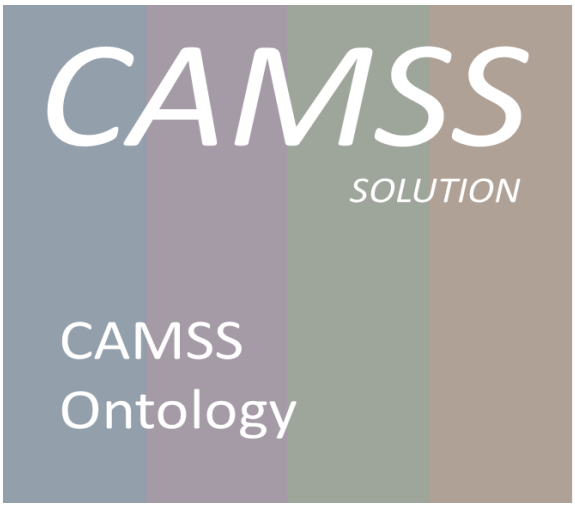
CAMSS Ontology

v.1.1.0



Specification

Change Control

Modification	Details
Version 1.1.0	
Current version	
Version 1.0.0	
Initial version	

Disclaimer

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1. INTRODUCTION

This deliverable addresses the objectives of task 03 CAMSS Ontology which aims to improve the CAMSS Ontology produced in the last phase by evolving it to a minor version v1.1.0. This document also describes how to access any CAMSS Ontology related data from the CELLAR TripleStore[1] through a new Jupyter Notebook[2] tool that has been developed by the CAMSS team in the context of this task.

1.1. General Context

CAMSS stands for Common Assessment Method for Standards and Specifications. It is a development of the Interoperable Europe Programme Action "*Achieving a modern ICT standardisation policy*[3]" aiming at "assessing and selecting standards and specifications for an eGovernment project, a reference when building an architecture and an enabler for justifying the choice of standards and specifications in terms of interoperability needs and requirements. It is fully aligned with the "European Standardisation Regulation 1025/2012"[4].

The CAMSS concepts need a formally agreed definition, and the current CAMSS assessments do not contain conveniently structured and machine-readable data. Hence the proposal of developing a CAMSS Ontology.

This CAMSS Ontology will be key for the agreement on the meaning of the CAMSS concepts, roles, and axioms. The interpretation of the resulting ontology will cast a clear idea of the method defined in CAMSS to assess standards and specifications. Examples of benefits identified would be:

- On one hand, it would formalize the reference terminology for the different concepts used in CAMSS. The terminology is definitional because it contains clear and atomic name symbols that are defined based on other atomic symbols. The terminology is, therefore "acyclic", thus providing a way to agree on the meaning of concepts such as scenario, assessment, criterion, and purpose, among others. This will ease the promotion, understanding, and adoption of the method and its components at the pan-European and international levels;
- On the other hand, a CAMSS machine-readable ontology would allow the discoverability, reuse, interoperability, integration, and processing (e.g. automated evaluation, comparison, production of reports, etc.) of the CAMSS assessments as Linked Open Data.

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[1] CELLAR Triplestore: http://publications.europa.eu/webapi/rdf/sparql

[2] Jupyter Notebook: https://jupyter.org/

[3] Achieving a modern standard ICT standardisation policy; CAMSS Action 2016.27: https://ec.europa.eu/isa2/actions/achieving-modern-ict-standardisation-policy_en.

[4] See CAMSS Joinup Community for additional details: https://joinup.ec.europa.eu/collection/common-assessment-method-standards-and-specifications-camss/about.

- Finally, the availability of the machine-readable CAMSS Ontology would provide MS and European Institutions with the capability of developing tools for the creation and maintenance of new scenarios and the production of assessments that may be exchanged cross-border and cross-domain.

1.2. Objective and Scope of the document

The objective of this document is to provide an interoperability-oriented solution for the expression and exchange of CAMSS Assessments. The solution proposed is an Ontology.

The scope of this document encompasses:

- Conceptual data models used for the CAMSS Vocabulary;
- Constraints and rules specific to the CAMSS domain;
- A reference implementation of the Ontology as an OWL Turtle[5] syntax v1.1;
- A CAMSS Knowledge Discovery Platform to facilitate the access and retrieval of information through CELLAR's SPARQL endpoint in an interactive way.

1.3. Structure of this document

This document consists of the following sections:

- Section 2 explains the CAMSS Ontology simplified view and identifies the classes and properties defined for the vocabulary.
- Section 3 explains the CAV model and identifies the classes and properties defined for the vocabulary.
- Section 4 explains the CSSV model and identifies the classes and properties defined for the vocabulary.
- Section 5 presents the CAMSS Ontology, the vocabulary, and the facts.
- Section 6 lists the different acronyms used in the whole document.
- Section 7 contains related references.

2. THE CAMSS ONTOLOGY (SIMPLIFIED OVERVIEW)

Error! Reference source not found. shows the classes and properties that are used or defined in the CAMSS Ontology. This ontology, which has its own namespace, reuses two classes and one property

[5] Turtle Syntax v1.1: https://www.w3.org/TR/turtle/

from two different vocabularies (CAV and CSSV). What is specific to the CAMSS Ontology is the fact that its domain is "the assessment of specifications".

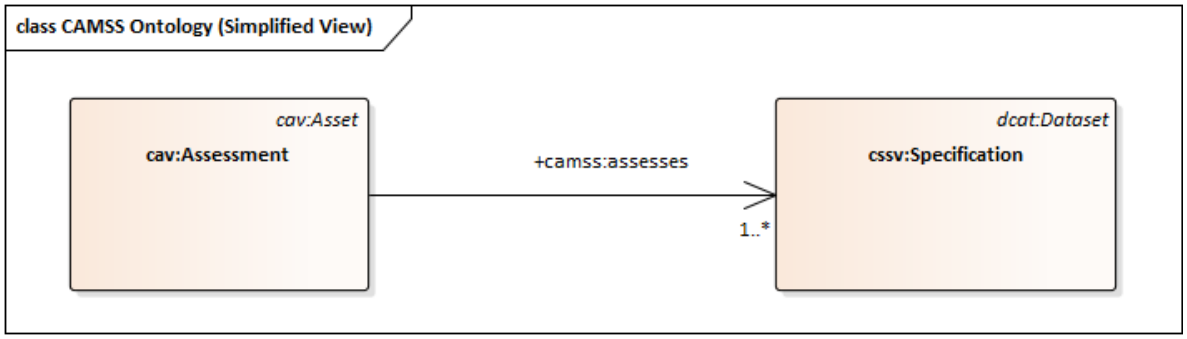

Figure 1 CAMSS Ontology (simplified overview)

Hence, the implementation of the CAMSS Ontology as a Knowledge Base (KB) would amount to saying that:

- The terminology[6] (or T-Box[7]) is defined by the CAV and the CSSV vocabularies. A graphic representation as UML is provided for both vocabularies in this very document, jointly with their symbol names, definitions, and properties.
- The assertions[6] (in the A-Box) would encompass all the opinions and facts expressed in each existing CAMSS Assessment, once transposed into triples and stored in the KB.
- The fact that CAMSS assesses only specifications (and all its descendants) is the specific constraint that makes the CAMSS Ontology a domain on its own, with a unique namespace. For this release of the CAMSS Ontology, SHACL shapes have been created to represent the CAMSS Ontology constraints. See Annex 5 – CAMSS Ontology SHACL Shapes.

In order to fully understand how the CAMSS Ontology is to be interpreted and used, the following two sections describe the CAV and the CSSV vocabularies.

2.1. CAMSS Ontology Prefixes

The following table lists the different prefixes and the corresponding namespaces used in the CAMSS Ontology:

prefix	namespace

[6] The Description Logic Handbook: Theory, Implementation, and Applications. Chapter 2. January 2007. Cambridge University Press, 2nd Edition.

https://www.researchgate.net/publication/230745455_The_Description_Logic_Handbook_Theory_Implementation_and_Applications

[7] See CAMSS Ontoloyg T-Box in Annex 4

camss	https://data.europa.eu/2sa/ontology
cav	https://data.europa.eu/2sa/cav/
rdfs	http://www.w3.org/2000/01/rdf-schema
cssv	https://data.europa.eu2sa/cssv/
skos	http://www.w3.org/2004/02/skos/core
dcat	http://www.w3.org/ns/dcat
foaf	http://xmlns.com/foaf/0.1/
cccev	https://data.europe.eu/semanticassets/ns/cv/cccev_v2.0.0

Table 1 CAMSS Ontology prefixes

3. CORE ASSESSMENT VOCABULARY (CAV)

The Core Assessment Vocabulary represents and defines what an "Assessment" of an "Asset" is and how to perform the Assessment using scenario-based "Criteria". It is a domain-agnostic vocabulary, meaning that it can be used to assess any type of asset. Hence, the CAV is at the very core of the CAMSS Ontology. Or, in other words, the CAMSS Ontology reuses 100% the CAV.

The CAV is depicted in *3*. The figure shows the classes and properties that are used or defined in the vocabulary.

3.1. Data Model for the CAV

The following data model results from:

- The analysis performed by the CAMSS Team,
- The review of the comments issued by the open community in the public GitHub,
- The comments issued by external experts during the review of the Core Assessment Vocabulary (CAV).

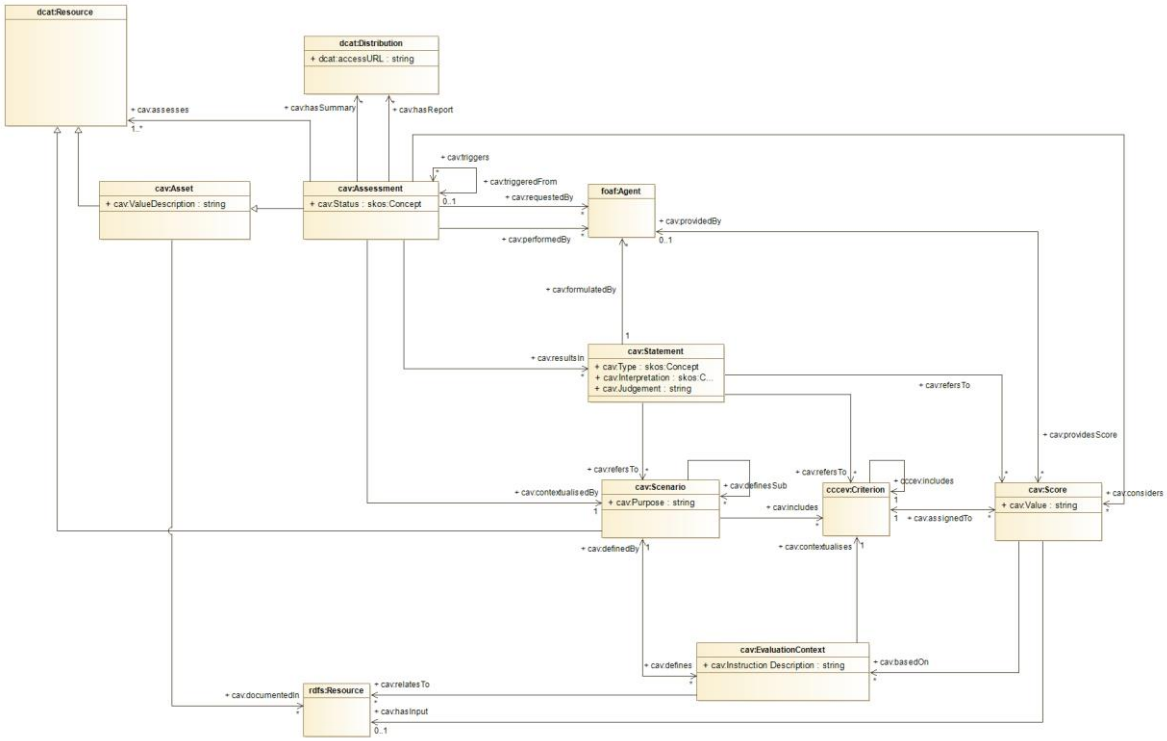

Figure 2 The Core Assessment Vocabulary

3

3.1.1. Interpretation

A CAV **Assessment** is a specialisation of an Asset, which is itself also a specialisation of the `dcat:Resource`. As any asset, it can be identified and described, and has individuals, distributions, publishers, etc. Additionally, to these properties, the CAV class Assessment needs to specify who are the requestors and evaluators of the Assessments. These can be anything represented by a FOAF[8] Agent, such as a natural person or an organisation. Notice that the objects assessed are also Resources meaning that the CAV may be used to assess anything that is considered a valuable resource. Examples of such resources could be products, services, or, in the case of CAMSS, standards, and specifications.

An Assessment results in **Statements** capturing the produced knowledge and providing value judgments. These can refer to the Assessment as a whole or a specific section, even being as detailed as to refer to individual evaluated criteria. A **Criterion** is typically derived from a Reference Framework, which is to be understood as a series of "agreed and descriptive reference requirements" coming from one or more sources (e.g., legislation, specifications and standards, ICT policy-related works like the EIF within the EIS, etc.). Throughout the Assessment each Criterion is assigned a **Score** (in principle by humans, but potentially also by systems) as the value output that is considered when formulating the resulting Statement(s). The **Score** can take into consideration

[8] FOAF Vocabulary Specification http://xmlns.com/foaf/spec/

any resource input (e.g., when the score is calculated based on different input parameters, algorithms, and formulae).

Any Assessment is performed in the context of a **Scenario**. The Scenario defines the purpose of the Assessment and the set of Criteria to be scored by one or more Agents. Scenarios can be defined with a flexible structure including nested sections (represented as sub-Scenarios) that serve to provide additional context, group thematically Criteria, and be referred to by the assessment's resulting Statement(s). Criteria can themselves be simple or complex and originate from various reference sources. The overall context for the evaluation of the Criteria is provided by the Scenario, however, in case certain Criteria require additional contextualisation or evaluation instructions these can exceptionally be provided by means of **EvaluationContext** which is related to a resource.

Finally, an Assessment might trigger another related Assessment of different content which has its own Scenario and Criteria. Note that it is also possible to model work in progress, expressed by having the Assessment defining optional links to Scores, Statements, reports, and summaries.

3.2. Class: cav:Asset

OWL Class	cav:Asset
Label:	Asset
Definition:	A resource, probably resulting from a work, with purpose and value. Additional information: This definition considers "resource" as res available for use". (See the definition of res in the IFLA FRBR/LRM specifications).
Subclass of:	dcat:Dataset

3.2.1. Property: cav:documentedIn

OWL Property	cav:documentedIn
OWL type:	owl:ObjectProperty
Label:	Documented in
Definition:	A link to any information supporting the value of the asset and any other related relevant details. Additional information:

	A good choice to implement instances of resources supporting the value of the asset can be the use of the cccev:Evidence class from the Core Criterion and Core Evidence Vocabulary.
Domain:	*cav:Asset*
Range:	*rdfs:Resource*
Cardinality:	0..n

3.3. Class: cav:Assessment

OWL Class	cav:Assessment
Label:	Assessment
Definition:	The intellectual work to evaluate an asset against the criteria of a given scenario.
Subclass of:	cav:Asset

3.3.1. Property: cav:hasStatus

OWL Property	cav:hasStatus
OWL type:	owl:DataProperty
Label:	hasStatus
Definition:	The current situation of the assessment. Additional Information: A list with different status codes is to be provided by context/domain-specific application profiles to identify the statuses that make sense for that context or domain.
Domain:	*cav:Assessment*
Property Type:	skos:Concept

3.3.2. *Property: cav:hasReport*

OWL Property	cav:hasReport
OWL type:	owl:ObjectProperty
Label:	hasReport
Definition:	A manifestation[9] of all the information related to and resulting from an assessment. Additional Information: The included information usually contains everything about the assessment, e.g., the purpose of the assessment, the criteria defined in the scenario, the responses, and the scoring provided by the evaluator; 1. The report may be manifested in one or multiple ways (distributed as different formats), e.g., as OWL triples, as an HTML, as a narrative text (pdf, doc, ods, etc.).
Domain:	*cav:Assessment*
Range:	*dcat:Distribution*
Cardinality:	0..n

3.3.3. *Property: cav:hasSummary*

OWL Property	cav:hasSummary
OWL type:	owl:ObjectProperty
Label:	hasSummary
Definition:	An abbreviated manifestation of the performed assessment.
Domain:	*cav:Assessment*
Range:	*dcat:Distribution*
Cardinality:	0..n

[9] The term "manifestation" is used herein as defined in the IFLA Library Reference Model (IFLA LRM): https://www.ifla.org/publications/node/11412

3.3.4. *Property: cav:assesses*

OWL Property	cav:assesses
OWL type:	owl:ObjectProperty
Label:	assesses
Definition:	The reference to the asset(s) that are the object of the assessment.
Domain:	*cav:Assessment*
Range:	*dcat:Resource*
Cardinality:	1..n

3.3.5. *Property: cav:performedBy*

OWL Property	cav:performedBy
OWL type:	owl:ObjectProperty
Label:	performedBy
Definition:	The agent(s) that carry out the assessment.
Domain:	*cav:Assessment*
Range:	*foaf:Agent*
Cardinality:	0..n

3.3.6. *Property: cav:requestedBy*

OWL Property	cav:requestedBy
OWL type:	owl:ObjectProperty
Label:	requestedBy
Definition:	The agent(s) requesting the assessment of an asset.
Domain:	*cav:Assessment*
Range:	*foaf:Agent*
Cardinality:	0..n

3.3.7. *Property: cav:contextualisedBy*

OWL Property	cav:contextualisedBy
OWL type:	owl:ObjectProperty
Label:	contextualisedBy
Definition:	The assignment of the scenario for the current assessment providing its context, purpose, and criteria.
Domain:	*cav:Assessment*
Range:	*cav:Scenario*
Cardinality:	1

3.3.8. *Property: cav:resultsIn*

OWL Property	cav:resultsIn
OWL type:	owl:ObjectProperty
Label:	resultsIn
Definition:	The creation of the statement(s) resulting from the assessment. Additional Information: The cardinality allows for optional associations to express an Assessment that is typically a work in progress.
Domain:	*cav:Assessment*
Range:	*cav:Statement*
Cardinality:	0..n

3.3.9. *Property: cav:considers*

OWL Property	cav:considers
OWL type:	owl:ObjectProperty
Label:	considers
Definition:	The evaluation of a criterion score in the context of the current assessment as input to issue one or more statements.

Domain:	*cav:Assessment*
Range:	*cav:Score*
Cardinality:	0..n

3.3.10. Property: cav:triggeredFrom

OWL Property	cav:triggeredFrom
OWL type:	owl:ObjectProperty
Label:	triggeredFrom
Definition:	The event causing the current assessment as the result of another related assessment.
Domain:	*cav:Assessment*
Range:	*cav:Assessment*
Cardinality:	0..1

3.3.11. Property: cav:triggers

OWL Property	cav:triggers
OWL type:	owl:ObjectProperty
Label:	triggers
Definition:	The event causing further related assessment(s) due to the current one.
Domain:	*cav:Assessment*
Range:	*cav:Assessment*
Cardinality:	0..n

3.4. Class: cav:Scenario

OWL Class	cav:Scenario
Label:	Scenario

Definition:	The context of the assessment establishing its purpose, the organisation of criteria being evaluated, and its reference Framework(s). Additional Information: A scenario can be used to include criteria sourced from various reference frameworks and organised in a flexible structure including nested parts (expressed as sub-scenarios each with a further specified context). A scenario with no included criteria is considered as high-level or informal.
Subclass of:	dcat:Dataset

3.4.1. Property: cav:includes

OWL Property	cav:includes
OWL type:	owl:ObjectProperty
Label:	includes
Definition:	The aggregation of criteria to one scenario or parts of it. Additional Information: This aggregation may be contextualised at different granularity levels, scenario, parts of the scenario or specific criteria. The cardinality is 0..n to allow assessments that are very high-level, informal, or subjective without criteria and scoring.
Domain:	*cav:Scenario*
Range:	*cccev:Criterion*
Cardinality:	0..n

3.4.2. Property: cav:definesSub

OWL Property	cav:definesSub
OWL type:	owl:ObjectProperty
Label:	definesSub
Definition:	The definition of nested scenarios grouped based on different sub-purposes, commonalities, or particularities of the sub-sets of criteria.
Domain:	*cav:Scenario*
Range:	*cav:Scenario*

Cardinality:	0..n

3.4.3. Property: cav:defines

OWL Property	cav:defines
OWL type:	owl:ObjectProperty
Label:	defines
Definition:	The link to the evaluation contexts for specific criteria provided by the given scenario.
Domain:	*cav:Scenario*
Range:	*cav:EvaluationContext*
Cardinality:	0..n

3.4.4. Property: cav:Purpose

OWL Property	cav:Purpose
OWL type:	owl:DataProperty
Label:	Purpose
Definition:	The reason for which the assessment is done.
Property Type:	xsd:String

3.5. Class: cav:Statement

OWL Class	cav:Statement
Label:	Statement
Definition:	A value judgement, resulting from the assessment, pertinent to its entirety or to one or more of its specific parts.

3.5.1. Property: cav:Judgement

OWL Property	cav:Judgement
OWL type:	owl:DataProperty

Label:	Judgement
Definition:	The text expressing the statement's resulting value judgement.
Property Type:	xsd:String

3.5.2. Property: cav:Type

OWL Property	cav:Type
OWL type:	owl:DataProperty
Label:	Type
Definition:	The categorisation of the statement. Additional Information: This code needs a context/domain-specific application profile codelist. An example of what this code can be used for is when there is a need to signalling whether the statement is totally subjective, a judgement based on comparative actions performed upon several score inputs, a sentence picked up from a database, and because of an automated calculation, etc.
Property Type:	skos:Concept

3.5.3. Property: cav:Interpretation

OWL Property	cav:Interpretation
OWL type:	owl:DataProperty
Label:	Interpretation
Definition:	The favorability perception of the statement (e.g., positive, negative, or neutral).
Property Type:	skos:Concept

3.5.4. Property: cav:formulatedBy

OWL Property	cav:formulatedBy
OWL type:	owl:ObjectProperty
Label:	formulatedBy
Definition:	The reference to the agent(s) responsible for issuing the current statement.

Domain:	*cav:Statement*
Range:	*foaf:Agent*
Cardinality:	0..n

3.5.5. Property: cav:refersTo

OWL Property	cav:refersTo
OWL type:	owl:ObjectProperty
Label:	refersTo
Definition:	The provision of a value judgement on one or more elements of the assessment.
Domain:	*cav:Statement*
Range:	*cav:Scenario*
Cardinality:	0..n

3.5.6. Property: cav:refersTo

OWL Property	cav:refersTo
OWL type:	owl:ObjectProperty
Label:	refersTo
Definition:	The provision of a value judgement on one or more elements of the assessment.
Domain:	*cav:Statement*
Range:	*cccev:Criterion*
Cardinality:	0..n

3.5.7. Property: cav:refersTo

OWL Property	cav:refersTo
OWL type:	owl:ObjectProperty
Label:	refersTo
Definition:	The provision of a value judgement on one or more elements of the assessment.

Domain:	*cav:Statement*
Range:	*cav:Score*
Cardinality:	0..n

3.6. Class: cav:EvaluationContext

OWL Class	cav:EvaluationContext
Label:	Evaluation Context
Definition:	The context for a criterion providing guidance on its evaluation considering the given scenario. This is used exceptionally to extend the context offered by the scenario when it is not sufficient for the evaluation of a given criterion. A criterion's evaluation produces an objective output that will then be considered to form value judgments expressed as the assessment's statements.

3.6.1. Property: cav:InstructionDescription

OWL Property	cav:InstructionDescription
OWL type:	owl:DataProperty
Label:	Instruction Description
Definition:	Guideline or description that needs to be followed during the evaluation of one particular criterion.
Property Type:	xsd:String

3.6.2. Property: cav:definedBy

OWL Property	cav:definedBy
OWL type:	owl:ObjectProperty
Label:	definedBy
Definition:	The link to the scenario provides the evaluation context for one or more criteria.
Domain:	*cav:EvaluationContext*
Range:	*cav:Scenario*

Cardinality:	1

3.6.3. Property: cav:contextualises

OWL Property	cav:contextualises
OWL type:	owl:ObjectProperty
Label:	contextualises
Definition:	The provision of context for the evaluation of the criterion.
Domain:	*cav:EvaluationContext*
Range:	*cccev:Criterion*
Cardinality:	1

3.6.4. Property: cav:relatesTo

OWL Property	cav:relatesTo
OWL type:	owl:ObjectProperty
Label:	relates To
Definition:	The context for a criterion related to a resource.
Domain:	*cav:EvaluationContext*
Range:	*rdfs:Resource*

3.7. Class: cav:Score

OWL Class	cav:Score
Label:	Score
Definition:	The value output assigned to the criterion as part of the assessment.

3.7.1. Property: cav:providedBy

OWL Property	cav:providedBy
OWL type:	owl:ObjectProperty

Label:	providedBy
Definition:	The agent responsible to provide the score.
Domain:	*cav:Score*
Range:	*foaf:Agent*
Cardinality:	0..1

3.7.2. Property: cav:Value

OWL Property	**cav:Value**
OWL type:	owl:DataProperty
Label:	Value
Definition:	The literal representing the final score assigned to one criterion. Additional Information • This literal is normally a number, generally a decimal. Be aware that one criterion may have multiple scores assigned, especially when there is the need of identifying who is the agent providing the score.
Property Type:	rdfs:Literal

3.7.3. Property: cav:hasInput

OWL Property	**cav:hasInput**
OWL type:	owl:ObjectProperty
Label:	hasInput
Definition:	The different resources provided to feed the context for the evaluation of a criterion. Additional Information: For example, the assessment of the quality of a criterion that is answered by multiple respondents, as the cases of an exam question answered by

	multiple students or the case of multiple evaluators evaluating the same quality aspect, etc.
Domain:	*cav:Score*
Range:	*rdfs:Resource*
Cardinality:	0..1

3.7.4. Property: cav:basedOn

OWL Property	cav:basedOn
OWL type:	owl:ObjectProperty
Label:	basedOn
Definition:	The consideration of a specific evaluation context when assigning the score to a criterion.
Domain:	*cav:Score*
Range:	*cav:CriterionEvaluationContext*
Cardinality:	0..n

3.7.5. Property: cav:assignedTo

OWL Property	cav:assignedTo
OWL type:	owl:ObjectProperty
Label:	assignedTo
Definition:	The assignment of a value output to the criterion.
Domain:	*cav:Score*
Range:	*cccev:Criterion*
Cardinality:	1

4. CORE STANDARDS AND SPECIFICATIONS VOCABULARY (CSSV)

The Core Standards and Specifications Vocabulary is depicted in Figure 2 CSSV Data model. The figure shows the classes and properties that are used or defined in the CSSV.

4.1. Data Model for the CSSV

The following data model results from:

- The analysis performed by the CAMSS Team,
- The review of the comments issued by the open community during previous public reviews of the vocabulary in the public GitHub,
- GAP Analysis between the CAMSS Assessment Scenarios and the CAMSS Core Vocabularies (i.e., CAV, CSSV).

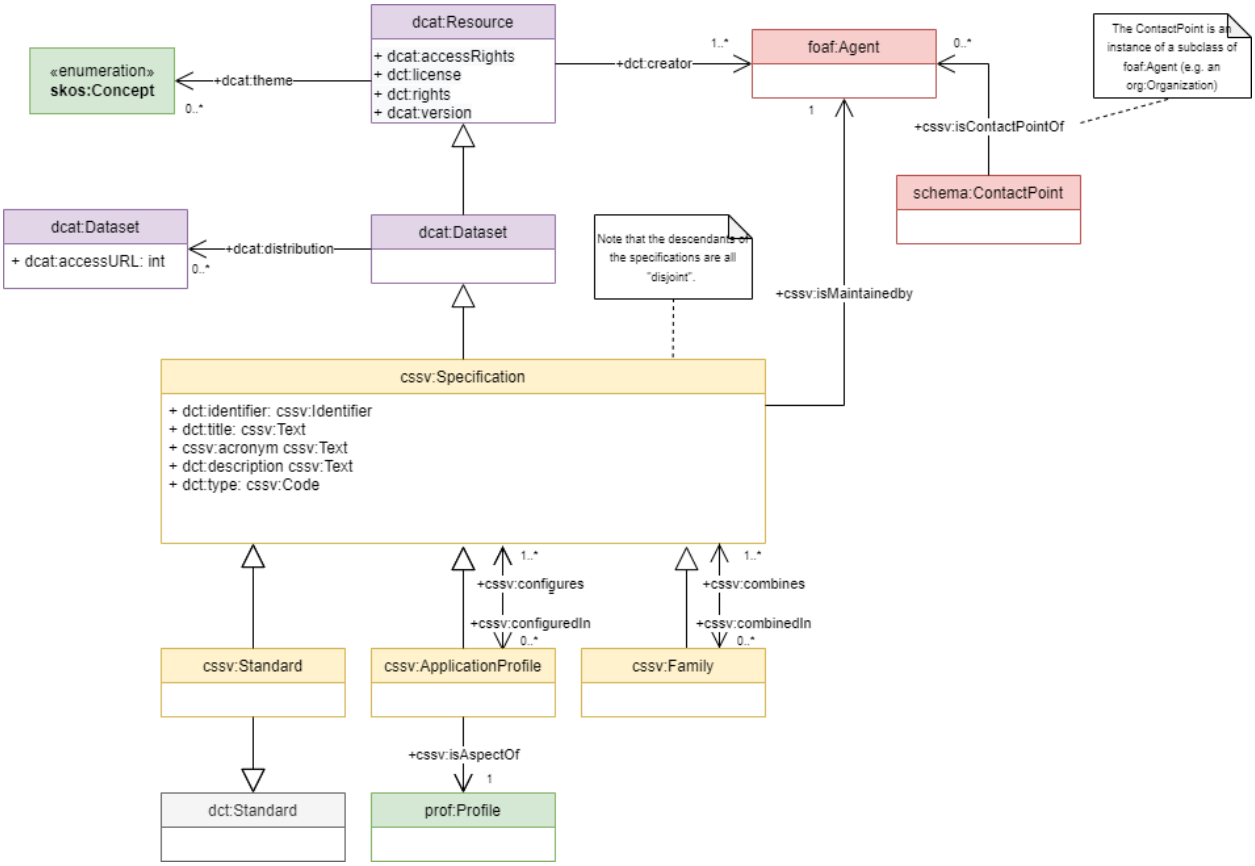

Figure 4 CSSV Data model

4.1.1. Interpretation

The main class of the CSSV model is the "Specification". A Specification is an asset, as it inherits from the *dcat:Dataset*, which inherits from the *dcat:Resource*.

A Specification, additionally, can be a Standard, an ApplicationProfile, a Family, or a collection of other specifications. The CSSV model defines:

- A **Specification** is a set of agreed, descriptive, and normative statements about how a specification should be designed or made.

- A **Standard** is a specification that is largely adopted and possibly endorsed.
- An **ApplicationProfile** is a customisation of one or more existing specifications potentially for a given use case or a policy domain adding an end-to-end narrative describing and ensuring the interoperability of its underlying specification(s). By customisation, we understand the "addition of more specificity by identifying mandatory, recommended, and optional elements, as well as by defining controlled vocabularies to be employed".
- A **Family** is a collection of interrelated and/or complementary specifications, standards, or application profiles and the explanation of how they are combined, used, or both.

A collection of Specifications differs from a Family of Specifications in the fact that the relationship amongst themselves is not explicit. In the CSSV model, a collection of Specifications is an Asset that is related to other Assets and that is realised as an individual of a Specification. In other words, a Specification that reuses the `dct:relation` property of its base class *dcat:Dataset*.

There are occasions where collections of Specifications are applied to a context or a domain in a specific "configuration". Thus, application profiles may conform sets of "themed" specifications. For this, the CSSV model uses the property "configures/includedIn" and the `dcat:theme` property pointing at a `skos:Concept` (i.e. a code, see the DCAT model above).

It is important to note that the descendants of the specifications are all "disjoint". Thus, ApplicationProfiles and Families are Specifications that refer to or are put together with other Specifications and/or Standards but cannot themselves be considered Standards.

One Specification, in time, may become a Standard. In these cases, the authority (author) that defined the Specification may be different from the one that creates and maintains artefacts out of the Standard. Think, for example, of the artefacts produced, maintained, and distributed by the Publications Office of the European Union (OP) in its site EU Vocabularies[10]: all these artefacts are defined by other authorities (e.g. the ISO), whilst the artefacts (e.g. the controlled vocabularies expressed in SKOS, XML, GeneriCode, XML, etc.) are supplied by the OP. For this, the CSSV uses the properties `dct:creator` and `cssv:isMaintainedBy`. Additionally, the `dcat:Dataset` has the property `dct:type` that can be used to state that the Specification is of type "definition, artefact or other". The DCAT vocabulary also provides the possibility of expressing who is responsible for the publication of the definition or the artefacts via the property `dct:publisher` (see the DCAT model).

The maintainer or publisher of a Specification is a `foaf:Agent`, which allows great flexibility to the CSSV model as `foaf:Agent` is the base class in many ontologies. The CSSV puts forward the reuse of the Core Person Vocabulary (CPV) and the Organization Ontology (W3C Org) for this purpose. Also, the `foaf:Agent` also provides the contact point of the specification.

Concerning the Intellectual Property Rights, they are covered by the fact that a specification which is a `dcat:Resource` and it allows to define the `dct:license` and `dct:rights`.

[10] EU Vocabularies: https://publications.europa.eu/en/web/eu-vocabularies/controlled-vocabularies

Finally, note that all the descendants of the *cssv:Specification* are disjoint. This entails that an individual of an application profile or family cannot be a standard, but does not preclude that, in time, the application profile or the family can become standard. If that were the case then individuals of *cssv:Standard* would be created to represent the standardisation of those specifications that are application profiles and families.

4.2. Class: Specification

OWL Class	cssv:Specification
Label:	Specification
Definition:	Set of agreed, descriptive, and normative statements about how a specification should be designed or made.
Subclass of:	dcat:Dataset

The sections below list the data properties (class attributes) inherited from DCAT that are of particular interest to the class Specification:

4.2.1. Property: dct:identifier

OWL Property	dct:identifier
OWL type:	owl:DataProperty
Label:	identifier
Definition:	This property contains the main identifier for the specification, e.g. the URI or another unique identifier.
Property Type:	xsd:AnyURI

Examples:	Any URI pointing at an instance of an Asset. An example of this could be:
	- DCAT (W3C)
	- URI: http://www.w3.org/ns/dcat#
	- Expression in CSSV:
	`@prefix cssv: <http://data.europa.eu/xyz/cssv#> .`
	`@prefix dct: <http://purl.org/dc/terms/> .`
	
	`<http://www.w3.org/ns/dcat#>`
	`a <cssv:Specification> ;`

	dct:identifier "http://www.w3.org/ns/dcat#" .

4.2.2. *Property: dct:title*

OWL Property	dct:title
OWL type:	owl:DataProperty
Label:	title
Definition:	The name given to the Specification.
Property Type:	xsd:String
Examples:	Core Standards and Specifications Vocabulary, Core Assessment Vocabulary, Core Public Service Vocabulary, Core Criterion, and Core Evidence Vocabulary, etc.

4.2.3. *Property: cssv:acronym*

OWL Property	cssv:acronym
OWL type:	owl:DataProperty
Label:	acronymSpecification
Definition:	Abbreviation of the specification.
Property Type:	xsd:String
Examples:	CSSV, CAV, CPSV, CCCEV, etc.

4.2.4. *Property: dct:description*

OWL Property	dct:description
OWL type:	owl:DataProperty
Label:	description
Definition:	This property contains a free-text account of the Specification. This property can be repeated for parallel language versions of the description.
Property Type:	xsd:String

Examples:	To define the main concepts and characteristics related to specifications, standards, and their combinations and relationships.

4.2.5. Property: dct:type

OWL Property	dct:type
OWL type:	owl:ObjectProperty
Label:	type
Definition:	This property refers to the type of the Specification. A controlled vocabulary for the values has not been defined for the time being. A proposal is provided in the examples below.
Property Type:	skos:Concept
Domain:	*dcat:Resource*
Range:	*skos:Concept*
Examples:	Definition, Artefact, Summary.

4.2.6. Property: dct:accessRights

OWL Property	dct:accessRights
OWL type:	owl:DataProperty
Label:	accessRights
Definition:	Information about who can access the resource or an indication of its security status.
Property Type:	xsd:AnyURI
Examples:	Read, write, modify, and delete rights.

4.2.7. Property: dct:license

OWL Property	dct:license
OWL type:	owl:DataProperty
Label:	license
Definition:	A legal document under which the resource is made available.

Property Type:	xsd:AnyURI
Examples:	Creative commons license.

4.2.8. Property: dct:rights

OWL Property	dct:rights
OWL type:	owl:DataProperty
Label:	rights
Definition:	A statement that concerns all rights not addressed with dct:license or dct:accessRights, such as copyright statements.
Property Type:	xsd:AnyURI

4.2.9. Property: cssv:configuredIn

OWL Property	cssv:configuredIn
OWL type:	owl:ObjectProperty
Label:	configuredIn
Definition:	A set of Specifications potentially for a given use case or policy domain that are aggregated in an ApplicationProfile.
Domain:	*cssv:Specification*
Range:	*cssv:ApplicationProfile*
Examples:	Instance classes representing application profiles, such as DCAT-AP, ADMS-AP, others.

4.2.10. Property: cssv:combinedIn

OWL Property	cssv:combinedIn
OWL type:	owl:ObjectProperty
Label:	combinedIn
Definition:	A set of Specifications that are complementary and interrelated, forming a Family of Specifications.
Domain:	*cssv:Specification*

Range:	*cssv:Family*
Examples:	OASIS UBL XML-based family (XML, XML Schema Definition, ISO Schematron, OASIS Genericode, Context Value Association (CVA), UN/CEFACT unqualified data types); OASIS JSON-based family; CEN TC 440 families; UN/CEFACT CII eInvoice family; other.

4.2.11. Property: cssv:isMaintainedBy

OWL Property	cssv:isMaintainedBy
OWL type:	owl:ObjectProperty
Label:	isMaintainedBy
Definition:	The Person, Organisation responsible to update and maintain the specification.
Domain:	*cssv:Specification*
Range:	*foaf:Agent*
Examples:	CAMSS Team, SEMIC, W3C, OASIS, others.

4.3. Class: cssv:Standard

OWL Class	cssv:Standard
Label:	Standard
Definition:	Specification that is largely adopted and possibly endorsed.
Subclass of:	cssv:Specification

At the present stage all the properties of the *cssv:Standard* class are the ones inherited from *cssv:Specification* and *dcat:Data set.*

4.4. Class: cssv:ApplicationProfile

OWL Class	cssv:ApplicationProfile
Label:	ApplicationProfile

Definition:	An application profile "customises one or more existing specifications potentially for a given use case or a policy domain adding an end-to-end narrative describing and ensuring the interoperability of its underlying specification(s)".
Subclass of:	cssv:Specification

4.4.1. Property: cssv:configures

OWL Property	cssv:configures
OWL type:	owl:ObjectProperty
Label:	configures
Definition:	Whether an Application Profile design or adapts a Specification for a specific purpose.
Domain:	*cssv:ApplicationProfile*
Range:	*cssv:Specification*
Examples:	DCAT-AP configuring DCAT for its use in the context of the EU Public Administrations; Any NATO profile configuring a set of interoperability Specifications for a specific context of use; other.

4.4.2. Property: cssv:isAspectOf

OWL Property	cssv:isAspectOf
OWL type:	owl:ObjectProperty
Label:	isAspectOf
Definition:	ApplicationProfile is a part of a Profile.
Domain:	*cssv:ApplicationProfile*
Range:	*prof:Profile*
Examples:	DCAT-AP.

4.5. Class: cssv:Family

OWL Class	cssv:Family
Label:	Family
Definition:	A family is a collection of interrelated and/or complementary specifications, standards, or application profiles and the explanation of how they are combined, used, or both.
Subclass of:	cssv:Specification

4.5.1. Property: cssv:combines

OWL Property	cssv:combines
OWL type:	owl:ObjectProperty
Label:	Combines
Definition:	Whether a Family is a union of more than one Specifications.
Domain:	*cssv:Family*
Range:	*cssv:Specification*
Examples:	One or more Specifications that are part of a family, e.g., OASIS UBL XML-based family (XML, XML Schema Definition, ISO Schematron, OASIS Genericode, Context Value Association (CVA), UN/CEFACT unqualified data types); OASIS JSON-based family; CEN TC 440 families; UN/CEFACT CII eInvoice family; other. Conformance Statement.

5. The CAMSS Ontology – Vocabulary and Facts

This section describes two essential aspects of the CAMSS Ontology:

- **The CAMSS Ontology Vocabulary:** On one side a graphic representation and textual descriptions of the CAMSS Ontology Vocabulary are provided. This vocabulary is to be taken as the basis for the building of a Knowledge Base T-Box ("T" stands for terminology).
- **The CAMSS Ontology Facts:** On the other side, the Ontology is to be completed with assertions, thus providing facts to populate the A-Box of the Knowledge Base ("A" standing for assertions). For this, the A-Box has been populated with the existing CAMSS Assessments once transformed into an OWL2 Syntax, and conformant to the axioms defined in the T-Box.

5.1. The CAMSS Ontology Vocabulary

The figure below shows the main entities and relations of the CAMSS Ontology Vocabulary needed for the building of the Knowledge Base T-Box.

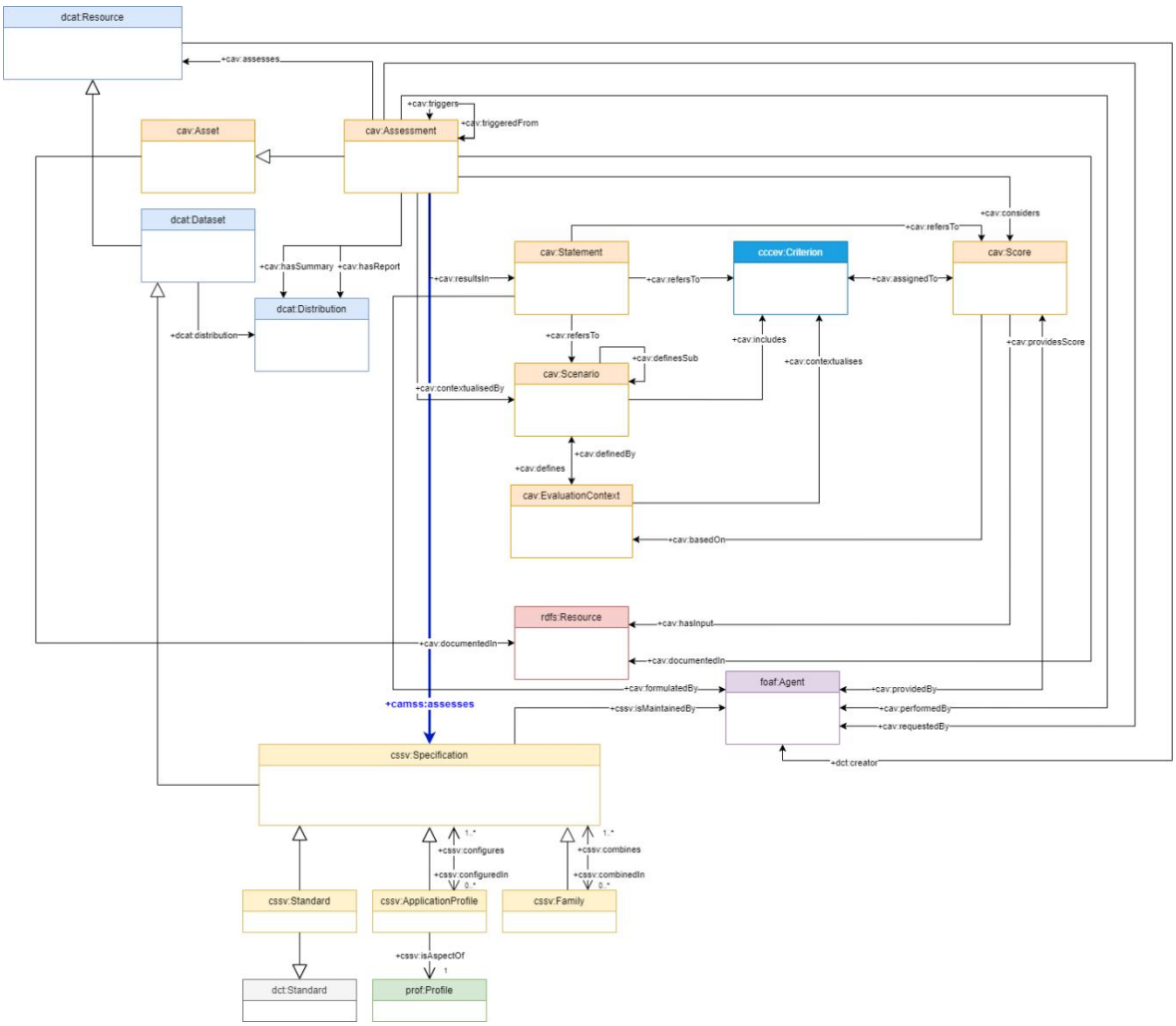

Figure 5 The CAMSS Ontology Vocabulary

The figure above provides a more detailed view of how the two vocabularies (CSSV and CAV) are connected in the context of the CAMSS Ontology. The important thing to observe is that whilst a CAV Assessment assesses a DCAT Resource, the CAMSS Ontology Assessment assesses CSSV Specifications, which are also DCAT Resource.

The CAMSS Ontology is different from the CAV in two senses:

1. It profiles the assessments to one specific type of asset, the specification (and its descendants);

2. It limits the assessments to one or more specifications. Beware that application profiles and families are descendants of one specification.

5.2. The CAMSS Ontology Facts

The CAMSS Ontology Vocabulary links the two domains of CAMSS, Assessments, and Specifications.

This section aims to illustrate the Physical Instantiation of the CAMSS Ontology into a CAMSS Knowledge Graph, composed of a T-Box (Terminology) and an A-Box (Assertions, the set of facts expressed as triples).

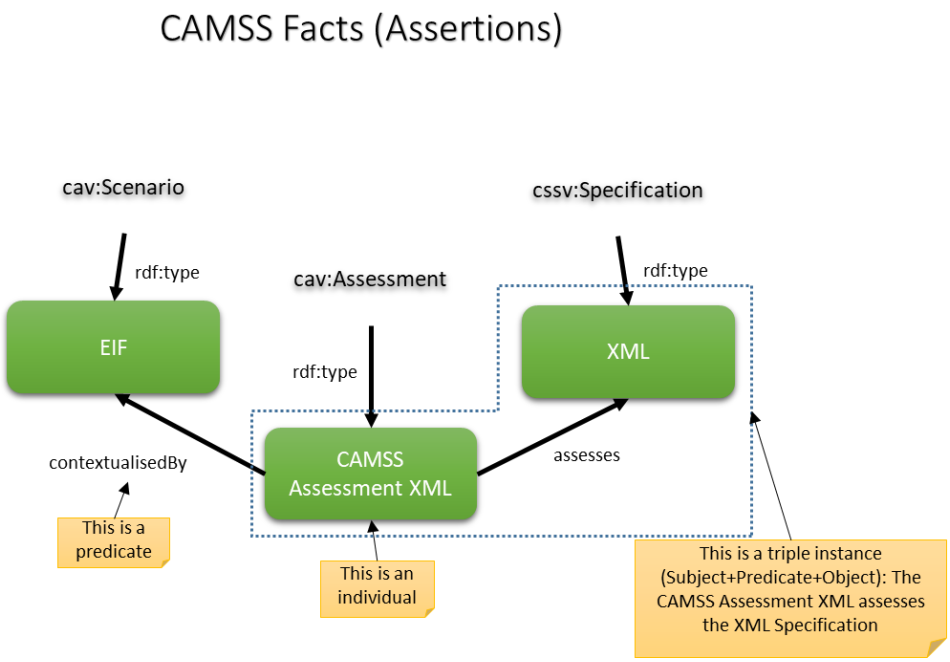

Figure 6 Example of CAMSS Facts

For the 'population' and maintenance of the A-Box with facts, some artefacts and developments have been performed. These artefacts and developments are explained in detail in the D02.01 CAMSS Toolkit v5.0.0.

6. ACRONYMS

Term	Description
ADMS	Asset Description Metadata Schema
CAMSS	Common Assessment Methods for Standards and Specifications
CAV	Core Assessment Vocabulary

CCCEV	Core Criterion and Core Evidence Vocabulary
CPV	Core Person Vocabulary
CSSV	Core Standards and Specifications Vocabulary
EIF	European Interoperability Framework
EIRA	European Interoperability Reference Architecture
ELIS	EIRA Library of Interoperability Specifications
ESPD	European Single Procurement Document
FOAF	Friend of a Friend
IMAPS	Interoperability Maturity Assessments of a Public Service
IQAT	Interoperability Quick Assessment Toolkit
MSP	Multi-Stakeholder Platform
OWL	The W3C Web Ontology Language

7. REFERENCES

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ANNEX 1 - ONTOLOGY BASIS

An Ontology, also known as T-Box, is a set of logical axioms that conceptualise a domain of interest by defining concepts and the semantics of relations among concepts.

The following picture depicts the T-Box of the CAMSS Ontology:

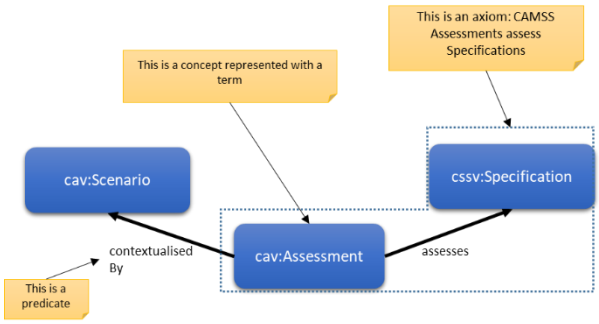

Figure 7 CAMSS Ontology (T-Box)

It is also worth noting when talking about ontologies to explain the meaning of the linked data concept or A-Box. Linked data are a set of assertions on individuals belonging to a domain of interest. Namely, assertions are facts associated with a conceptual model (i.e. the ontology) within a knowledge graph.

The following picture depicts an example of an A-Box:

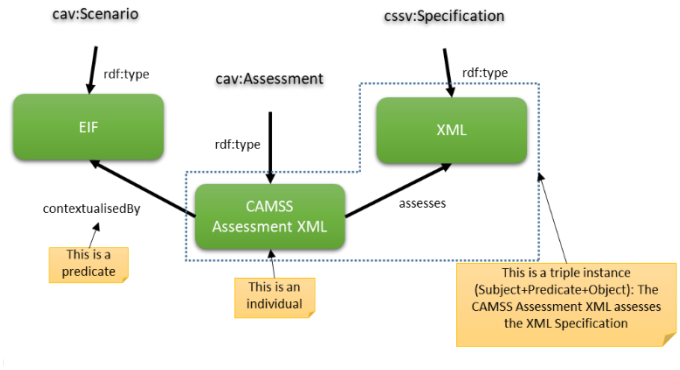

Figure 8 Linked Data (A-Box)

The grouping of the T-Box and the A-Box constitute the knowledge graph. The knowledge graph represents a collection of interlinked descriptions of entities – real-world objects and events, or abstract concepts (e.g., documents) – where:

- Descriptions have formal semantics that allows both people and computers to process them in an efficient and unambiguous manner;
- Entity descriptions to one another, forming a network, where each entity represents part of the description of the entities, related to it, and provides context for their interpretation.

ANNEX 2 – CAMSS ONTOLOGY CONCEPTUAL DATA MODEL

Disclaimer

In order to open the files embedded in the annex, please use Drawio editor.

CAMSS Ontology.drawio

ANNEX 3 – CAMSS ONTOLOGY T-BOX

CAMSS_Ontology v1.1.0.ttl

ANNEX 4 – CAMSS ONTOLOGY A-BOX

CAMSS_Ontology_Assessments_graph.ttl

CAMSS_Ontology_Specifications_graph.

ANNEX 5 – CAMSS ONTOLOGY SHACL SHAPES

CAMSS_Ontology_SHACL_shapes.ttl.rdf