
Dataspaces Tool Catalog (DS TCAT) Ontology – Metadata Requirements Gathering Document

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1. Introduction

DS TCAT Ontology: An ontology for modeling metadata for a dataspace tools catalogue (toolbox). It defines general metadata elements (e.g., title, version, provider, license), DSSC service category-specific metadata (covering the categories: *Federation Services*, *Participant Agent Services*, and *Value Creation Services*), and DSSC service type-specific metadata (e.g., for tools of type *Vocabulary Service* within the *Federation Services* category) used in the DSSC Toolbox.

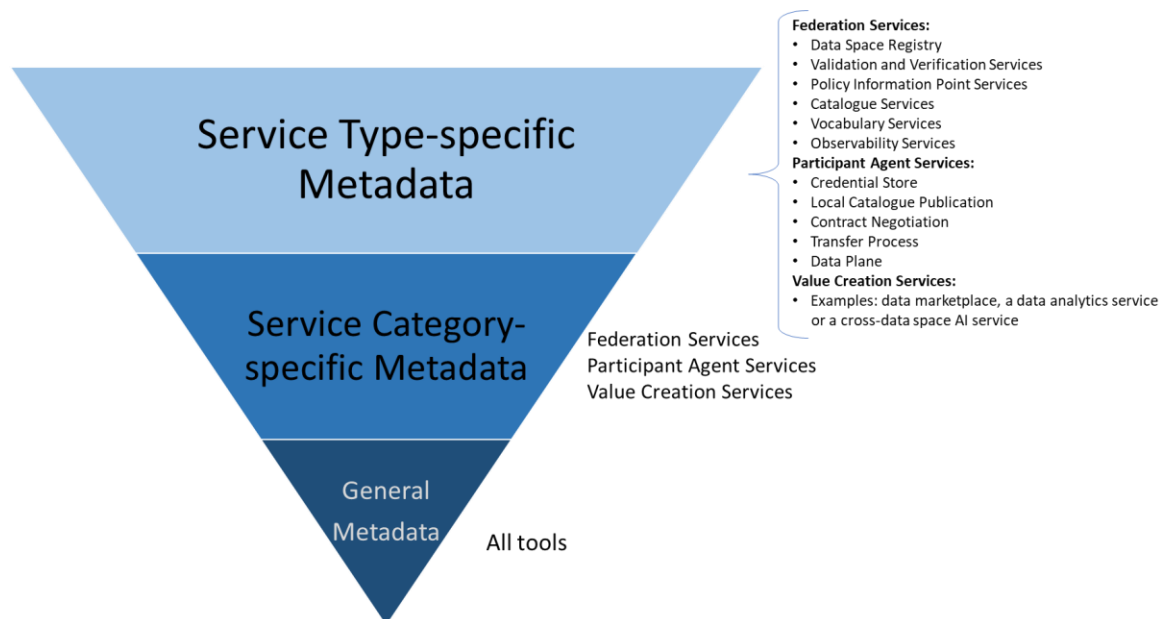
Namespace (to be registered):

tcat: <https://w3id.org/tcat>

1.1 Purpose and composition

Purpose: It is being developed as an underlying semantic data model for the Data Spaces Support Centre (**DSSC**) Toolbox. It aims to enable the **discovery** of tools based on rich multi-parameter queries.

Metadata layers: The following figure shows an inverted pyramid consisting of three layers of metadata specification.



1.2 Advantages and characteristics

Some advantages of using semantic metadata models over traditional JSON Schema-based models:

- Improved **discovery** through semantic search and reasoning
 - Synonym-based retrieval (e.g., "Participant Agent" ~ "Connector")
 - Hierarchical reasoning (e.g., searching for "Federation Services" tools also returns tools of type "Validation and Verification Services", "Vocabulary Services", etc.)
 - More advanced querying capabilities using SPARQL
- **Interoperability** across different domains and knowledge graphs
 - Human-readability: Reuse of existing known vocabularies (e.g., DCMI, Schema.org) facilitates unambiguous interpretation and better understanding of the models by humans
 - Linked Data advantage: Tools can be described in a machine-readable, linked data format (RDF), facilitating interoperability and making integration with other ontologies, catalogs, and knowledge graphs easier
- **Extensibility**: Semantic data model dynamically extensible by design

1.3 Existing data models collection

List of ontologies, vocabularies, and other data models for representing software tools metadata that can be potentially reused.

This “Existing Data Models Collection” serves as the first reference, and it will be maintained and enhanced throughout the ontology development process as a living document.

Data Model	Prefix: URI	Links	Comment
DCMI Terms	dcterms: http://purl.org/dc/terms/	Link	dc is a subset of dcterms.
DCMI Elements	dc: http://purl.org/dc/elements/1.1/		
DCMI Type	dcmitype: http://purl.org/dc/dcmitype/		
DCMI Dcam	dcam: http://purl.org/dc/dcam/		
Software Metadata Recommended Format Guide Version 1.0.0 February 2022		Link	
Asset Description Metadata Schema (ADMS) 2013	adms: http://www.w3.org/ns/adms#	Link	

System Packaging Data Exchange (SPDX)	spdx: http://spdx.org/rdf/terms	Link	RDF: https://github.com/spdx/license-list-data/tree/main/rdfturtle
Schema.org	schema: https://schema.org/	Link	https://schema.org/SoftwareApplication
Smart Data Models (Any specific data models that can be reused?)	https://smart-data-models.github.io/dataModel.DataSpace/	Link	
DCAT (Data Catalog Vocabulary) v3	dcat: https://www.w3.org/TR/vocab-dcat-3/		
Friend of a Friend (foaf) Vocabulary	foaf: http://xmlns.com/foaf/0.1/		
...			

2. General metadata common to all tools

Legend:

Reference for cardinality notations and level of commitment:

- 1..1: Exactly one (Level of commitment: mandatory)
- 0..1: At most one (Level of commitment: recommended or optional)
- 1..*: At least one (Level of commitment: mandatory)
- 0..*: Any (Level of commitment: recommended or optional)

2.1 General information

General tooling metadata information corresponds to terms defined in <https://schema.org/Product> , since every tool is an example of a product which is broadly defined as “*Any offered product or service*”.

See also:

- <https://schema.org/SoftwareApplication>
- <https://schema.org/Product>

Property title	Property Description	Property URI (suggestion)	Value type (Range)	Value vocabulary	Cardinality	Level of commitment (Mandatory, Recommended, or Optional)	Comments
Title	Name of the tool/implementation	dcterms:title	String (xsd:string)	-	1..*	Mandatory	Allow multiple titles in various languages.
Description	A brief overview of the primary focus and key features of the implementation.	dcterms:description	String (xsd:string)	-	1..*	Mandatory	
Homepage URL	This link should navigate users to a webpage where they can find more information about the tool/implementation.	foaf:homepage (or schema:url)	URI (xsd:anyURI)	-	0..1	Recommended	
Version	The current version of the implementation adhering to SemVer 2.0 (https://semver.org/) for versioning and what does it signify.	dcterms:hasVersion	String Object	Value must adhere to SemVer 2.0 for versioning.	1..*	Mandatory	Latest, old but supported, deprecated, upcoming – Is there a vocabulary for this?
Maintainer	The organization that maintains the implementation.	schema:maintainer	schema:Organization	-	1..1	Mandatory	
Logo	Logo of the maintainer of the implementation.	schema:logo	URI (xsd:anyURI)	-	0..1	Optional	
Purpose (DSSC) → Moved to Section 3	Description of how the implementation contributes to DSSC's objectives of facilitating data sharing, interoperability, and data sovereignty.	tcat:dataspaceProductPurpose	String (xsd:string)	-	1..1	Mandatory	This is the only general purpose field which is specific to DSSC.
Links to relevant documents	Direct linkages to relevant documents for your implementation, such as: product page, documentation, software repository, API specification, support.	schema:documentation	URI (xsd:anyURI)	-	1..*	Mandatory	

Relevant screenshots / pictures	Relevant pictures or screenshot of the tool's user interface.	schema:image	URI (xsd:anyURI)	-	0..*	Optional	
License Details (Duplicate)	License details for accessing and using the tool.	schema:license	URI (xsd:anyURI)	=	1..*	Mandatory	Schema.org recommends a link to the actual license.
License	The licensing that the creators of the tool have declared. A machine searchable license type.	spdx.org:licenseDeclared	URI Object	Value must adhere to https://spdx.org/licenses/	1..*	Mandatory	UNLICENSED is a valid option according to SPDX RDF: https://github.com/spdx/license-list-data/tree/main/rdfturtle
Keywords	Keywords that are part of the DSSC Glossary that categorize the tool.	schema:keywords	URI (xsd:anyURI)	To be created	0..*	Recommended	Keywords should be defined as URIs so that multiple natural language terms can be mapped to a common URI to encompass variations in terminology. We need an RDF Controlled Vocabulary for the DSSC Glossary.

Note: If you are finding it difficult to articulate a property, but still want the tool to be searchable using certain kind of metadata, please enter the expected queries below:

Expected queries (aka Competency questions):

- Search by provider organization, license information
- Search based on standardized keywords
- Retrieve all versions of a tool and the associated licenses
- ...

2.2 DSSC Blueprint related information → Moved to Section 3

Additional DSSC Blueprint Terms can be found in <https://smart-data-models.github.io/dataModel.DataSpace/>

Property title	Property Description	Property URI (suggestion)	Value type (Range)	Value vocabulary	Cardinality	Level of commitment (Mandatory, Recommended, or Optional)	Comments
Data space service category	Data Space services are one of three types, those aimed at participants to join a data space, those that facilitate the interplay for data sharing and services that support value creation.	tcat:serviceCategory	URI	To be created	1..1	Mandatory	Automatically assigned based on the Service Type : <ul style="list-style-type: none"> — Federation services — Participant Agent services — Value Creation services
Data space service (type)	This tool is an implementation of which data space service ?	tcat:dataspaceService	URI	To be created	1..*	Mandatory	See the pyramid above for possible values.
Related Data space building blocks	The functions of this tool are directly related to which data space building block ?	tcat:dataspaceBuildingBlock	URI	To be created	1..*	Mandatory	Building blocks to break data spaces into manageable smaller pieces. Building blocks are basic units or components that can be implemented and combined to achieve the functionality of a data space. For the Participant Agent services and Federation

							services this is automatically assigned based on the service type:
Additional functionalities	For any supplementary functionality this tool offers, which data space building block are they related to?	tcat:additionalBuildingBlock	URI	As above	0..*	Recommended	List of additional building block functions offered by this component outside of the listed building block defined above:
Additional functionalities	Description of additional implemented functions beyond the core building block functionality	tcat:additionalBuildingBlockDescription	String (xsd:string)	-	0..*	Recommended	Textual description of: additional functionalities –described in other building blocks – that the tool realizes:

2.3 Market readiness

Additional DSSC Market readiness Terms can be found in <https://smart-data-models.github.io/dataModel.DataSpace/>

Property title	Property Description	Property URI (suggestion)	Value type (Range)	Value vocabulary	Cardinality	Level of commitment (Mandatory, Recommended, or Optional)	Comments
Technology readiness level (TRL)	Specify an indication of the Technology Readiness Level (1-9) of the tool	tcat:technologyReadiness	Integer (schema.org:Integer)	1-9	1..1	Mandatory	
TRL Justification	For the TRL above. Briefly explain why.	tcat:technologyReadinessDescription	String (xsd:string)	-	0..1	Recommended	

Deployment s in operations	provide an overview or direct linkages to usage/deployments of the tool in operations.	tcat:existingD eployments	String (xsd:string)	-	0..*	Recommended	Necessary if the TRL level is 7 or higher, please
Business offerings		tcat:business Offerings	String (xsd:string)	-	0..*	Recommended	Is the tool provided by an organisation as managed service, a SAAS/PAAS and/or is there a support offering? If so, briefly specify the offering.

2.4 Detailed information

Property title	Property Description	Property URI (suggestion)	Value type (Range)	Value vocabulary	Cardi nality	Level of commitment (Mandatory, Recommended, or Optional)	Comments
Version (Duplicate= see Section 2.1)							Describe major released versions of the tool, specifying both which ones are relevant/current and which ones were archived and should no longer be used
Dependenci es	Describe the dependencies or prerequisites on other tools, components for to tool to be functional, such as: software prerequisites, software						

	dependencies, hardware prerequisites.						
Similar/competing tools	List similar tools.						
Supporting attachments	Include additional attachment or links for more information.						

2.5 Application domain

Property title	Property Description	Property URI (suggestion)	Value type (Range)	Value vocabulary	Cardinality	Level of commitment (Mandatory, Recommended, or Optional)	Comments
Functional application area	Describe the applications for which the tool is mandatory or recommended (depending on list status): For what purposes is the standard mandatory or recommended						
Domain / sector / industry	Describe the domain(s) and/or communities for which the tool is relevant						
Geographical application area	Specify whether the tool is intended for global adoption, Europe, or another specific region.						

3. DSSC-specific metadata

Property title	Property Description	Property URI (suggestion)	Value type (Range)	Value vocabulary	Cardinality	Level of commitment (Mandatory, Recommended, or Optional)	Comments
Purpose (Data space)	Description of how the implementation contributes to Data space's objectives of facilitating data sharing, interoperability, and data sovereignty.	tcat:dataspaceProductPurpose	String (xsd:string)	-	1..1	Mandatory	
Data space service category	Data Space services are one of three types, those aimed at participants to join a data space, those that facilitate the interplay for data sharing and services that support value creation.	tcat:serviceCategory	URI	To be created	1..1	Mandatory	Automatically assigned based on the Service Type . <ul style="list-style-type: none"> Federation services Participant Agent services Value Creation services
Data space service (type)	This tool is an implementation of which data space service ?	tcat:dataspaceService	URI	To be created	1..*	Mandatory	See the pyramid above for possible values.
Related Data space building blocks	The functions of this tool are directly related to which data space building block ?	tcat:dataspaceBuildingBlock	URI	To be created	1..*	Mandatory	Building blocks to break data spaces into manageable smaller pieces. Building blocks are basic units or components that can be implemented and combined to achieve the functionality of a data space.

							For the Participant Agent services and Federation services this is automatically assigned based on the service type.
Additional functionalities	For any supplementary functionality this tool offers, which data space building block are they related to?	tcat:additional BuildingBlock	URI	As above	0..*	Recommended	List of additional building block functions offered by this component outside of the listed building block defined above.
Additional functionalities	Description of additional implemented functions beyond the core building block functionality	tcat:additional BuildingBlock Description	String (xsd:string)	-	0..*	Recommended	Textural description of. additional functionalities - described in other building blocks - that the tool realizes.

4. Service-specific metadata

4.1 Federation services

Property title	Property Description	Property URI (suggestion)	Value type (Range)	Value vocabulary	Cardinality	Level of commitment (Mandatory, Recommended, or Optional)	Comments

4.1.1 Data Space Registry

4.1.2 Validation and Verification Services

Property title	Property Description	Property URI (suggestion)	Value type (Range)	Value vocabulary	Cardinality	Level of commitment (Mandatory, Recommended, or Optional)	Comments
VC Data Model Standardization Body	Name of the standardization body responsible for creating the data model of the credential technical specification	tcats:standardizedBy	String (xsd:string)		1..*	Mandatory	e.g. W3C etc.
VC Data Model Specification Name	Name of the data model used by the credentials offered/verified	dc:title	String (xsd:string)	-	1..*	Mandatory	e.g. Verifiable Credentials Data Model
VC Data Model Version	Version of the data model used by the credentials offered/verified	Dcterms:conformsTo	String (list)		1..*	Mandatory	Semantic Versioning 2.0.0
VC Data Model Specification Homepage	Link to download or purchase the human readable documentation defining the API(s) used by the transfer process	foaf:homepage	URI (xsd:anyURI)	-	1..* ²	Mandatory	Human Readable definition of the data models in use by the credential store

4.1.3 Policy Information Point Services

4.1.4 Catalogue Services

4.1.5 Vocabulary Services

See <https://smart-data-models.github.io/dataModel.DataSpace/VocabularyService>

Property title	Property Description	Property URI (suggestion)	Value type (Range)	Value vocabulary	Cardinality	Level of commitment (Mandatory, Recommended, or Optional)	Comments
Data model(s) domain	Describes the subject areas, business domains, or specific types of data models typically managed or hosted by the service.	Dcterms:subject	String	E.g., Purchase to pay in healthcare	0..n	Recommended	Provide a concise overview of the business domains and specific types of data model that your service is designed to manage.
Data models specifications	Specifies the types of data model specification that the service supports. The DSSC describes 4 types of specifications: https://dssc.eu/space/BVE2/1071255252/Data+Models#3.1-Building-a-data-model-for-the-data-space	Has type..	String (codelist)	Vocabulary, Ontology, Application Profile, Data Schema	1..1	Mandatory	Select one of the four DSSC defined data model specification types that your service primarily supports or creates (e.g., "Ontology", "Data Schema").
Data model syntaxes	Specifies the data model syntaxes or formalisms the service can process	Dc:format	String	(e.g., OWL, RDFS, SKOS, SHACL, JSON Schema)	1..n	Mandatory	List all specific data model syntaxes your service can understand and process (e.g., "OWL", "JSON Schema", "SHACL"). Separate multiple values with a comma.
Import format	Data formats the vocabulary service can import for creating or updating a data model	Dcat:mediatype or dc:format	String (list of MIME types)	(e.g., `text/csv`, `application/json`, `application/rdf+xml`, `application/vnd.ms-excel`)	1..n	Mandatory	List all file formats or MIME types that can be imported into your service to create a data model (e.g., "` application/rdf+xml` ", "` text/turtle` ").

Export format	Data formats in which the service can export data models (e.g., JSON, XML, OpenAPI, RDF/XML, Turtle, SKOS, etc)	Dcat:mediaType or dc:format	String (list of MIME types)	`text/csv`, `application/json`, `application/rdf+xml`	1..n	Mandatory	List all file formats or MIME types in which data models can be exported from the your service (e.g., "`application/json`", "`application/openapi+json`").
Data model versioning	Describes the approach used for data model versioning (e.g., Semantic Versioning)	Schema:version	String / controlled vocabulary	Semantic versioning, none, full history	0..1	Recommended	
Reference datasets management	Specifies how the vocabulary service manages reference datasets.		String		0..1	Optional	Describe if and how your service supports the creation, maintaining, and linking, of reference datasets (codelist) related to the data models
Governance features	Governance functionalities, such as role-based access control, workflow management.		String		0..1	Recommended	List or describe the governance features offered for creating and maintaining data models, such as Role-based access control, working groups workflows, change request management.
Publication accessibility	Methods used to publish and make vocabularies accessible (e.g., persistent URIs/PIDs, API endpoint, SPARQL endpoint, web portal).	Dcat:accessService	String		0..n		List the methods your service uses to make vocabularies accessible to users or other systems
Validation capabilities	Specifies if the service offers validation of data instances against		String (list of	Json validator, XML validator, shacl validator	0..n	Recommended	List the types of validation your service can perform (e.g.,

	data models, and its available syntaxes (JSON, XML, SHACL, etc)		capabilities)				Instance validation against data model schema) and specify supported syntaxes (e.g., SHACL or JSON validator).
Supported standards	List of specific formal/ industry standards that the services supports	Dcterms:conformsTo	String (list)		0..n	Recommended	List any formal or industry standards that your service explicitly supports or conforms to.
Mapping functionalities	Describes if the services provides functionalities for mapping between different the data models specifications		String		0..1	Optional	Describe if your service offers features for creating mappings or alignments between different data models (specifications).

4.1.6 Observability Services

4.2 Participant agent services

Property title	Property Description	Property URI (suggestion)	Value type (Range)	Value vocabulary	Cardinality	Level of commitment (Mandatory, Recommended, or Optional)	Comments

See <https://smart-data-models.github.io/dataModel.DataSpace/ParticipantAgent>

Sample JSON-LD data structure describing a Participation Agent capable of offering read/write NGSI-LD data and downloadable images

```
{
  "id": "urn:ngsi-ld:ParticipantAgent:FIWARE-DSC-2.28.0",
  "type": "ParticipantAgent",
  "title": "FIWARE Data Space Connector",
  "description": "An integrated suite of components implementing DSBA recommendations",
  "url": "https://github.com/FIWARE/data-space-connector",
  "hasVersion": "2.28.0",
  "maintainer": {
    "name": "FIWARE Foundation"
  },
  "dataspaceProductPurpose": "To provide a ready-to-use component for participants to join and interact within a data space.",
  "documentation":
    "https://github.com/FIWARE/data-space-connector/blob/main/README.md",
  "license":
    "https://github.com/FIWARE/data-space-connector/blob/main/LICENSE",
  "licenseDeclared": "MIT",
  "dataspaceServiceCategory": "Participant Agent",
  "dataspaceService": [
    "Credential Store",
    "Contract Negotiation",
    "Transfer Process",
    "Data Plane"
  ],
  "dataspaceBuildingBlock": [
    "Identity Management",
    "Contract and Usage Policies",
    "Data Exchange"
  ],
  "technologyReadinessLevel": 8,
  "credentialStore": {
    "vcDataModel": {
      "name": "Verifiable Credentials Data Model",

```

```
    "standardizedBy": "W3C",
    "conformsTo": [
      "1.1",
      "2.0"
    ],
    "homepage": "https://www.w3.org/TR/vc-data-model/"
  },
  "vcIssuanceAPI": {
    "name": "OpenID for Verifiable Credential Issuance",
    "standardizedBy": "OpenID",
    "conformsTo": "1.0.15",
    "homepage": "https://openid.net/specs/openid-4-verifiable-credential-issuance-1_0.html"
  },
  "vcPresentationAPI": {
    "name": "OpenID for Verifiable Presentations",
    "standardizedBy": "OpenID",
    "conformsTo": "1.0",
    "homepage": "https://openid.net/specs/openid-4-verifiable-presentations-1_0.html"
  }
},
"contractNegotiation": {
  "name": "Agreement Management API",
  "standardizedBy": "TMForum",
  "conformsTo": "5.0.0",
  "homepage": "https://www.tmforum.org/oda/open-apis/agreement"
},
"transferProcess": {
  "protocol": {
    "name": "Dataspace Protocol",
    "standardizedBy": "DSP",
    "conformsTo": "2024-1",
    "homepage": "https://docs.internationaldataspaces.org/dataspace-protocol/"
  },
  "authorization": {
    "name": "ODRL",
    "standardizedBy": "W3C",
    "conformsTo": "2.2",
```

```
    "homepage": "https://www.w3.org/TR/odrl-model/"
  },
  "dataPlane": [
    {
      "apiSpecification": {
        "name": "NGSI-LD",
        "standardizedBy": "ETSI",
        "conformsTo": [
          "1.8.1",
          "1.9.1"
        ],
        "homepage":
"https://www.etsi.org/deliver/etsi_gs/CIM/001_099/009/01.09.01_60/gs_CIM009v010901p.pdf"
      },
      "accepts": [
        "application/json",
        "application/ld+json"
      ],
      "contentType": [
        "application/json",
        "application/ld+json",
        "application/geo+json"
      ],
      "openAPI": [
        "https://forge.etsi.org/rep/cim/ngsi-ld-openapi/-/raw/v1.9.1/ngsi-ld-api-v1.9.1.yaml"
      ]
    },
    {
      "apiSpecification": {
        "name": "HTTP File Download",
        "standardizedBy": "IETF",
        "conformsTo": "RFC7231",
        "homepage": "https://tools.ietf.org/html/rfc7231"
      },
      "accepts": [],
      "contentType": [
```

```

        "image/jpeg",
        "image/png"
    ]
}
],
"@context": " https://dssc.eu/data-model/context.jsonld",
}

```

4.2.1 Credential Store

Property title	Property Description	Property URI (suggestion)	Value type (Range)	Value vocabulary	Cardinality	Level of commitment (Mandatory, Recommended, or Optional)	Comments
VC Data Model Standardization Body	Name of the standardization body responsible for creating the data model of the credential technical specification	tcat:standardizedBy	String (xsd:string)		1..*	Mandatory	e.g. W3C etc.
VC Data Model Specification Name	Name of the data model used by the credentials offered/verified	dc:title	String (xsd:string)	-	1..*	Mandatory	e.g. Verifiable Credentials Data Model
VC Data Model Version	Version of the data model used by the credentials offered/verified	Dcterms:conformsTo	String (list)		1..*	Mandatory	Semantic Versioning 2.0.0
VC Data Model Specification Homepage	Link to download or purchase the human readable documentation defining the API(s) used by the transfer process	foaf:homepage	URI (xsd:anyURI)	-	1..* ²	Mandatory	Human Readable definition of the data models in use by the credential store

VC Issuance API Standardization Body	Name of the API specification used by the credentials store for credentials issuance	tcat:standardizedBy	String (xsd:string)		1..*	Mandatory	e.g. OpenID etc.
VC Issuance API Specification Name	Name of the API specification used by the credentials store for credentials issuance	tcat:dataModel	String (xsd:string)	-	1..*	Mandatory	e.g. OpenID for Verifiable Credential Issuance
VC Issuance API Version	Version of the API specification used by the credentials store for credentials issuance	dc:title	String (xsd:string)		1..*	Mandatory	Semantic Versioning 2.0.0
VC Issuance API Specification Homepage	Link to download or purchase the human readable documentation defining the API(s) used by the transfer process	foaf:homepage	URI (xsd:anyURI)	-	1..* ²	Mandatory	Human Readable definition of the issuance API in use by the credential store
VC Presentation API Standardization Body	Name of the standardization body responsible the API specification used by the credentials store for presentations	tcat:standardizedBy	String (xsd:string)		1..*	Mandatory	e.g. OpenID etc.
VC Presentation API Specification Name	Name of the API specification used by the credentials store for presentations	dc:title	String (xsd:string)	-	1..*	Mandatory	e.g. OpenID for Verifiable Presentations
VC Presentation API Version	Version of the presentation API used by the credentials store	Dcterms:conformsTo	String (list)		1..*	Mandatory	Semantic Versioning 2.0.0
VC Presentation API Specification Homepage	Link to download or purchase the human readable documentation defining the API(s) used by the transfer process	foaf:homepage	URI (xsd:anyURI)	-	1..* ²	Mandatory	Human Readable definition of the presentation API in use by the credential store

4.2.2 Local Catalogue Publication

Property title	Property Description	Property URI (suggestion)	Value type (Range)	Value vocabulary	Cardinality	Level of commitment (Mandatory, Recommended, or Optional)	Comments

4.2.3 Contract Negotiation

Property title	Property Description	Property URI (suggestion)	Value type (Range)	Value vocabulary	Cardinality	Level of commitment (Mandatory, Recommended, or Optional)	Comments
Standardization Body	Name of the standardization body responsible for creating the technical specification	tcat:standardizedBy	String (xsd:string)		1..*	Mandatory	e.g. TMForum etc.
Contract Negotiation Specification Name	Name of standard(s) used directly the contract negotiation phase	dc:title	String (xsd:string)	-	1..* ¹	Mandatory	e.g. TMForum Agreement Management API
Contract Negotiation Conformance Version	Range of versions of the contract negotiation API(s) supported by the component	Dcterms:conformsTo	String (list)		1..* ¹	Mandatory	Semantic Versioning 2.0.0 – potentially a range of versions could be supported
Contract Negotiation	Link to download or purchase the human readable documentation	foaf:homepage	URI (xsd:anyURI)	-	1..* ¹	Mandatory	Human Readable definition of the API in use by the transfer process

¹ Note that multiple standards could be supported simultaneously within the Contract Negotiation

Specification Homepage	defining the API(s) used by the contract negotiation						
------------------------	--	--	--	--	--	--	--

4.2.4 Transfer Process

Property title	Property Description	Property URI (suggestion)	Value type (Range)	Value vocabulary	Cardinality	Level of commitment (Mandatory, Recommended, or Optional)	Comments
Transfer Process Standardization Body	Name of the standardization body responsible for creating the technical specification	tc:standardizedBy	String (xsd:string)		1..*	Mandatory	e.g. ISO etc.
Transfer Process Specification Name	Name of standard(s) used directly the transfer process	dc:title	String (xsd:string)	-	1..* ²	Mandatory	Expected to include DSP 2024-1
Transfer Process Conformance Version	Range of versions of the transfer process API(s) supported by the component	Dcterms:conformsTo	String (list)		1..* ²	Mandatory	Semantic Versioning 2.0.0 – potentially a range of versions could be supported
Transfer Process Specification Homepage	Link to download or purchase the human readable documentation defining the API(s) used by the transfer process	foaf:homepage	URI (xsd:anyURI)	-	1..* ²	Mandatory	Human Readable definition of the API in use by the transfer process
Authorization	Name of standard(s) used internally within the component within the transfer process	dc:title	String (xsd:string)	-	1..* ³	Mandatory	Expected to include ODRL 2.2

² Note that multiple transfer standards could be supported simultaneously within the Transfer Process.

³ Note that multiple policy languages could be supported simultaneously within the Transfer Process.

Specification Name							
Authorization Conformance Version	Range of versions of the authorization protocol(s) supported by the component	Dcterms:conformsTo	String (list)		1..* ³	Mandatory	Semantic Versioning 2.0.0 – potentially a range of versions could be supported
Authorization Specification Homepage	Link to download or purchase the human readable documentation defining the protocol(s) used for authorization	foaf:homepage	URI (xsd:anyURI)	-	1..* ³	Mandatory	Human Readable definition of the Authorization protocol in used internally within the component

4.2.5 Data Plane

Property title	Property Description	Property URI (suggestion)	Value type (Range)	Value vocabulary	Cardinality	Level of commitment (Mandatory, Recommended, or Optional)	Comments
Import format	Data formats the data plane API can accept for import for creating or updating a data entity	tc:accepts	String (list of MIME types)	application/json application/xml etc.	1..*	Mandatory	List all file formats or MIME types that can be imported into your service to create a data entity Corresponds to Accept
Export format	Data formats in which the data plane API can export data entities(e.g., JSON, XML, GeoJSON, etc)	tc:contentType	String (list of MIME types)	application/json application/ld+json application/geo+json etc.	1..*	Mandatory	List all file formats or MIME types in which data models can be exported from the your service . Corresponds to Content-Type

API Specification Name	Name of standard(s) supported within the data plane	dc:title	String (xsd:string)	-	1..* ⁴	Mandatory	e.g. AAS, NGSI-LD etc.
Conformance Version	Range of versions of the Data Plane API(s) supported by the component	Dcterms:conformsTo	String (list)		1..* ⁴	Mandatory	Semantic Versioning 2.0.0 – allows for a range of versions to be supported.
API Specification Homepage	Link to download or purchase the human readable documentation defining the API(s) used by the data plane	foaf:homepage	URI (xsd:anyURI)	-	1..* ⁴	Mandatory	Human Readable definition of the API in use by the data plane
Standardization Body	Name of the standardization body responsible for creating the technical specification	tcap:standardizedBy	String (xsd:string)		1..* ⁴	Mandatory	e.g. ISO, ETSI, IETF etc.
OpenAPI Link	Link to a machine-readable interface of the API	tcap:openAPI	URI (xsd:anyURI)	-	0..* ⁴	Recommended	Machine Readable definition of the API in use by the data plane

4.3 Value creation services

Property title	Property Description	Property URI (suggestion)	Value type (Range)	Value vocabulary	Cardinality	Level of commitment (Mandatory, Recommended, or Optional)	Comments

⁴ Note that multiple standards could be supported simultaneously within the Data Plane