cardinality 1..n contains a name given to the Catalogue. This property can be repeated for parallel language versions of the name.
- Recommended property homepage (foaf:homepage) in range foaf:Document with cardinality 0..1 refers to a web page that acts as the main page for the Catalogue.
- Recommended property language (dct:language) in range dct:LinguisticSystem with cardinality 0..n 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.
- Recommended property licence (dct:license) in range dct:LicenseDocument with cardinality 0..1 refers to the licence under which the Catalogue can be used or reused.
- Recommended property release date (dct:issued) in range rdfs:Literal typed as xsd:date or xsd:dateTime and cardinality 0..1 contains the date of formal issuance (e.g., publication) of the Catalogue.
- Recommended property themes (dcat:themeTaxonomy) in range skos:ConceptScheme with cardinality 0..n refers to a knowledge organization system used to classify the Catalogue's Datasets.
- Recommended property update/modification date (dct:modified) in range rdfs:Literal typed as xsd:date or xsd:dateTime with cardinality 0..1 contains the most recent date on which the Catalogue was modified.
- Optional property has part ()dct:hasPart) in range dcat:Catalog with cardinality 0..n refers to a related Catalogue that is part of the described Catalogue
- Optional property is part o (dct:hasPart) in range dcat:Catalog with cardinality 0..1 refers to a related Catalogue in which the described Catalogue is physically or logically included.
- Optional property record (dcat:record) in range dcat:CatalogRecod with cardinality 0..n refers to a Catalogue Record that is part of the Catalogue
- Optional property rights (dct:rights) in range dct:RightsStatement with cardinality 0..1 refers to a statement that specifies rights associated with the Catalogue.
- Optional property spatial / geographic (dct:spatial) in range dct:Location with cardinality 0..n refers to a geographical area covered by the Catalogue.

- Dataset (dcat:Dataset) represent a conceptual entity that represents the information published.
    - Mandatory property description (dct:description) in range rdfs:Literal with cardinality 1..n contains a free-text account of the Dataset. This property can be repeated for parallel language versions of the description.
    - Mandatory property title (dct:title) in range rdfs:Literal with cardinality 1..n contains a name given to the Dataset. This property can be repeated for parallel language versions of the name.
    - Recommended property contact point (dcat:contactPoint) in range vcard:Kind and cardinality 0..n contains contact information that can be used for sending comments about the Dataset.
    - Recommended property dataset distribution (dcat:distribution) in range dcat:Distribution and cardinality 0..n links the Dataset to an available Distribution.
    - Recommended property keyword/tag (dcat:keyword) in range rdfs:Literal with cardinality 0..n contains a keyword or tag describing the Dataset.
    - Recommended property publisher (dct:publisher) in range foaf:Agent with cardinality 0..1 refers to an entity (organisation) responsible for making the Dataset available.
    - Recommended property theme/category (dcat:theme, subproperty of dct:subject) in range skos:Concept refers to a category of the Dataset. A Dataset may be associated with multiple themes.
    - Optional property access rights (dct:accessRights) in range dct:RightsStatement with cardinality 0..1 refers to information that indicates whether the Dataset is open data, has access restrictions or is not public. A controlled vocabulary with three members (:public, :restricted, :non-public) will be created and maintained by the Publications Office of the EU.
    - Optional property conforms to (dct:conformsTo) in range dct:Standard with cardinality 0..n refers to an implementing rule or other specification.
    - Optional property documentation (foaf:page) in range foaf:Document with cardinality 0..n refers to a page or document about this Dataset.
    - Optional property frequency (dct:accrualPeriodicity) in range dct:Frequency with cardinality 0..1 refers to the frequency at which the Dataset is updated.
    - Optional property has version (dct:hasVersion) in range dcat:Dataset with cardinality 0..n refers to a related Dataset that is a version, edition, or adaptation of the described Dataset.
    - Optional property identifier (dct:identifier) in range rdfs:Literal with cardinality 0..n contains the main identifier for the Dataset, e.g. the URI or other unique identifier in the context of the Catalogue.
    - Optional property is version of (dct:isVersionOf) in range dcat:Dataset with cardinality 0..n refers to a related Dataset of which the described Dataset is a version, edition, or adaptation.

- Optional property landing page (dcat:landingPage) in range foaf:Document with cardinality 0..n 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.
- Optional property language (dct:language) in range dct:LinguisticSystem with cardinality 0..n refers to a language of the Dataset. This property can be repeated if there are multiple languages in the Dataset.
- Optional property other identifier (adms:identifier) in range adms:Identifier with cardinality 0..n refers to a secondary identifier of the Dataset, such as MAST/ADS18, DataCite19, DOI20, EZID21 or W3ID22.
- Optional property provenance (dct:provenance) in range dct:ProvenanceStatement with cardinality 0..n contains a statement about the lineage of a Dataset..
- Optional property related resource (dct:relation) in range rdfs:Resource with cardinality 0..n refers to a related resource.
- Optional property release date (dct:issued) in range rdfs:Literal typed as xsd:date or xsd:dateTime with cardinality 0..1 contains the date of formal issuance (e.g., publication) of the Dataset.
- Optional property sample (adms:sample) in range dcat:Distribution with cardinality 0..n refers to a sample distribution of the dataset
- Optional property source (dct:source) in range dcat:Dataset with cardinality 0..n refers to a related Dataset from which the described Dataset is derived.
- Optional property spatial/ geographical coverage (dct:spatial) in range dct:Location with cardinality 0..n refers to a geographic region that is covered by the Dataset.
- Optional property temporal coverage (dct:temporal) in range dct:PeriodOfTime with cardinality 0..n refers to a temporal period that the Dataset covers.
- Optional property type (dct:type) in range skos:Concept with cardinality 0..1 refers to the type of the Dataset. A controlled vocabulary for the values has not been established.
- Optional property update/ modification date (dct:modified) in range rdfs:Literal typed as xsd:date or xsd:dateTime with cardinality 0..1 contains the most recent date on which the Dataset was changed or modified.
- Optional property version (owl:versionInfo) in range rdfs:Literal with cardinality 0..1 contains a version number or other version designation of the Dataset.
- Optional property version notes (adms:versionNotes) in range rdfs:Literal with cardinality 0..n 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.

- Literal (rdfs:Literal) represent value such as a string or integer; Literals may be typed, e.g. as a date according to xsd:date.

- Resource (rdfs:Resource) is anything described by RDF.

Recommended classes and properties

- Category (skos:Concept) defines a subject of a Dataset.
  - *Mandatory property preferred label (skos:prefLabel) with cardinality 1..n which* contains a preferred label of the category. This property can be repeated for parallel language versions of the label.
- Category scheme (skos:ConceptScheme) provide concept collection (e.g. controlled vocabulary) in which the Category is defined.
  - Mandatory property title (dct:title) in range rdfs:Literal with cardinality 1..n represent a property which contains a name of the category scheme. May be repeated for different versions of the name
- Distribution (dcat:Distribution) represent a physical embodiment of the Dataset in a particular format.
  - Mandatory property access URL (dcat:accessURL) in range rdfs:Resource with cardinality 1..n contains a URL that gives access to a Distribution of the Dataset. The resource at the access URL may contain information about how to get the Dataset.
  - Recommended property description (dct:description) in range rdfs:Literal with cardinality 0..n contains a free-text account of the Distribution. This property can be repeated for parallel language versions of the description.
  - Recommended property format (dct:format) in range dct:MediaTypeOrExtent with cardinality 0..1 refers to the file format of the Distribution.
  - Recommended property licence (dct:license) in range dct:LicenseDocument with cardinality 0..1 refers to the license under which the Distribution is made available.
  - Optional property byte size (dcat:byteSize) in range rdfs:Literal typed as xsd:decimal with cardinality 0..1 contains the size of a Distribution in bytes.
  - Optional property checksum (spdx:checksum) in range spdx:Checksum with cardinality 0..1 contains the size of a Distribution in bytes.
  - Optional property documentation (foaf:page) in range foaf:Document with cardinality 0..n refers to a page or document about this Distribution.
  - Optional property download URL (dcat:downloadURL) in range rdfs:Resource with cardinality 0..n contains a URL that is a direct link to a downloadable file in a given format.
  - Optional property language (dct:language) in range dct:LinguisticSystem with cardinality 0..n refers to a language used in the Distribution. This property can be repeated if the metadata is provided in multiple languages.

- Optional property linked schemas (dct:conformsTo) in range dct:Standard with cardinality 0..n refers to an established schema to which the described Distribution conforms.
- Optional property media type (dcat:mediaType, subproperty of dct:format) in range dct:MediaTypeOrExtent with cardinality 0..1 refers to the media type of the Distribution as defined in the official register of media types managed by IANA.
- Optional property release date (dct:issued) in range rdfs:Literal typed as xsd:date or xsd:dateTime with cardinality 0..1 contains the date of formal issuance (e.g., publication) of the Distribution.
- Optional property rights (dct:rights) in range dct:RightsStatement with cardinality 0..1 refers to a statement that specifies rights associated with the Distribution.
- Optional property status (adms:status) in range skos:Concept with cardinality 0..1 refers to the maturity of the Distribution
- Optional property title (dct:title) in range rdfs:Literal with cardinality 0..n contains a name given to the Distribution. This property can be repeated for parallel language versions of the description.
- Optional property update/ modification date (dct:modified) in range rdfs:Literal typed as xsd:date or xsd:dateTime with cardinality 0..1 recent date on which the Distribution was changed or modified.

- Licence document (dct:LicenseDocument) represent a legal document giving official permission to do something with a resource.
  - Recommended proprerty licence type (dct:type) in range skos:Concept with cardinality 0..1 refers to a type of licence, e.g. indicating ‘public domain’ or ‘royalties required’.

Optional classes and properties

- Catalogue Record (dcat:CatalogRecord) represent a description of a Dataset’s entry in the Catalogue.
  - Mandatory property primary topic (foaf:primaryTopic) in range dcat:Dataset with cardinality 1..1 links the Catalogue Record to the Dataset described in the record.
  - Mandatory property update/modification date (dct modified) in range rdfs:Literal typed as xsd:date or xsd:dateTime with 1..1 cardinality contains the most recent date on which the Catalogue entry was changed or modified.
  - Recommended property application profile (dct:conformsTo) in range rdfs:Resource with cardinality 0..1 refers to an Application Profile that the Dataset’s metadata conforms to
  - Recommended property change type (adms:status) in range skos:Concept with 0..1 cardinality refers to the type of the *latest* revision of a Dataset's entry in the Catalogue. It MUST take one of the values :created, :updated or :deleted

depending on whether this *latest* revision is a result of a creation, update or deletion.

- Recommended property listing date (dct:issued) in range rdfs:Literal typed as xsd:date or xsd:dateTime with 0..1 cardinality contains the date on which the description of the Dataset was included in the Catalogue.
- Optional property description (dct:description) in range rdfs:Literal with cardinality 0..n contains a free-text account of the record. This property can be repeated for parallel language versions of the description.
- Optional property language (dct:language) in range dct:LinguisticSystem with cardinality 0..n 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.
- Optional property source metadata (dct:source) in range dcat:CatalogRecord with cardinality 0..1 refers to the original metadata that was used in creating metadata for the Dataset.
- Optional property title (dct:title) in range rdfs:Literal with cardinality 0..n contains a name given to the Catalogue Record. This property can be repeated for parallel language versions of the name.

- Checksum (spdx:Checksum) defines 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.
  - Mandatory property algorithm (spdx:algorithm) in range spdx:checksumAlgorithm_sha1 with cardinality 1..1 identifies the algorithm used to produce the subject Checksum. Currently, SHA-1 is the only supported algorithm. It is anticipated that other algorithms will be supported at a later time.
  - Mandatory property checksum value (spdx:checksumValue) in range rdfs:Literal typed as xsd:hexBinary with cardinality 1..1 provides a lower case hexadecimal encoded digest value produced using a specific algorithm.
- Document (foaf:Document) represent a textual resource intended for human consumption that contains information, e.g. a web page about a Dataset.
- Frequency (dct:Frequency) represent a rate at which something recurs, e.g. the publication of a Dataset.
- Identifier (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
  - Mandatory property notation (skos:notation) in range rdfs:Literal typed with the URI of one of the members of the DataCite Resource Identifier Scheme23 with cardinality 0..1 contains a string that is an identifier in the context of the identifier scheme referenced by its datatype.
- Kind (vcard:Kind) 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).

- Linguistic system (dct:LinguisticSystem) A system of signs, symbols, sounds, gestures, or rules used in communication, e.g. a language
- Location (dct: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 Vocabulary17 is recommended, following the approach described in the GeoDCAT-AP specification.
- Media type or extent (dct:MediaTypeOrExtent) A media type or extent, e.g. the format of a computer file
- Period of time (dct:PeriodOfTime) An interval of time that is named or defined by its start and end dates.
    - Optional property start date/time (schema:startDate) in range rdfs:Literal typed as xsd:date or xsd:dateTime with cardinality 0..1 contains the start of the period
    - Optional property end date/time (schema:endDate) in range rdfs:Literal typed as xsd:date or xsd:dateTime with cardinality 0..1 contains the end of the period. While both properties are optional, one of the two must be present for each instance of the class dct:PeriodOfTime, if such an instance is present. The start of the period should be understood as the start of the date, hour, minute etc. given (e.g. starting at midnight at the beginning of the day if the value is a date); the end of the period should be understood as the end of the date, hour, minute etc. given (e.g. ending at midnight at the end of the day if the value is a date)
- Publisher type (skos:Concept) A type of organisation that acts as a publisher
- Rights statement (dct: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.
- Standard (dct:Standard) A standard or other specification to which a Dataset or Distribution conforms
- Status (skos:Concept) An indication of the maturity of a Distribution or the type of change of a Catalogue Record.
- Provenance Statement (dct: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

4. Application profile for Serbia

Based on recommendation of countries which use DCAT-AP, DCAT-AP-SRB is proposed on Figure 3.

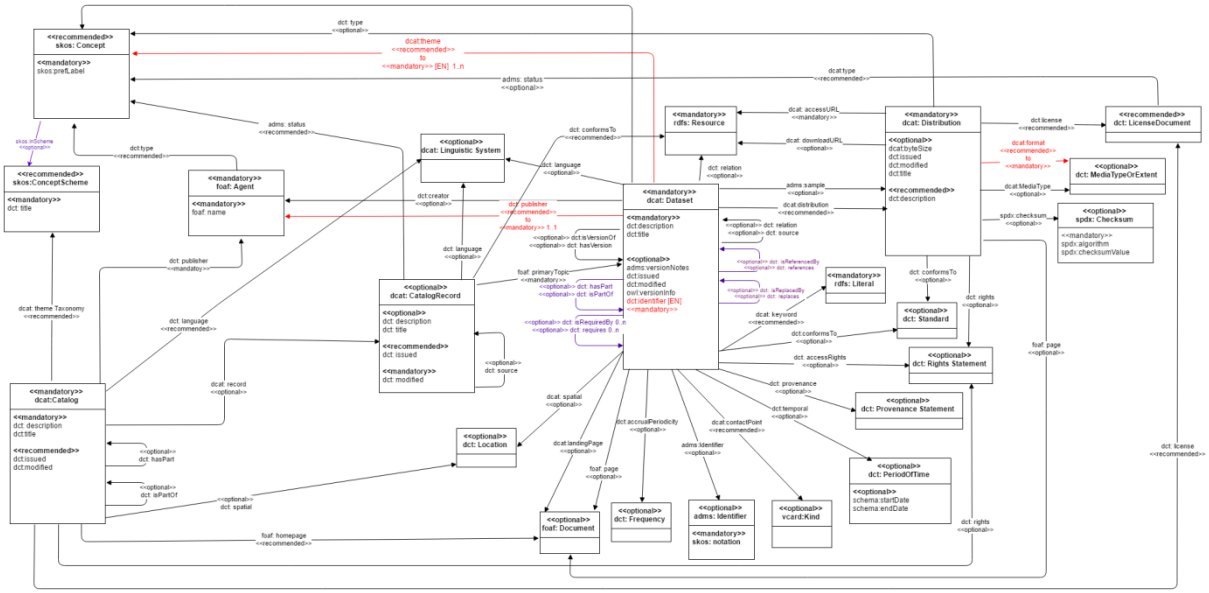


Figure 3 – DCAT Application Profile for Serbia

This version of the standard has differed from the underlying DCAT-AP version 1.1 the following points:

- Dataset: publisher which refers to an entity (organization) responsible for making the Dataset available has changed from recommended to mandatory attribute with cardinality 1..1.
- Dataset: identifier has changed from optional to mandatory attribute. Description changed from being unique in the context of the catalog to a stable and globally unique identifier
- Dataset: theme has changed from recommended to mandatory attribute
- relationships Dataset: is part of and Dataset: has part are added as new optional features
- relationships Dataset: requires and Dataset: required by is added as new optional features
- relationships Dataset: replaces and Dataset: replaced is added as new optional features
- relationships Dataset: refers to and Dataset: referenced by is added as new optional features
- relationships skos: inSheme is added as a new optional feature

The standard is recommended to be used to describe data sets and data directories in the public sector. It will apply to all data in the public sector (including open data) described in terms of entry in a directory or "inventory" (internal or external). This proposal, in order to be relevant must to follow the EU's use of DCAT-AP and modification work relating to, because based on implementations and problems in some countries this standard can be changed. In this kind of standards it is important to give users the opportunity to provide feedback. Now a lot of countries considering changes of the standard and such input will be included in the work of audits of new DCAT-AP versions to see if any of them should lead to updates.

5. Conclusions

The objective of DCAT-AP is quite simple and, therefore, has had a great reception in the community open data. DCAT-AP specification based on DCAT aims to provide a vocabulary RDF (a set of classes and properties) to describe in a structured way the content of dataset and catalogues of data in the web. Main contributions DCAT-AP can be summarized in the following points: (i) do not introduce a new vocabulary because its objective is to define the usage of some properties and DCAT classes for the publication of data within the European Union. In those necessary extensions for the description of catalogues and dataset and that are not present in DCAT are reused in other existing files (as is the case of foaf: Document to identify the web portals in which was published catalogs), (ii) defines a comprehensive policy for the use of DCAT-AP specifying what kinds and properties are mandatory, recommended or optional in the implementation of the vocabulary within the European Union, (iii) regulatory establishes principles according to the publication and consumption of documents DCAT-AP, (iv) explains the use of controlled vocabularies (in SKOS) for the description of the theme of the dataset which is really important recommendation explicit about the reuse of vocabularies Europeans, which opens the door to possible DCAT-AP applications in the field of public procurement.

It is important to say that DCAT-AP has a moreover ongoing new developments like GeoDCAT-AP and StatDCAT-AP. GeoDCAT-AP is an extension of DCAT-AP for sharing descriptions of space services and its main objective is to provide a syntax to combine RDF metadata schemes of the initiative INSPIRES and ISO 19115:2003, according to the principles in accordance established by DCAT-AP.[8] StatDCAT-AP is an extension of DCAT-AP for the publication of statistical datasets with main objective to find relevant metadata common among the different portals of publication of statistical data, as is the case with Eurostat. Looking similarities, StatDCAT-AP intended to be for the vocabulary RDF Cube Standing, as well as the metadata schema SDMX / EMS it is for the specification SDMX.[9]

Finally, the European commission has opened a line of activity for the development guides DCAT-AP implementations. In this sense, it seeks to open participation of different European organizations, contribute to make real experiences in implementing DCAT-AP and the problems and challenges encountered in its implementation. However, this new specification and its early adoption by the European Data Portal is a very good sign for the world Open Data which is primary and global objective of using DCAT-AP.

Literature

[1] Wyns , B., Dekkers, M., Loutas, N., Peristeras, V. & Karalopoulos A. (2016). *DCAT Application Profile for Data Portals in Europe,* W3C 2016 {https://www.w3.org/2016/11/sdsvoc/SDSVoc16_paper_30 }

[2] European Commission(2013). *DCAT Application Profile for data portals in Europe Final version*, European Union { https://joinup.ec.europa.eu/system/files/project/8a/71/a0/DCAT-AP_Final_v1.01.pdf }

[3] European Commission (2015). *DCAT Application Profile for data portals in Europe Version 1.1*, European Union {https://joinup.ec.europa.eu/system/files/project/dcat-ap_version_1.1_0.pdf}

[4] Ciasullo, G., Lodi, G., & Rotundo, A. Core Public Service Vocabulary: The Italian Application Profile.

[5] Maali, F., Cyganiak, R., & Peristeras, V. (2010). Enabling interoperability of government data catalogues. In *International Conference on Electronic Government* (pp. 339-350). Springer Berlin Heidelberg.

[6] Bradner, S. (1997). *Key words for use in RFCs to Indicate Requirement Levels*, Harvard University {http://www.ietf.org/rfc/rfc2119.txt}

[7] W3C (2016, November). *W3C Resource Description Framework (RDF)* { http://www.w3.org/RDF/}

[8] European Commission (2015). *GeoDCAT-AP: A geospatial extension for the DCAT application profile for data portals in Europe Version 1.0.1*, European Union { https://joinup.ec.europa.eu/system/files/project/geodcat-ap_v1.0.1.pdf}

[9] European Commission (2016). *D02.01.01.02: StatDCAT-AP – DCAT Application* Profile *for description of statistical datasets, Draft 1,* European Union {https://joinup.ec.europa.eu/system/files/project/statdcat-ap_draft_1.pdf }