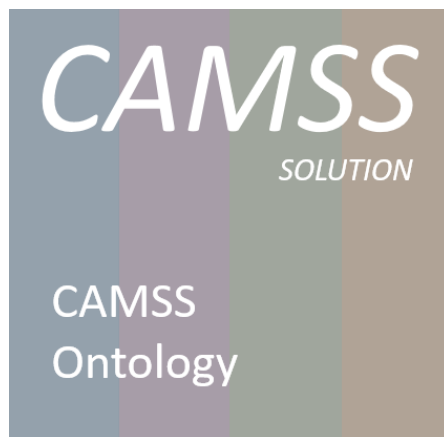


CAMSS Ontology BETA v1.1.0



Specification

Change Control

Modification		Details
Version 1.1.0 BETA		
BETA version		

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1. INTRODUCTION

This document contains the BETA version of the CAMSS Ontology.

1.1. General Context

CAMSS stands for Common Assessment Method for Standards and Specifications. It is a development of the ISA2 Programme Action “*Achieving a modern ICT standardisation policy*”¹ 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”².

The CAMSS Ontology analysis identifies that (i) the CAMSS concepts need a formally agreed definition, and (ii) 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 definitorial 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, purpose, other. 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.
- 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 Achieving a modern standard ICT standardisation policy; CAMSS Action 2016.27: https://ec.europa.eu/isa2/actions/achieving-modern-ict-standardisation-policy_en.

² See CAMSS Joinup Community for additional details: <https://joinup.ec.europa.eu/collection/common-assessment-method-standards-and-specifications-camss/about>.

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 Turtle³ syntax v1.1.

1.3. Methodological approach

The approach followed for the development of the CAMSS Ontology sticks to three fundamental principles:

1. Reuse and share (i.e., do not reinvent the wheel);
2. Do not betray the knowledge and experience of the domain, nor the terminology and interpretation of the concepts (i.e. do not invent new terms when they already exist in the communities of practice or generic domains);
3. Isolate technical and business constraints and rules as much as possible; (i.e. externalise them in separate artefacts, e.g. graph and data shapes for the control and validation of the data). This has a large impact on the quality and cost of the implementation and maintenance of the ontology.

Thus, one way of facilitating the semantic interoperability consists of reusing existing generic ontologies and vocabularies. This way, the semantics of common concepts and properties are agreed without having to re-discuss them. When concepts or properties have not been identified nor defined for the purposes pursued, they have to be proposed either as extensions or from scratch.

The methodological approach followed for the development of the CAMSS Ontology reuses the following ontologies and vocabularies:

- Friend of a Friend (FOAF);
- Core Person Vocabulary (CPV), only Natural Person;
- The Organization Ontology;
- Core Criterion and Core Evidence Vocabulary (CCCEV).

³ Turtle Syntax v1.1: <https://www.w3.org/TR/turtle/>

Additionally, other concepts and properties that are needed in the CAMSS Ontology had to be defined in new vocabularies, which use common terms and definitions agreed with experts and users from the CAMSS domain (namely the Member States and EU Public Administrations, EU Working Groups and Stakeholders⁴):

- Core Standards and Specifications Vocabulary (CSSV);
- Core Assessment Vocabulary (CAV).

The rationale for defining these two new vocabularies goes as follows. See examples in the sections *3 Core Assessment Vocabulary (CAV)* and *4 Core Standards and Specifications Vocabulary (CSSV)*:

1. No generic ontologies or vocabularies have been found defining what a Specification and Assessment are that fulfil the purposes of CAMSS, partially or totally (e.g. There is not an ontology covering both specifications and assessments. Some initiatives define the concept standard as a generic concept, e.g. Dublin Core⁵, W3C Profile⁶; or define methodologies for assessment, but not ontologies or vocabularies);
2. Existing concepts in other ontologies did not cover all the information requirements needed in CAMSS and therefore had to be reused or specialised by new classes (e.g. Both CSSV and CAV benefit greatly of the existence of the ADMS Asset concept);
3. Concepts and properties existing in other ontologies have different semantics to the ones needed in CAMSS (e.g. Dublin Core definition for Standard provides a partial semantic field. The CAV extends this definition);
4. Concepts required in CAMSS have not been identified in any other existing ontologies and therefore needed to be defined at new (e.g. the concepts of Family of Standards in the CSSV or Scenario in the CAV).
5. Given these are “Core” vocabularies a key goal is to make them as flexible as possible. This means that predicates are set with optional and multiple cardinality (0..n) unless there is a strong reason to further restrict.

1.4. Structure of this document

This document consists of the following sections:

⁴ Examples of Working Groups and Stakeholders are the European Multi-Stakeholder Platform on ICT Standardisation (MSP Working Group) and Standard Development Organisations such as UN/CEFACT, OASIS, W3C and private sector representatives, which also participate in the regular MSP sessions.

⁵ Dublin Core Metadata Initiative: <https://www.dublincore.org/specifications/dublin-core/dcmi-terms/>

⁶ The Profiles Vocabulary. W3C Working Draft 02 April 2019: <https://www.w3.org/TR/dx-prof/>

- 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 introduces the current version of the CCCEV which is being evolved by SEMIC.
- Section 6 presents the CAMSS Ontology in a detailed overview.
- Section 7 exposes the conclusions and the next steps of the CAMSS Ontology.
- Section 8 lists the different acronyms used in the whole document.
- Section 9 contains related references.

1.5. Current status and future evolution disclaimer

The title of this document is *The CAMSS Ontology BETA*. The word BETA refers to the fact that the CAMSS Ontology has dependencies of other vocabularies that are currently under development, namely the CSSV, the CAV and the CCCEV. These vocabularies are respectively under public revision, development or evolution in parallel to the development of the CAMSS Ontology:

- The CSSV was opened for public consultation⁷ and some findings and relevant conclusions were produced. Some future actions shall be carried out in order to challenge the vocabulary. The CAMSS Ontology reuses the CSSV in a very decoupled way and, therefore, the review of the CSSV should not impact on to the CAMSS Ontology;
- The CAV is being developed as a very generic vocabulary in the context of the CAMSS Ontology development. It is being developed by the CAMSS Team and has been reviewed by a group of experts. Once the BETA CAMSS Ontology finalized, the CAV will be opened for public consultation;
- The CCCEV is also currently being evolved into a simpler and more flexible version within the SEMIC initiative.

In conclusion, the current version has to be considered *BETA*. Once all dependency developments are finished or stable, new releases of the CAMSS Ontology would follow.

⁷ CSSV Public Consultation: <https://joinup.ec.europa.eu/collection/common-assessment-method-standards-and-specifications-camss/news/cssv-public-review>

2. THE CAMSS ONTOLOGY (SIMPLIFIED OVERVIEW)

The **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 from two different vocabularies (CAV and CSSV). What is specific of the CAMSS Ontology is the fact that its domain is “the assessment of specifications”.

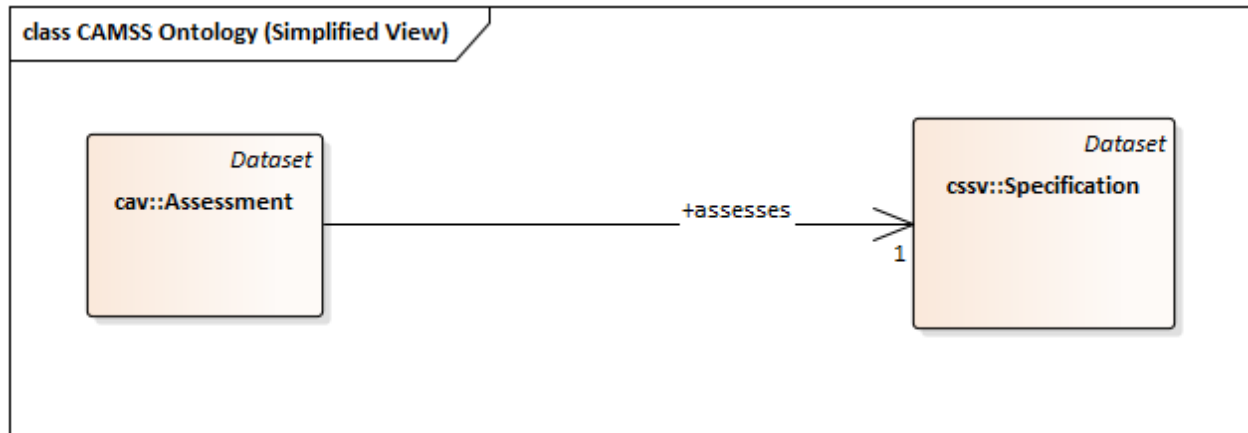


Figure 1 CAMSS Ontology (simplified overview)

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

- The terminology⁸ (or T-Box) 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 assertions⁸ (in the A-Box) would encompass all the opinions and facts expressed in each existing CAMSS Assessments, once transposed into triples and stores in the KB;
- The fact that CAMSS assess only specifications (and all its descendants) is the specific constraint that makes the CAMSS Ontology a domain on its own, with a unique namespace.

Notice that both, the CAV Assessment and CSSV Specification classes specialisation of the *dcat:Dataset*, i.e. it is an Asset as represented in ADMS .

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.

⁸ 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

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 assets. Hence, the CAV is at the very core of the CAMSS Ontology. Or, in other words, the CAMSS Ontology reuses 100% the CAV.

As the first Use Case identified for the CAV is CAMSS⁹, the CAV and CAMSS Ontology are being developed in parallel. This entails that a revision needs to be performed by multi-domain experts and the CAMSS community. Until this revision is not completed a stable version of both the CAV and the CAMSS Ontology is not possible, and would be considered *BETA* versions.

The CAV is depicted in *Figure 2 The Core Assessment Vocabulary*. The figure shows the classes and properties that are used or defined in the vocabulary.

⁹ Other domains have already been identified as candidates for the CAV, e.g. the Interoperability Maturity Assessment of a Public Service (IMAPS), but also for assessment of products in both public and private sectors.

3.1. Data Model for the CAV

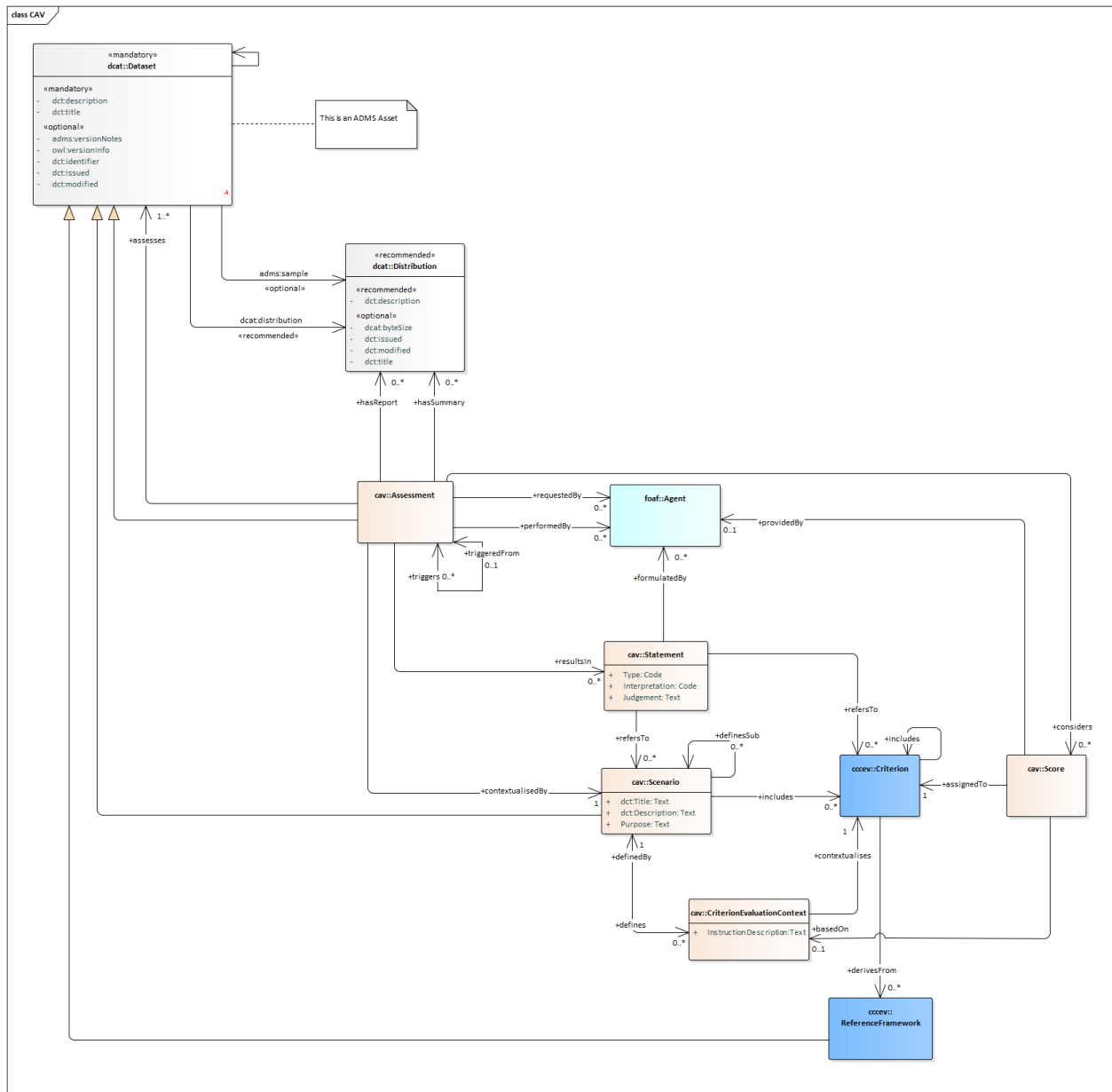


Figure 2 The Core Assessment Vocabulary

3.1.1. Interpretation

A **CAV Assessment** is a specialisation of the *dcat:Dataset*, i.e. it is an Asset as represented in ADMS¹⁰. Like any Asset, it can be identified and described and has individual distributions, publishers, etc. In addition 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 FOAF¹¹ Agent, such as a natural person, an organisation or a system. Notice that the objects assessed are also Assets meaning that the CAV may be used to assess anything that is considered a valuable resource. Example of such resources could be products, services, or, in the case of CAMSS, 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 its value output that is considered when formulating the resulting Statement(s).

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 **CriterionEvaluationContexts**.

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:Assessment**

OWL Class	cav:Assessment
Label:	Assessment

¹⁰ More specifically have a look into the ADMS-AP and DCAT-AP models in the Joinup platform. ADMS Application Profile <https://joinup.ec.europa.eu/solution/asset-description-metadata-schema-adms/releases>. DCAT Application Profile <https://joinup.ec.europa.eu/solution/dcat-application-profile-data-portals-europe/releases>

¹¹ FOAF Vocabulary Specification <http://xmlns.com/foaf/spec/>

Definition:	The intellectual work to evaluate an asset against the criteria of a given scenario.
Subclass of:	dcat:Dataset

3.2.1. Property: cav:hasReport

OWL Property	cav:hasReport
OWL type:	owl:ObjectProperty
Label:	hasReport
Definition:	<p>A manifestation¹² of all the information related to and resulting from an assessment.</p> <p>Additional Information:</p> <p>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;</p> <ol style="list-style-type: none"> 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

3.2.2. Property: cav:hasSummary

OWL Property	cav:hasSummary
OWL type:	owl:ObjectProperty
Label:	hasSummary
Definition:	An abbreviated manifestation of the performed assessment.

¹² The term "manifestation" is used herein as defined in the IFLA Library Reference Model (IFLA LRM):

<https://www.ifla.org/publications/node/11412>

Domain:	<i>cav:Assessment</i>
Range:	<i>dcat:Distribution</i>
Cardinality:	0..n

3.2.3. 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:	<i>cav:Assessment</i>
Range:	<i>dcat:Dataset</i>
Cardinality:	1..n

3.2.4. Property: cav:performedBy

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

3.2.5. Property: cav:requestedBy

OWL Property	cav:requestedBy
OWL type:	owl:ObjectProperty
Label:	requestedBy

Definition:	The agent(s) requesting the assessment of an asset.
Domain:	<i>cav:Assessment</i>
Range:	<i>foaf:Agent</i>
Cardinality:	0..n

3.2.6. 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:	<i>cav:Assessment</i>
Range:	<i>cav:Scenario</i>
Cardinality:	1

3.2.7. Property: cav:resultsIn

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

3.2.8. Property: cav:considers

OWL Property	cav:considers
OWL type:	owl:ObjectProperty
Label:	considers
Definition:	<p>The evaluation of a criterion score in the context of the current assessment as input to issue one or more statement(s).</p> <p>Additional Information:</p> <p>Scores are optional to allow expression of Assessments that are in progress, and to express Assessments that are informal and don't include specific Criteria.</p>
Domain:	cav:Assessment
Range:	cav:Score
Cardinality:	0..n

3.2.9. Property: cav:triggeredFrom

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

3.2.10. 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:	<i>cav:Assessment</i>
Range:	<i>cav:Assessment</i>
Examples:	0..n

3.3. Class: *cav:Scenario*

OWL Class	<i>cav:Scenario</i>
Label:	Scenario
Definition:	<p>The context of the assessment establishing its purpose, the organisation of criteria being evaluated, and its reference Framework(s).</p> <p>Additional Information:</p> <p>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.</p>
Subclass of:	<i>dcat:Dataset</i>

3.3.1. Property: *cav:includes*

OWL Property	<i>cav:includes</i>
OWL type:	<i>owl:ObjectProperty</i>
Label:	includes
Definition:	<p>The aggregation of criteria to one scenario or parts of it.</p> <p>Additional Information:</p> <p>This aggregation may be contextualised at different granularity levels, scenario, parts of the scenario or specific criteria.</p> <p>The cardinality is 0..* to allow assessments that are very high-level, informal or subjective without criteria and scoring. For CAMSS the cardinality is 1..*.</p>
Domain:	<i>cav:Scenario</i>

Range:	<i>cccev:Criterion</i>
Cardinality:	0..n

3.3.2. 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:	<i>cav:Scenario</i>
Range:	<i>cav:Scenario</i>
Cardinality:	0..n

3.3.3. 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:	<i>cav:Scenario</i>
Range:	<i>cav:CriterionEvaluationContext</i>
Cardinality:	0..n

3.3.4. Property: dct:Title

OWL Property	dct:Title
OWL type:	owl:DataProperty
Label:	Title

Definition:	A short self-descriptive name of the scenario.
Property Type:	xsd:String

3.3.5. Property: dct:Description

OWL Property	dct:Description
OWL type:	owl:DataProperty
Label:	Description
Definition:	An explanatory text about the scenario.
Property Type:	xsd:String

3.3.6. 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

3.4. Class: cav:Statement

OWL Class	cav:Statement
Label:	Statement
Definition:	<p>A value judgement, resulting from the assessment, pertinent to its entirety or to one or more of its specific parts (sub-scenarios or even individual criteria).</p> <p>Additional Information:</p> <p>An assessment without resulting statements is considered as a work in progress.</p>

3.4.1. 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

3.4.2. Property: cav:Type

OWL Property	cav:Type
OWL type:	owl:DataProperty
Label:	Type
Definition:	The categorisation of the statement (e.g. Whether the statement is a strong value judgement, a recommendation, a comment, etc.).
Property Type:	skos:Concept

3.4.3. Property: cav:Interpretation

OWL Property	cav:Interpretation
OWL type:	owl:DataProperty
Label:	Interpretation
Definition:	A code expressing the degree of favourability implied by the statement. Additional Information: Different domains could use different code list to express this (e.g. positive, negative, neutral).
Property Type:	skos:Concept

3.4.4. 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:	<i>cav:Statement</i>
Range:	<i>foaf:Agent</i>
Cardinality:	0..n

3.4.5. Property: cav:refersTo

OWL Property	cav:refersTo
OWL type:	owl:ObjectProperty
Label:	refersTo
Definition:	The reference to the specific elements on the assessment for which the statement is used. These can be the assessment's complete scenario, its parts (sub-scenarios) or even individual criteria. A statement with no such references is considered to apply to the assessment as a whole.
Domain:	<i>cav:Statement</i>
Range:	<i>cav:Scenario</i>
Cardinality:	0..n

3.4.6. Property: cav:refersTo

OWL Property	cav:refersTo
OWL type:	owl:ObjectProperty
Label:	refersTo
Definition:	The reference to the specific elements of the assessment for which the statement is issued. These can be the assessment's complete scenario, its parts (sub-scenarios) or even individual criteria. A statement with no such references is considered to apply to the assessment as a whole.
Domain:	<i>cav:Statement</i>

Range:	<i>cccev:Criterion</i>
Cardinality:	0..n

3.5. Class: *cav:CriterionEvaluationContext*

OWL Class	<i>cav:CriterionEvaluationContext</i>
Label:	Criterion 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.

3.5.1. Property: *cav:Description*

OWL Property	<i>cav:InstructionDescription</i>
OWL type:	owl:DataProperty
Label:	Instruction Description
Definition:	A text describing the context and evaluation instructions for the relevant criterion.
Property Type:	xsd:String

3.5.2. Property: *cav:definedBy*

OWL Property	<i>cav:definedBy</i>
OWL type:	owl:ObjectProperty
Label:	definedBy
Definition:	<p>The link to the scenario that provides the evaluation context for one or more criteria.</p> <p>Additional Information:</p> <p>The current evaluation context is meant to extend or replace the overall context of its defining scenario.</p>

Domain:	<i>cav:CriterionEvaluationContext</i>
Range:	<i>cav:Scenario</i>
Cardinality:	1

3.5.3. Property: cav:contextualises

OWL Property	cav:contextualises
OWL type:	owl:ObjectProperty
Label:	contextualises
Definition:	The provision of context for the evaluation of the criterion as an extension or replacement of the scenario's overall context.
Domain:	<i>cav:CriterionEvaluationContext</i>
Range:	<i>cccev:Criterion</i>
Cardinality:	1

3.6. Class: cav:Score

OWL Class	cav:Score
Label:	Score
Definition:	<p>The value output assigned to the criterion as part of the assessment.</p> <p>Additional Information:</p> <p>An assessment with no scores can be a work in progress or an assessment that is high-level and that does not include specific criteria.</p>

3.6.1. 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:	<i>cav:Score</i>
Range:	<i>cav:CriterionEvaluationContext</i>
Cardinality:	0..1

3.6.2. Property: *cav:assignedTo*

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

4. CORE STANDARDS AND SPECIFICATIONS VOCABULARY (CSSV)

The Core Standards and Specifications Vocabulary is depicted in *Figure 3 The Core Standards and Specifications Vocabulary*. The figure shows the classes and properties that are used or defined in the CSSV.

4.1. Data Model for the CSSV

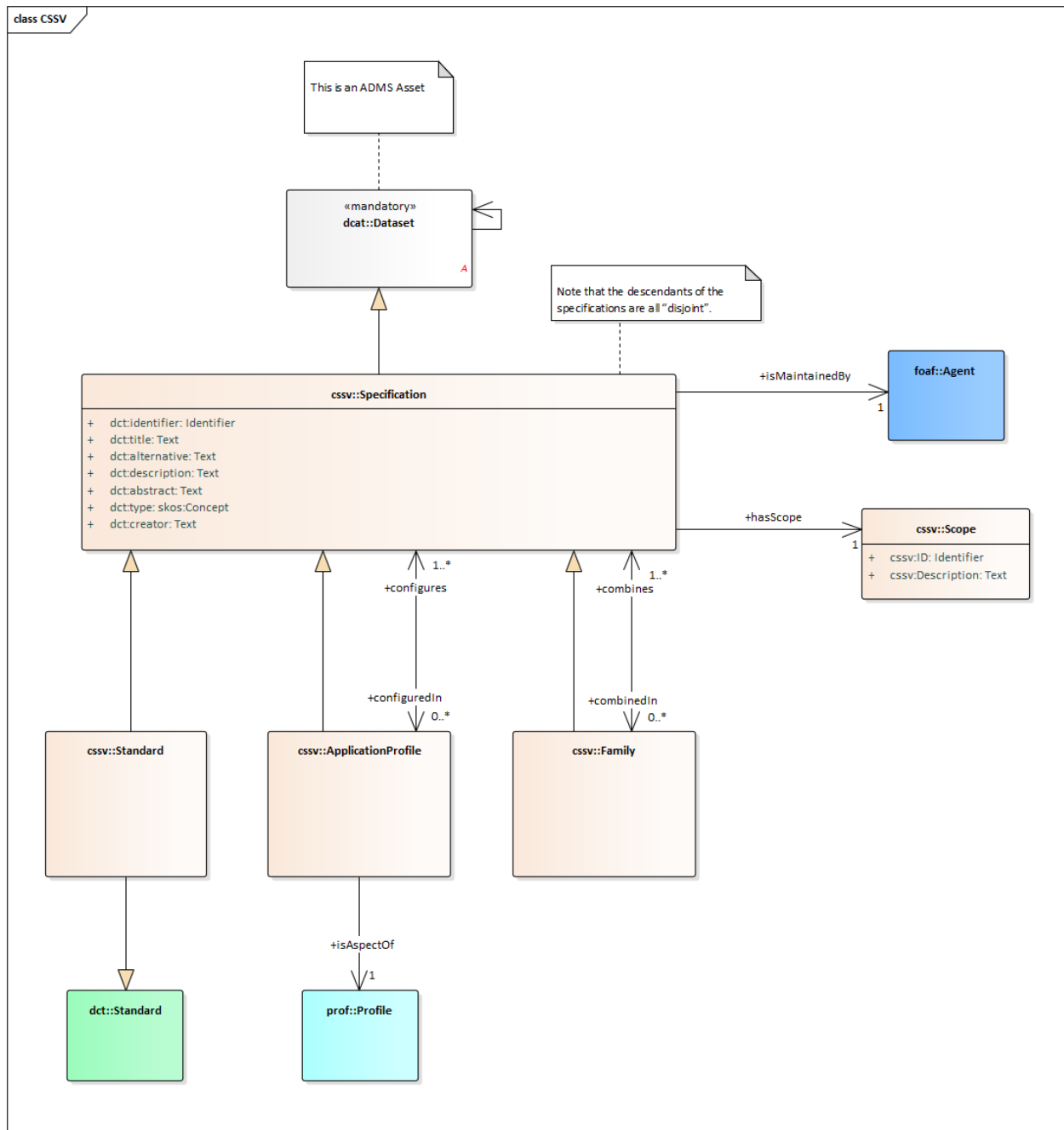


Figure 3 The Core Standards and Specifications Vocabulary

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 is the representative of an ADMS Asset.

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

- A **Specification** as a set of agreed, descriptive and normative statements about how a specification should be designed or made.
- A **Standard** as a specification that is largely adopted and possibly endorsed.
- An **ApplicationProfile** as 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** as 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 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 Vocabularies¹³: 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 ADMS and DCAT models).

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 (ISA² CPV) and the Organization Ontology (W3C Org) for this purpose.

¹³ EU Vocabularies: <https://publications.europa.eu/en/web/eu-vocabularies/controlled-vocabularies>

In terms of reusability, the class *cssv:Scope* allows the reuse of the Specification. It makes reference to the area of requirements addressed by the specification.

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 standards. 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 ADMS 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: <ul style="list-style-type: none"> - DCAT (W3C) - URI: http://www.w3.org/ns/dcat# - Expression in CSSV: <pre>@prefix cssv: <http://data.europa.eu/xyz/cssv#> . @prefix dct: <http://purl.org/dc/terms/> .</pre>

	<pre> <http://www.w3.org/ns/dcat#> a <cssv:Specification> ; dct:identifier "http://www.w3.org/ns/dcat#" . </pre>
--	--

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: dct:alternative

OWL Property	dct:alternative
OWL type:	owl:DataProperty
Label:	Alternative Title
Definition:	The alternative name 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:	A free-text account of the Specification.

4.2.5. Property: dct:abstract

OWL Property	dct:abstract
OWL type:	owl:DataProperty
Label:	Abstract
Definition:	A summary of the specification.
Property Type:	xsd:String
Examples:	To define the main concepts and characteristics related to specifications, standards and their combinations and relationships.

4.2.6. Property: dct:type

OWL Property	dct:type
OWL type:	owl:DataProperty
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
Examples:	Definition, Artefact, Summary.

4.2.7. Property: dct:creator

OWL Property	dct:creator
OWL type:	owl:DataProperty

Label:	Creator
Definition:	The primary entity responsible for making the specification.
Property Type:	xsd:AnyURI
Examples:	A creator include a person, an organization, or a service.

4.2.8. 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:	<i>cssv:Specification</i>
Range:	<i>cssv:ApplicationProfile</i>
Examples:	Instance classes representing application profiles, such as DCAT-AP, ADMS-AP, other.

4.2.9. 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:	<i>cssv:Specification</i>
Range:	<i>cssv:Family</i>
Examples:	OASIS UBL XML-based family (XML, XML Schema Definition, ISO Schematron, OASIS Genericcode, Context Value Association (CVA), UN/CEFACT unqualified data types); OASIS JSON-based family; CEN TC 440 families; UN/CEFACT CII elnvoice family; other.

4.3. Class: *cssv:Standard*

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

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	<i>cssv:ApplicationProfile</i>
Label:	Application Profile
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:	<i>cssv:Specification</i>

4.4.1. Property: *cssv:configures*

OWL Property	<i>cssv:configures</i>
OWL type:	owl:ObjectProperty
Label:	Configures
Definition:	Whether an Application Profile design or adapts a Specification for a specific purpose.
Domain:	<i>cssv:ApplicationProfile</i>
Range:	<i>cssv:Specification</i>

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.
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4.5. Class: *cssv:Family*

OWL Class	<i>cssv:Family</i>
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:	<i>cssv:Specification</i>

4.5.1. Property: *cssv:combines*

OWL Property	<i>cssv:combines</i>
OWL type:	owl:ObjectProperty
Label:	Combines
Definition:	Whether a Family is a union of more than one Specifications.
Domain:	<i>cssv:Family</i>
Range:	<i>cssv:Specification</i>
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 invoice family; other. Conformance Statement.

4.6. Class: *cssv:Scope*

OWL Class	<i>cssv:Scope</i>
Label:	Scope

Definition:	Area of requirements addressed by the specification.
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4.6.1. Property: cssv:ID

OWL Property	cssv:ID
OWL type:	owl:DataProperty
Label:	identifier
Definition:	This property contains the main identifier for the scope, e.g. the URI or another unique identifier.
Property Type:	xsd:AnyURI
Examples:	Any URI pointing at an instance of the Scope.

4.6.2. Property: cssv:Description

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

5. CORE CRITERION AND CORE EVIDENCE VOCABULARY (CCCEV)

The Core Criterion and Core Evidence Vocabulary is depicted in *Figure 4 The Core Criterion and Core Evidence Vocabulary*. The figure shows the classes and properties that are used or defined in the CCCEV.

5.1. Data Model for the CCCEV¹⁴

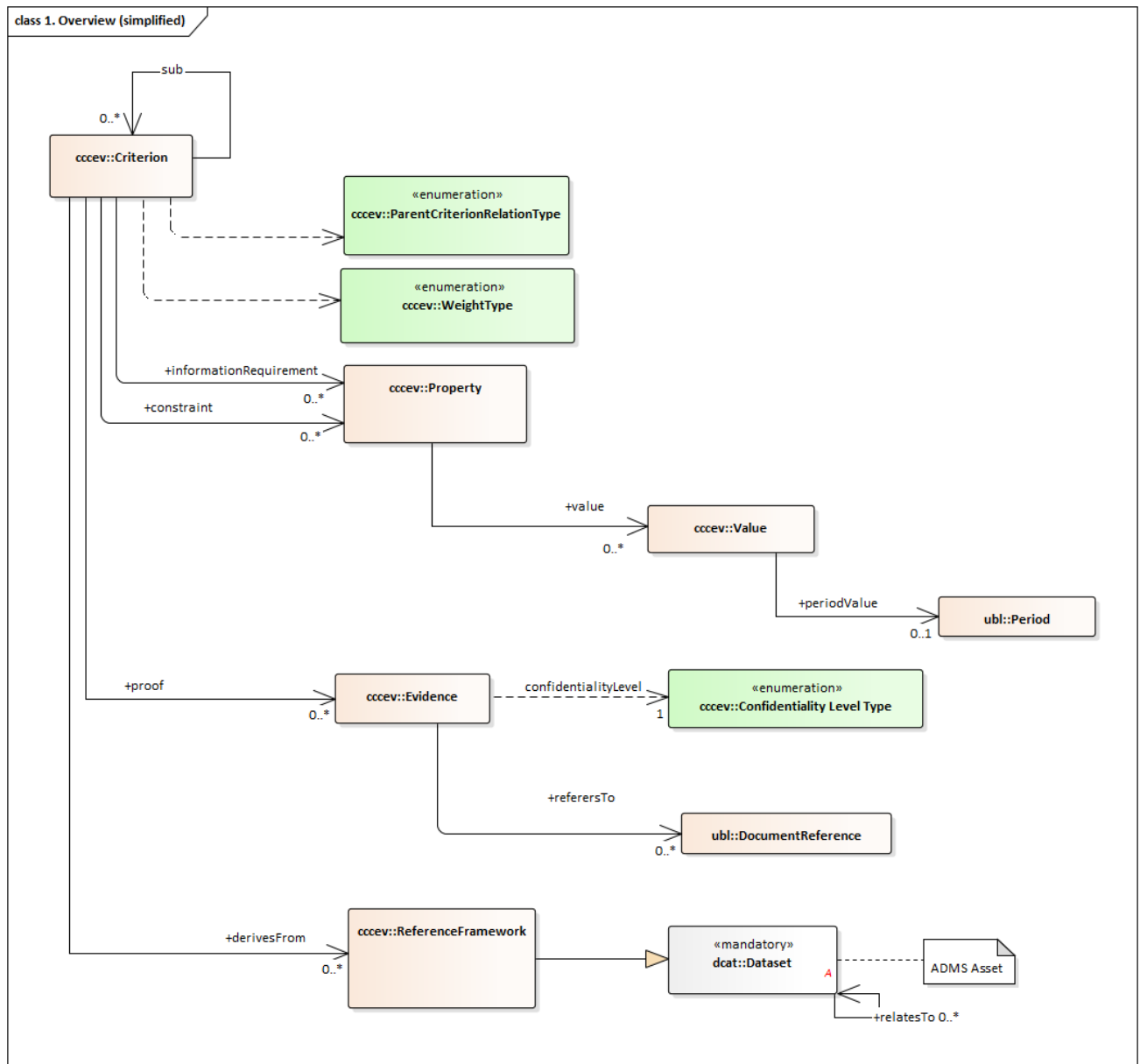


Figure 4 The Core Criterion and Core Evidence Vocabulary

¹⁴ SEMIC CCCEV issues: <https://github.com/SEMICeu/CCCEV/issues>

The CCCEV is currently being evolved based on its used by different EU projects (CAMSS, ESPD, ePO, TOOP, UBL 2.2, other). The BETA CAMSS Ontology would benefit of this version of the CCCEV reviewed by the SEMIC WG. Visit the SEMIC GitHub platform, notably the issues, to locate the latest versions of the model.

5.1.1. Interpretation

From a very generic perspective, a “Criterion” is “one condition for evaluation”. One criterion may constitute a very atomic data structure amounting to the requirement of one single information, usually in the form of a question, or a quite complex one composed of a collection of information requirements and nested sub-criteria.

Sometimes, the author of the criterion needs to “constrain” the information requirement. Thus, examples of atomic criteria containing an information requirement and a constraint could be:

- **Example 1** (in the domain of public procurement):
 - Information requirement: “What is the average turnover of your company for the past three years?” (the expected response is one value instance of type “Amount” (a quantity of money and the currency);
 - Constraint: “Candidates with average turnovers below 1,000,000.00 Euros will be discarded” (the value type provided by the author is an amount and currency: 1M Euros).
- **Example 2** (in the domain of assessments of standards and specifications):
 - Information Requirement: “Is the standard subject to royalties?” (The expected answer is one value instance of type Indicator, i.e. a boolean).
- **Example 3** (in the domain of personnel selection in Human Resources):
 - Information Requirement: “Provide the ESCO URI leading to the description of the jobseeker’s qualification (the expected response is one value instance of the type URI pointing to a concept within the ESCO Taxonomy1);
 - Constraint: Jobseekers with no university degrees, masters or PHD will be discarded.
- **Example 4** (in the domain of Fiscal operations):
 - Information Requirement: “Provide the fiscal year periods (start date, end date/period unit, and optionally the period description) for each one the companies of the mother holding organisation” (the expected response is a set of multiple value instances of the type Period).

To one information requirement, only one type of data value can be provided as a response (examples 1 to 3 above). This means that the different types of values (the attributes in the class “Value”) are disjoint amongst themselves. This does not preclude the fact that a collection of values of the same type can be provided in one response (example 4).

Both, information requirements and constraints on them are considered “properties” of the criterion that can be identified, classified, described and associated with values of one specific type.

Criteria may be supported by pieces of evidence. Evidence provides metadata about where to get information proving that the responses are trustworthy, how to access them, the type of evidence, the authority responsible for it, etc.

Criteria are not drafted “out of the blue”. They are usually derived from the analysis of existing “reference frameworks”, e.g. based on the principles, dimensions and recommendations of the European Interoperability Framework (EIF), an ISO, a legislative act, or just the knowledge and experience of a person or a team.

An example of a non-atomic and yet quite simple criterion could be:

- Criterion: “Minimum qualification to access this PhD program”
 - Information requirement: “Do you have a degree in a technical discipline?”
 - Sub-criterion: “Is the degree on an ICT discipline?”
 - Information requirement 1: “Answer Yes or No”
 - Information requirement 2: “If Yes please specify it”

6. THE CAMSS ONTOLOGY

This section describes two essential aspects of the CAMSS Ontology:

- **The CAMSS Ontology Vocabulary:** On the 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” standing 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 will be populated with the existing CAMSS Assessments once transformed into an OWL2 Syntax, and conformant to the axioms defined in the T-Box.

6.1. 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.

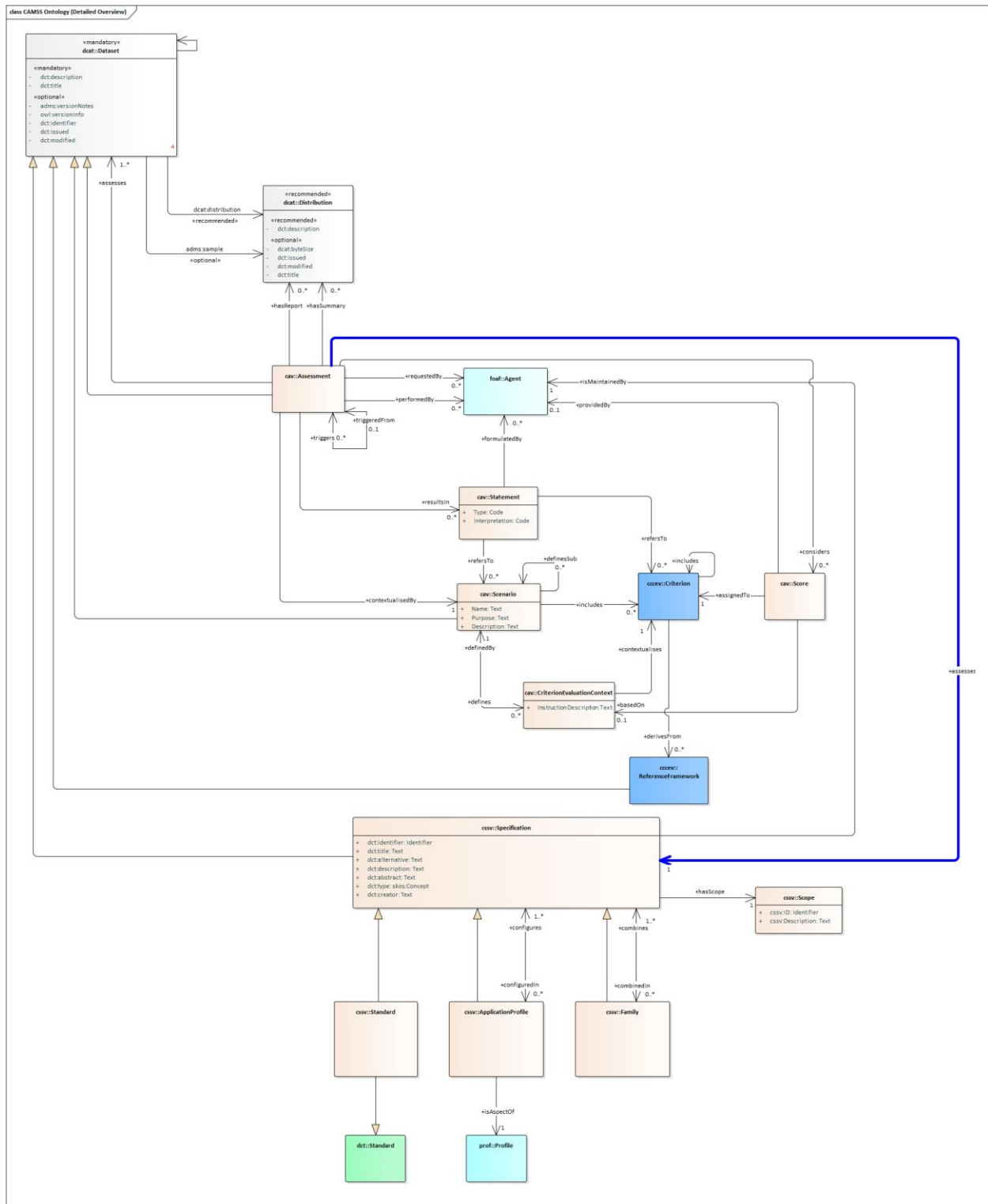


Figure 5 The CAMSS Ontology Vocabulary

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 Dataset, the CAMSS Ontology Assessment assesses CSSV Specifications, which are also DCAT Datasets.

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 only one specification. Beware that application profiles and families are descendants of one specification. Thus the cardinality 1.

6.2. The CAMSS Ontology Facts

The CAMSS Ontology Vocabulary links the two domains of CAMSS, Assessments and Specifications. For the time being, the Assessments and Specifications performed in the context of CAMSS have not been yet expressed according to the CAMSS Ontology Vocabulary described in the section above. This is yet an on-going work, since the Ontology has dependencies on other vocabularies currently under development. Therefore, the population of the A-Box will be done in next releases of the CAMSS Ontology, once the dependencies stability is greater or solved.

Nonetheless, this section aims to introduce how the Physical Instantiation of the CAMSS Ontology would be in the next release. For that purpose, the following figure depicts an example of possible assertions in a CAMSS Knowledge Base A-Box.

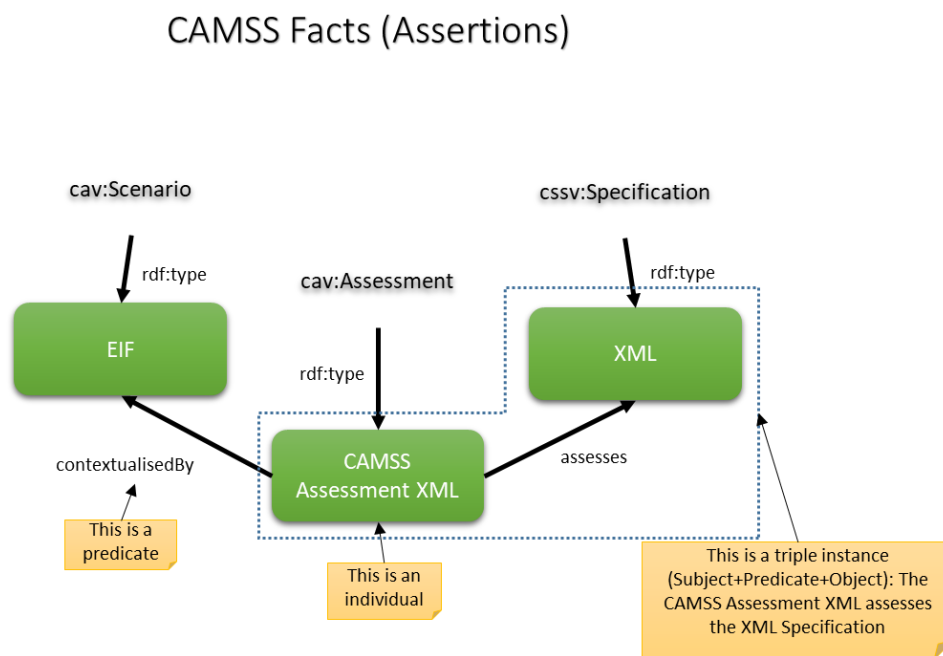


Figure 6 Example of CAMSS Facts

7. CONCLUSIONS AND NEXT STEPS

7.1. Conclusions

1. No ontologies or vocabularies were identified that fully covered the needs of the CAMSS domain. Hence the decision of developing a new CAMSS Ontology was made;
2. The CAMSS Ontology does not provide any new entity *per se*: It is a very simple model that reuses existing vocabularies and restricts their properties;
3. Some of the vocabularies reused by the CAMSS Ontology are currently under revision or evolution (CSSV and CCCEV). Therefore the outcome of this document must be considered a BETA version of the CAMSS Ontology.
4. One of the vocabularies reused by the CAMSS Ontology had to be developed from scratch, the CAV. Therefore once the CAMSS Ontology is reviewed, a public consultation of the CAV should be proposed.

7.2. Next Steps

1. **CAV PoC and Public Consultation:** It would be convenient to perform a proof of concept of the CAV. One proposal is to use the CAV in different existing domains of assessments, e.g. IMAPS¹⁵, IQAT¹⁶, CAMSS¹⁷, other to be identified. Once finished the PoC, the CAV might be modified. That would be a good moment to launch a public consultation of the CAV.

8. DEFINITIONS, ACRONYMS AND ABBREVIATIONS

Term	Description
IMAPS	Interoperability Maturity Assessments of a Public Service
IQAT	Interoperability Quick Assessment Toolkit
CAMSS	Common Assessment Methods for Standards and Specifications

¹⁵ Interoperability Maturity Assessment of a Public Service (IMAPS): <https://joinup.ec.europa.eu/collection/imaps-interoperability-maturity-assessment-public-service>

¹⁶ Interoperability Quick Assessment Toolkit (IQAT): <https://joinup.ec.europa.eu/release/iqat/v120>

¹⁷ Common Assessment Method for Standards and Specifications (CAMSS): <https://joinup.ec.europa.eu/collection/common-assessment-method-standards-and-specifications-camss/about>

EIF	European Interoperability Framework
ESPD	European Single Procurement Document
OWL	The W3C Web Ontology Language
FOAF	Friend of a Friend
CAV	Core Assessment Vocabulary
CSSV	Core Standards and Specifications Vocabulary
CCCEV	Core Criterion and Core Evidence Vocabulary
ADMS	Asset Description Metadata Schema
CPV	Core Person Vocabulary
MSP	Multi-Stakeholder Platform

9. REFERENCES

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ANNEX 1 - ONTOLOGY BASIS

An Ontology is a formal description of knowledge as a set of concepts within a domain and the axioms connecting concepts and allowing for logic inferences. When speaking about an ontology, we do not refer only to the terminology (or T-Box) but also to all the “assertions” about the concepts and roles (the A-Box), i.e. all the individuals or instances of concepts and roles of the terminology and as important, the rules for logic inference: the semantics “part”.

The following picture depicts the T-Box and A-Box of the CAMSS Ontology. The right part of the picture represents the T-Box, also known as Vocabulary, and the left part of the picture represents the T-Box plus instances of it (elements of the A-Box).

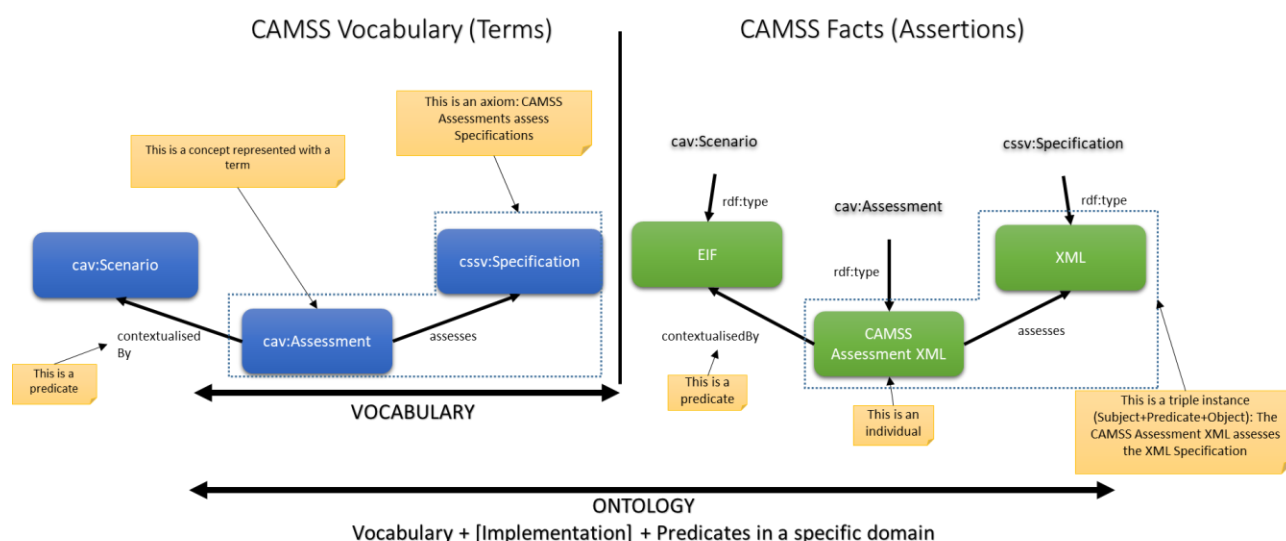


Figure 7 CAMSS Ontology components (T-Box and A-Box)

ANNEX 2 - CAMSS ONTOLOGY AND EIRA ONTOLOGY ALIGNMENT



The CAMSS
Ontology v1.0.pptx

ANNEX 3 – CAMSS ONTOLOGY MODEL (BETA VERSION)



CAMSS Ontology
BETA v1.1.0.eap

ANNEX 4 – CORE ASSESSMENTS VOCABULARY (BETA VERSION)



CAV v1.0 BETA.eap

ANNEX 5 – CORE STANDARDS AND SPECIFICATIONS VOCABULARY (v1.0.0)



CSSV v1.0.0.eap