Deliverable D2.2
Metadata Specification

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			Introduced new external classes +MPEG-21-DIA_NetworkMetadata, +MPEG-21-DIA_NaturalEnvironmentMetadata, +MPEG-21-DIA_ContentPreferencesMetadata +MPEG-21-DIA_PresentationPreferencesMetadata +MPEG-7-UserPersonalMetadata
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28/05/09	V1E1	I.M. Bilasco, S. Amir, J. Martinet, C. Djeraba, J.Laitakari, E. Martinez, A. Heikkinen, M. Rautiainen	Introduction of mandatory properties and some type changing (decimal -> int; double -> float)
18/06/09	V1E2	I.M. Bilasco	Introduction of hasDeviceIdentity property

Table of contents

1 Introduction

This document shows technical definitions for metadata elements. The work is based on ITEA 2008 RDF schema while accommodating to D2.1 definitions.

We first describe the Abstract part of the model: by specifying core-related abstract classes, supplementary-related abstract classes and external-related abstract classes.

Concrete Core schema concerning metadata elements that directly describe a CAM Object or a CAM Bundle are presented in section 3.

Concrete supplementary metadata that is not directly linked to CAM Object or CAM Bundle elements is presented in section 4.

Concrete external metadata are presented in section 5.

We have adopted the following naming convetions :

- all classes names start with Capital letter
- all properties names start with a regular letter
- all properties that contain CAM4HOME structured metadata start with the “has” prefix
- properties are listed in alphabetical order

We use the following **namespaces** in order to distinguish between the abstract part of the model and the concrete parts of the model

- abstract – http://www.cam4home-itea.org/metamodel/abstract# : introduces classes and properties belonging to CAM Abstract Metamodel
- core – http://www.cam4home-itea.org/metamodel/core# *:* introduces classes and properties belonging to CAM Core Concrete Metamodel
- supplementary – http://www.cam4home-itea.org/metamodel/supplementary# *:*introduces classes and properties belonging to CAM Supplementary Concrete Metamodel
- external – http://www.cam4home-itea.org/metamodel/external# *:* introduces classes and properties belonging to CAM External Concrete Metamodel

For each **metadata class**, we provide:

- description of use and purpose
- origin of metadata
- metadata format, target types and RDF Schema definitions

For each **metadata property**, we provide:

- description of use and purpose
- origin of metadata
- metadata format, target types and RDF Schema definitions
- practical examples (optional)

Due to the fact that the RDF Schema language do not allow to differentiate between **Aggregation vs Composition encodings**, we have adopted the following conventions :

- Composition : all the compositions will be encoded either using nesting or using rdf:resource references.
- Aggregation : all the aggregations will be encoded using string references that corresponds to the CAM4Home UID of composing objects.
- When deleting an RDF instance, the system will delete all the nested instances or instances referred to using rdf internal mecanism (rdf:resource).

In order to deal with the fact that some properties are mandatory in the instantiation of some structured metadata constructs (such as camElementMetadataID in CAM Object), we introduce a specific control property called mandatoryProperty(as indicated here bellow). All mandatory properties inherit from this mandatoryProperty rdf:Property

```
<rdf:Property rdf:about="&abstract;controlProperty"
      rdfs:label="abstract:controlProperty"/>

<rdf:Property rdf:about="&abstract;mandatoryProperty"
      rdfs:label="abstract:mandatoryProperty">
      <rdfs:subPropertyOf rdf:resource="&abstract;controlProperty"/>
      </rdf:Property>.
```

2 Abstract Metamodel

CAM Abstract Metamodel is a higher level description of the CAM Concrete Metamodel and it defines a generic categorization of concrete metadata entities and associations between them on an abstract level. Abstract level representation of the concrete metadata entities in the CAM Metamodel enables the following features.

- **Generic description of the domain**. Generic categorization of concepts provides a common general backbone model for intelligent distribution, delivery and consumption of CAM content that can be extended and specialized to cater more specific subdomains without losing system compatibility.
- **Reuseability of the model**. When the common concepts and their relations of the domain are specified in a general level, the model can be more efficiently reused for defining metadata models for other subdomains.
- **Shared knowledge**. As the common concepts of the domain have their generic definitions, the abstract model allows interpretation (e.g. searches) of the extended subdomain models that might be completely different.
- **Explicit rule definitions**. The Abstract Metamodel defines explicit restrictions on the model level that propagates to the more specific metadata entities extending the Abstract Metamodel thus reducing the required system level policies for prohibited instantiations of the model or association of model elements.

The Abstract Metamodel is divided to three different categories according to the categories of CAM Concrete Metamodel part for which they provide the generic categorization. This division is illustrated in Figure 1 and described more in details as follows.

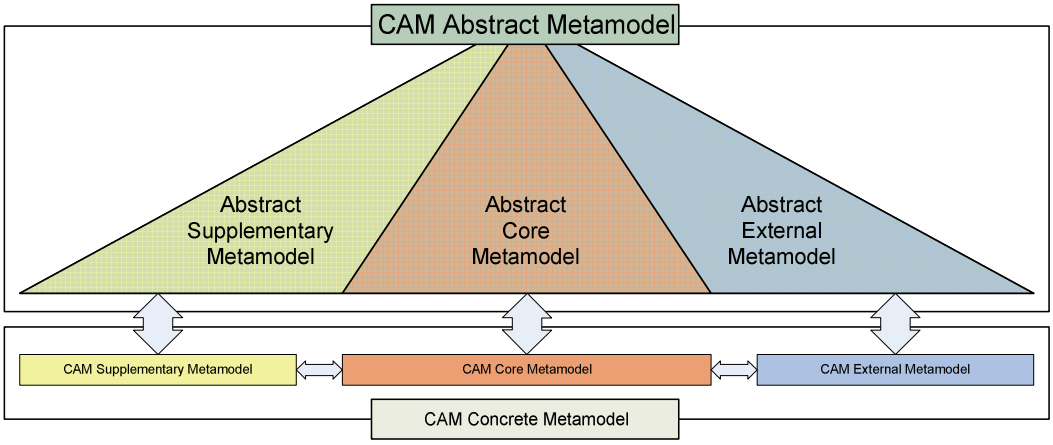

Figure 1. The categories of CAM Abstract Metamodel

- **Abstract Core Metamodel.** Categorizes, and provides generic associations for metadata entities representing CAM Elements, CAM Element metadata, CAM Bundle and CAM Bundle metadata.
- **Abstract Supplementary Metamodel.** Provides a generilization of the environment model where the CAM Bundles are existing in different phases of their lifecycle (creation, modification, distribution, delivery, interpretation and consumption) by introducing the high level model for devices, services, users and communities related to the CAM4Home domain.

- **Abstract External Metamodel.** Categorizes of exisiting metadata formats that can be associated with the content inside the CAM Bundle when a more specific metadata description of content is required by certain applications.

This chapter is organized according to the different categories of the Abstract Metamodel and a detailed description of the generic constructs and associations is provided in the following sections.

2.1 Abstract Core Metamodel

The core metamodel is organized as illustrated in Figure 2. The metamodel defines metadata and metadata containers. A metadata container can either contain structured metadata (ContentMetadata) or simple metadata (described by literals). For reinforcing the types associated with simple metadata, we have adopted the simple types defined by the XML Schema language. This choice is motivated by the fact that most of the existing XML parsers can manage and interpret a least simple XSD types. In this way, the implementation of the CAM4HOME metadata framework can benefit of existing technologies.

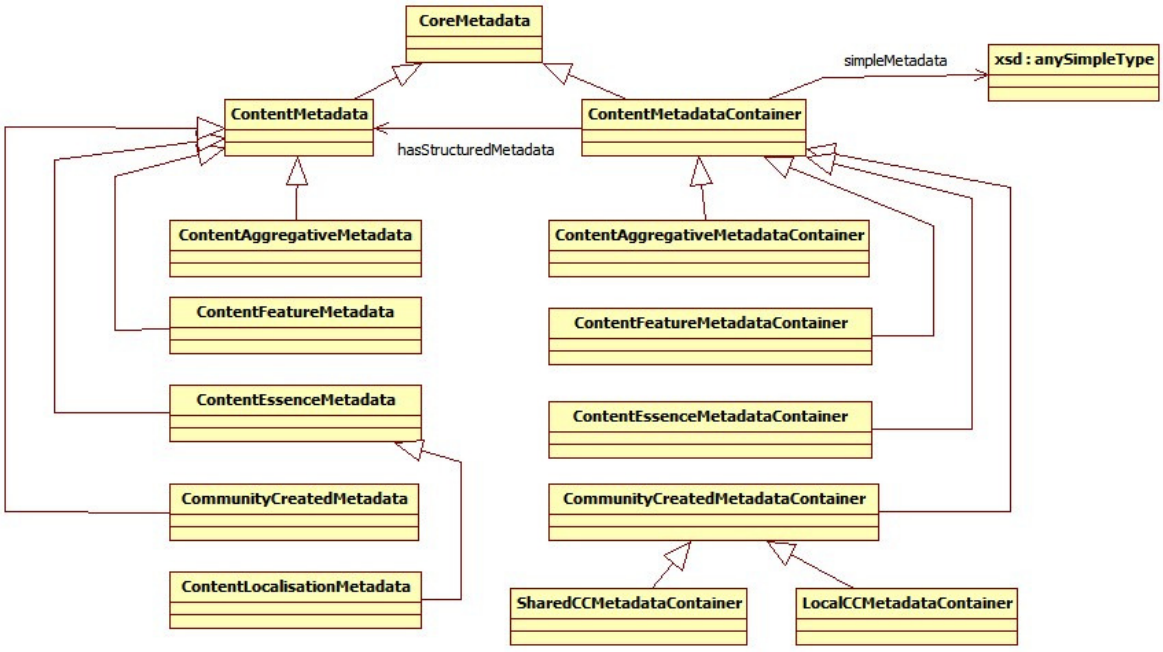

Figure 2 Core metamodel class hierarchy

This section is organized as follows. We describe metadata classes. Then we detail the container classes. Finally, we present the properties linking containers and metadata.

2.1.1 Metadata class specifications

This section specifies the classes contained in the abstract part of the Core Metamodel represented in Figure 2.

2.1.1.1 CoreMetadata

Purpose

This class is the upper class for all metadata classes in Core Metamodel.

Not intended to be instantiated.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&abstract;CoreMetadata"
    rdfs:label="abstract:CoreMetadata">
  <rdfs:subClassOf rdf:resource="&rdfs;Resource"/>
</rdfs:Class>
```

2.1.1.2 ContentMetadata

Purpose

Category class for core metadata datatypes.

Not intended to be instantiated.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&abstract;ContentMetadata"
    rdfs:label="abstract:ContentMetadata">
  <rdfs:subClassOf rdf:resource="&abstract;CoreMetadata"/>
</rdfs:Class>
```

2.1.1.3 ContentAggregativeMetadata

Purpose

This class divides the core metadata datatypes that are used to describe aggregation of content.

Not intended to be instantiated.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&abstract;ContentAggregativeMetadata"
    rdfs:label="abstract:ContentAggregativeMetadata">
  <rdfs:subClassOf rdf:resource="&abstract;ContentMetadata"/>
</rdfs:Class>
```

2.1.1.4 ContentEssenceMetadata

Purpose

This class is a category for metadata datatypes that are used to describe the actual content (essence). Instances of this class describes the connection from the metadata level to the concrete level.

Not intended to be instantiated.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&abstract;ContentEssenceMetadata"
    rdfs:label="abstract:ContentEssenceMetadata">
  <rdfs:subClassOf rdf:resource="&abstract;ContentMetadata"/>
</rdfs:Class>
```

2.1.1.5 ContentLocalizationMetadata

Purpose

Subclass of ContentEssenceMetadata. This class is a category for metadata datatypes that are used to describe the localization of the actual content (essence). Instances of this class describes the connection from the metadata level to the concrete level.

Not intended to be instantiated.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&abstract;ContentLocalizationMetadata"
    rdfs:label="abstract:ContentLocalizationMetadata">
  <rdfs:subClassOf rdf:resource="&abstract;ContentEssenceMetadata"/>
</rdfs:Class>
```

2.1.1.6 CommunityCreatedMetadata

Purpose

This class is a category for metadata datatypes that are used to evaluate content.

Not intended to be instantiated.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&abstract;CommunityCreatedMetadata"
    rdfs:label="abstract:CommunityCreatedMetadata">
  <rdfs:subClassOf rdf:resource="&abstract;ContentMetadata"/>
</rdfs:Class>
```

2.1.1.7 ContentFeatureMetadata

Purpose

This class is a category for all metadata datatypes that describe the features of content.

Origin of metadata

Not intended to be instantiated.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&abstract;ContentFeatureMetadata"
```

```
    rdfs:label="abstract:ContentFeatureMetadata">
  <rdfs:subClassOf rdf:resource="&abstract;ContentMetadata"/>
</rdfs:Class>
```

2.1.2 Metadata container class specifications

2.1.2.1 ContentMetadataContainer

Purpose

Upper class for all core metadata that can be thought as containers for the metadata that is used describe content (instances of ContentMetadata).

Not intended to be instantiated.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&abstract;ContentMetadataContainer"
    rdfs:label="abstract:ContentMetadataContainer">
  <rdfs:subClassOf rdf:resource="&abstract;CoreMetadata"/>
</rdfs:Class>
```

2.1.2.2 ContentAggregativeMetadataContainer

Purpose

Upper class for all metadata containers which purpose is to describe content aggregation.

Not intended to be instantiated.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&abstract;ContentAggregativeMetadataContainer"
    rdfs:label="abstract:ContentAggregativeMetadataContainer">
  <rdfs:subClassOf rdf:resource="&abstract;ContentMetadataContainer"/>
</rdfs:Class>
```

2.1.2.3 ContentEssenceMetadataContainer

Purpose

Upper class for all metadata containers which purpose is to hold the metadata that provides the content with connection from the metadata level to the concrete level.

Not intended to be instantiated.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&abstract;ContentEssenceMetadataContainer"
    rdfs:label="abstract:ContentEssenceMetadataContainer">
  <rdfs:subClassOf rdf:resource="&abstract;ContentMetadataContainer"/>
</rdfs:Class>
```

2.1.2.4 CommunityCreatedMetadataContainer

Purpose

Upper class for all metadata containers which purpose is to hold the metadata that evaluates the content.

Not intended to be instantiated.

Details about the usage of local vs shared metadata containers can be found in section 6.1.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&abstract;CommunityCreatedMetadataContainer"
    rdfs:label="abstract:CommunityCreatedMetadataContainer">
  <rdfs:subClassOf rdf:resource="&abstract;ContentMetadataContainer"/>
</rdfs:Class>
```

LocalCCMetadataContainer rdf class definition

```
<rdfs:Class rdf:about="&abstract;LocalCCMetadataContainer"
    rdfs:label="abstract:LocalCCMetadataContainer">
<rdfs:subClassOf
    rdf:resource="&abstract;CommunityCreatedMetadataContainer"/>
</rdfs:Class>
```

SharedCCMetadataContainer rdf class definition

```
<rdfs:Class rdf:about="&abstract;SharedCCMetadataContainer"
     rdfs:label="abstract:SharedCCMetadataContainer">
  <rdfs:subClassOf
     rdf:resource="&abstract;CommunityCreatedMetadataContainer"/>
</rdfs:Class>
```

2.1.2.5 ContentFeatureMetadataContainer

Purpose

Upper class for all metadata that can be thought as a container for metadata that describes the features of a content.

Not intended to be instantiated.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&abstract;ContentFeatureMetadataContainer"
    rdfs:label="abstract:ContentFeatureMetadataContainer">
  <rdfs:subClassOf rdf:resource="&abstract;ContentMetadataContainer"/>
</rdfs:Class>
```

2.1.3 Metadata property specifications

This section specifies the properties in abstract part of the Core Metamodel. Five categories of properties where identified at abstract level :

- properties that references Core metadata from other Core concepts (i)
- properties that references Supplementary metadata from Core concepts (ii)
- properties that associates External metadata to Core concepts (ii)
- properties that associate ContentMetadata subclasses to ContentMetadataContainer subclasses (1.1.1.2-1.1.1.4)
- properties that associate system dependant data (e.g. IDs) to metadata containers (object and bundle descriptions) (1.1.1.5)

The first three categories of metadata are illustrated in Figure 3

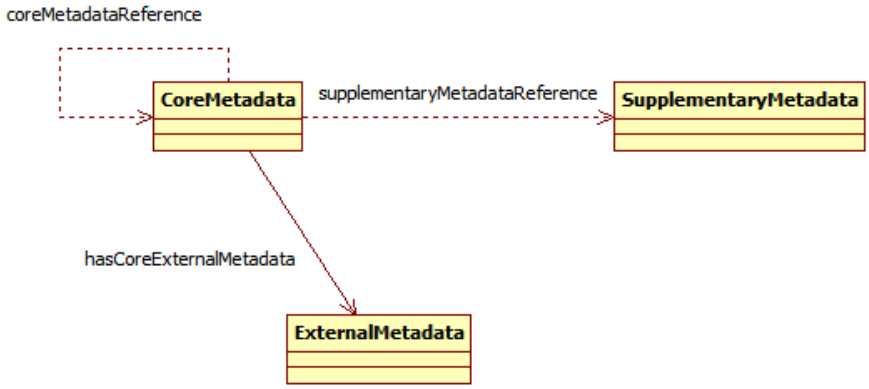

Figure 3 Relations between the core, supplementary and external concepts

The fourth category is illustrated in Figure 4.

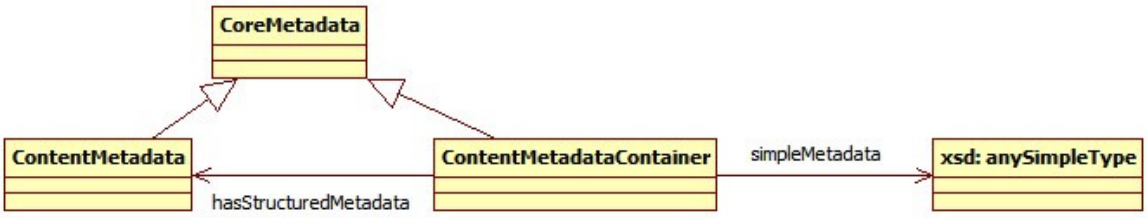

Figure 4 Metadata types associated with core metadata containers

2.1.3.1 CoreMetadata properties

i. coreMetadataReference

Purpose

Associates the Core Metamodel instances to other Core Metamodel instances through the usage of CAM4Home internal references. It supports the encoding of aggregation relations (e.g. a CAMBundle is aggregated from

CAMObject1, CAMObject2 and CAMObject3) as indicated in the introductory section of this document (section 1)

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;coreMetadataReference"
    rdfs:label="abstract:coreMetadataReference">
  <rdfs:domain rdf:resource="&abstract;CoreMetadata"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

ii. hasCoreExternalMetadata

Purpose

Associates the Core Metamodel instances to the instances of External Metamodel.

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;hasCoreExternalMetadata"
    rdfs:label="abstract:hasCoreExternalMetadata">
  <rdfs:domain rdf:resource="&abstract;CoreMetadata"/>
  <rdfs:range rdf:resource="&abstract;ExternalCoreMetadataFormat"/>
</rdf:Property>
```

iii. supplementaryMetadataReference

Purpose

Associates the Core Metamodel instances or Supplementary Metamodel instances to the instances of Supplementary Metamodel using the CAM4HOME UID associated to supplementary entities. It supports the encoding of aggregation relations as indicated in the introductory section of this document (section 1)

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;supplementaryMetadataReference"
    rdfs:label="abstract:supplementaryMetadataReference">
  <rdfs:domain rdf:resource="&abstract;CoreMetadata"/>
  <rdfs:domain rdf:resource="&abstract;SupplementaryMetadata"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

1.1.1.2 ContentMetadataContainer properties

i. contentProperty

Purpose

Upper property that can be thought as the most generic property in the abstract model. Refinements of this property is provided for each specific metadata containers depending on the nature of metadata (complex – extending ContentMedata class or simple – corresponding to textual description : title, description, etc.).

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;contentProperty"
    rdfs:label="abstract:contentProperty">
  <rdfs:domain rdf:resource="&abstract;ContentMetadataContainer"/>
  <rdfs:range rdf:resource="&rdfs;Resource"/>
</rdf:Property>
```

ii. hasStructuredMetadata

Purpose

Upper property that can be thought as the most generic property linking complex metadata (subclasses of ContentMetadata) to metadata containers in the abstract model. Refinements of this property are provided for each specific metadata containers.

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;hasStructuredMetadata"
    rdfs:label="abstract:hasStructuredMetadata">
  <rdfs:subPropertyOf rdf:resource="&abstract;contentProperty"/>
  <rdfs:domain rdf:resource="&abstract;ContentMetadataContainer"/>
  <rdfs:range rdf:resource="&abstract;ContentMetadata"/>
</rdf:Property>
```

iii. simpleMetadata

Purpose

Upper property that can be thought as the most generic property linking simple (textual) metadata (example: title, description, …) to metadata containers in the abstract model. Refinements of this property are provided for each specific metadata containers.

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;simpleMetadata"
    rdfs:label="abstract:simpleMetadata">
  <rdfs:subPropertyOf rdf:resource="&abstract;contentProperty"/>
  <rdfs:domain rdf:resource="&abstract;ContentMetadataContainer"/>
  <rdfs:range rdf:resource="&xsd;anySimpleType"/>
</rdf:Property>
```

1.1.1.3 CommunityCreatedMetadataContainer properties

i. hasCCMetadata

Purpose

Upper property that can be thought as the most generic at CommunityCreatedMetadataContainer level linking CommunityCreatedMetadata to CommunityCreatedMetadataContainer.

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;hasCCMetadata"
```

```
    rdfs:label="abstract:hasCCMetadata">
  <rdfs:domain
      rdf:resource="&abstract;CommunityCreatedMetadataContainer"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;hasStructuredMetadata"/>
  <rdfs:range rdf:resource="&abstract;CommunityCreatedMetadata"/>
</rdf:Property>
```

ii. retrieveDate

```
<rdf:Property rdf:about="&abstract;retrieveDate"
   rdfs:label="abstract:retrieveDate">
  <rdfs:domain
      rdf:resource="&abstract;SharedCCMetadataContainer"/>
  <rdfs:range rdf:resource="&xsd;dateTime"/>
</rdf:Property>
```

iii. simpleCCMetadata

Purpose

Upper property that can be thought as the most generic at CommunityCreatedMetadataContainer level linking simple (textual) metadata into CommunityCreatedMetadataContainer.

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;simpleCCMetadata"
    rdfs:label="abstract:simpleCCMetadata">
  <rdfs:domain
      rdf:resource="&abstract;CommunityCreatedMetadataContainer"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleMetadata"/>
  <rdfs:range rdf:resource="&xsd;anySimpleType"/>
</rdf:Property>
```

iv. serverURI

```
<rdf:Property rdf:about="&abstract;serverURI"
    rdfs:label="abstract:serverURI">
  <rdfs:domain
      rdf:resource="&abstract;SharedCCMetadataContainer"/>
  <rdfs:range rdf:resource="&xsd;anyURI"/>
</rdf:Property>
```

1.1.1.2 ContentAggregativeMetadataContainer properties

i. hasAggregativeMetadata

Purpose

Upper property that can be thought as the most generic at ContentAggregativeMetadataContainer level linking ContentAggregativeMetadata to ContentAggregativeMetadataContainer.

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;hasAggregativeMetadata"
```

```
    rdfs:label="abstract:hasAggregativeMetadata">
  <rdfs:domain
    rdf:resource="&abstract;ContentAggregativeMetadataContainer"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;hasStructuredMetadata"/>
  <rdfs:range rdf:resource="&abstract;ContentAggregativeMetadata"/>
</rdf:Property>
```

ii. simpleAggregativeMetadata

Purpose

Upper property that can be thought as the most generic at ContentAggregativeMetadataContainer level linking simple (textual) metadata into ContentAggregativeMetadataContainer.

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;simpleAggregativeMetadata"
    rdfs:label="abstract:simpleAggregativeMetadata">
  <rdfs:domain
    rdf:resource="&abstract;ContentAggregativeMetadataContainer"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleMetadata"/>
  <rdfs:range rdf:resource="&xsd;anySimpleType"/>
</rdf:Property>
```

1.1.1.3 ContentEssenceContainer properties

i. hasEssenceMetadata

Purpose

Upper property that can be thought as the most generic at ContentEssenceMetadataContainer level linking ContentEssenceMetadata to ContentEssenceMetadataContainer.

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;hasEssenceMetadata"
    rdfs:label="abstract:hasEssenceMetadata">
  <rdfs:domain
    rdf:resource="&abstract;ContentEssenceMetadataContainer"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;hasStructuredMetadata"/>
  <rdfs:range rdf:resource="&abstract;ContentEssenceMetadata"/>
</rdf:Property>
```

ii. hasLocalizationMetadata

Purpose

Upper property that can be thought as common to all further extensions of structured essence localization schemes.

It serves to include structured essence localization information (ContentLocalizationMetadata) into ContentEssenceMetadataContainer.

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;hasLocalizationMetadata"
    rdfs:label="abstract:hasLocalizationMetadata">
  <rdfs:domain
    rdf:resource="&abstract;ContentEssenceMetadataContainer"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;hasEssenceMetadata"/>
  <rdfs:range rdf:resource="&abstract;ContentLocalizationMetadata"/>
</rdf:Property>
```

iii. simpleEssenceMetadata

Purpose

Upper property that can be thought as the most generic at ContentEssenceMetadataContainer level linking simple (textual) metadata into ContentEssenceMetadataContainer.

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;simpleEssenceMetadata"
    rdfs:label="abstract:simpleEssenceMetadata">
  <rdfs:domain
    rdf:resource="&abstract;ContentEssenceMetadataContainer"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleMetadata"/>
  <rdfs:range rdf:resource="&xsd;anySimpleType"/>
</rdf:Property>
```

iv. simpleLocalizationMetadata

Purpose

Upper property that can be thought as common to all further extensions of simple essence localization schemes.

It serves to include simple essence localization information into ContentEssenceMetadataContainer.

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;simpleLocalizationMetadata"
    rdfs:label="abstract:simpleLocalizationMetadata">
  <rdfs:domain rdf:resource="&abstract;ContentEssenceMetadataContainer"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleEssenceMetadata"/>
  <rdfs:range rdf:resource="&xsd;anySimpleType"/>
</rdf:Property>
```

1.1.1.4 ContentFeatureContainer properties

i. hasFeatureMetadata

Purpose

Upper property that can be thought as the most generic at ContentFeatureMetadataContainer level linking ContentFeatureMetadata to ContentFeatureMetadataContainer.

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;hasFeatureMetadata"
    rdfs:label="abstract:hasFeatureMetadata">
  <rdfs:domain
    rdf:resource="&abstract;ContentFeatureMetadataContainer"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;hasStructuredMetadata"/>
  <rdfs:range rdf:resource="&abstract;ContentFeatureMetadata"/>
</rdf:Property>
```

ii. simpleFeatureMetadata

Purpose

Upper property that can be thought as the most generic at ContentFeatureMetadataContainer level linking simple (textual) metadata into ContentFeatureMetadataContainer.

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;simpleFeatureMetadata"
    rdfs:label="abstract:simpleFeatureMetadata">
  <rdfs:domain
    rdf:resource="&abstract;ContentFeatureMetadataContainer"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleMetadata"/>
  <rdfs:range rdf:resource="&xsd;anySimpleType"/>
</rdf:Property>
```

1.1.1.5 System-related properties

In this category we include container properties that cover data such as: identification data, versionning data, data about the validity of a given description, etc. A commonSystem property – upper property of common system property is further declined in objectSystemProperty and bundleSystemProperty in order to distinguish between system properties related to objects and bundles.

i. systemProperty

Purpose

Upper property used to attached CAM4Home system specific data to metadata containers.

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;systemProperty"
    rdfs:label="abstract:systemProperty">
  <rdfs:domain
    rdf:resource="&abstract;ContentMetadataContainer"/>
  <rdfs:range rdf:resource="&rdfs;Literal"/>
</rdf:Property>
```

ii. genericSystemProperty

Purpose

Upper property used to attached CAM4Home system specific data to Feature or Aggregative metadata containers (object descriptions or bundle descriptions).

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;genericSystemProperty"
    rdfs:label="abstract:genericSystemProperty">
  <rdfs:domain
    rdf:resource="&abstract;ContentAggregativeMetadataContainer"/>
  <rdfs:domain
    rdf:resource="&abstract;ContentFeatureMetadataContainer"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;systemProperty"/>
  <rdfs:range rdf:resource="&rdfs;Literal"/>
</rdf:Property>
```

iii. bundleSystemProperty

Purpose

Upper property used to attached CAM4Home system specific data to Aggregative metadata containers (bundle descriptions).

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;bundleSystemProperty"
    rdfs:label="abstract:bundleSystemProperty">
  <rdfs:domain
    rdf:resource="&abstract;ContentAggregativeMetadataContainer"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;systemProperty"/>
  <rdfs:range rdf:resource="&rdfs;Literal"/>
</rdf:Property>
```

iv. objectSystemProperty

Purpose

Upper property used to attached CAM4Home system specific data to Feature metadata containers (object descriptions).

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;objectSystemProperty"
    rdfs:label="abstract:objectSystemProperty">
  <rdfs:domain
    rdf:resource="&abstract;ContentFeatureMetadataContainer"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;systemProperty"/>
  <rdfs:range rdf:resource="&rdfs;Literal"/>
</rdf:Property>
```

1.2 Abstract Supplementary Metamodel

Supplementary Metamodel permits interoperability among platform services and supplements the manipulation of Core Metadata. This metamodel concerns the metadata related to domains outside the CAM Bundle concept, that is, several profiles for the different entities like users, devices, networks, communities and services with its respective environment descriptions.

The organization of the supplementary metadata consists of three main concepts *SupplementaryEntity*, *SupplementaryProfile* and *SupplementaryEntityMetada* Figure 5.

- **SupplementaryEntity**: Represents the entities that interact with the CAM4Home platform: User, Device, Community, Service and Network.
- **SupplementaryProfile**: Organises the properties of an entity (UserProfile, DeviceProfile, CommunityProfile. ServiceProfile and NetworkProfile)
- **SupplementaryEntityMetadata**: Generic container for introducing complex metadata that specify the information of entities and entity profiles (UserMetadata, DeviceMetadata, CommunityMetadata, ServiceMetadata and NetworkMetadata).

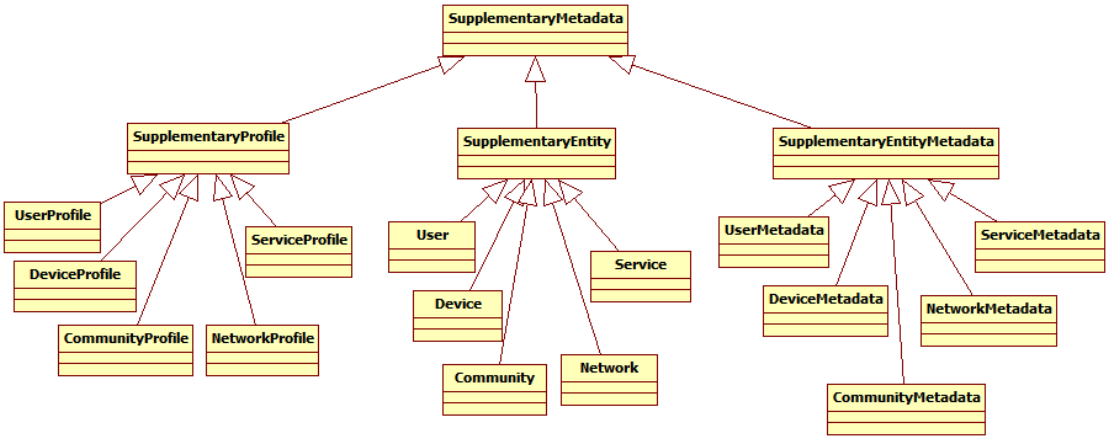

Figure 5 Organization Supplementary Meta-model

A variety of entities that interact in this project (user, community, device, etc...) can be linked with different profiles (user profile, community profile, device profile, etc ...) which are associated with various supplementary metadata (user metadata, community metadata, device metadata, etc...). This metadata provides detailed information about the entities related to personal information and interests for the user or hardware and software information for the device.

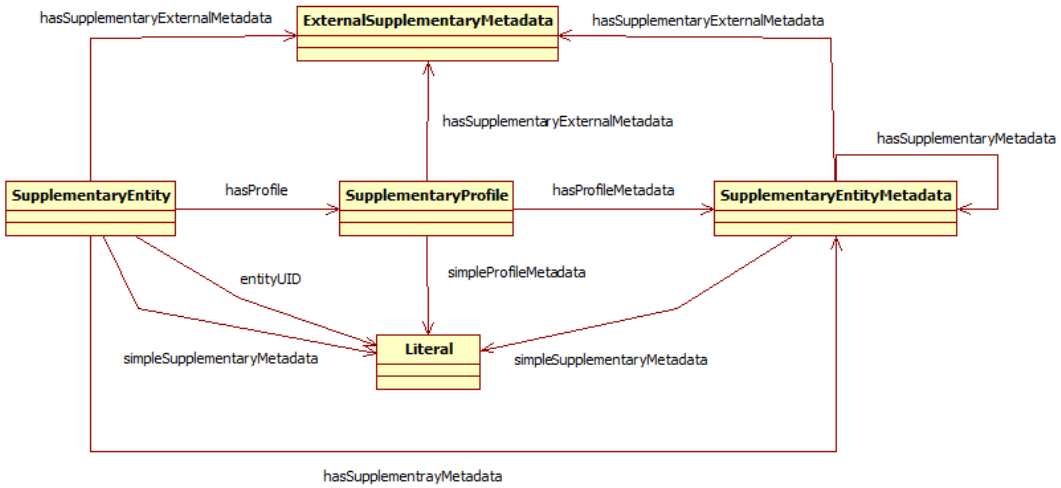

Figure 6 Organisation of entity, profiles and supplementary metadata.

The abstract/generic relationships that are defined between entities, profiles and metadata are illustrated in the Figure 6.

The entities are also linked between each other. A user entity can belong to a community entity. A user entity uses a given device entity on a given network entity. A device entity uses, at a given time, a network entity. Those relations are represented in Figure 7. The dash lines indicate that the links are implemented by means of references.

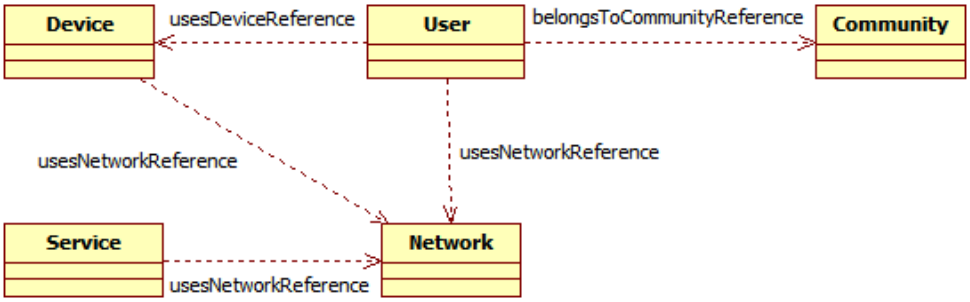

Figure 7 Relations between supplementary entities

In the following sections, all the concepts and properties that are involved in this metamodel will be explained with more details. Finally we present properties associated to generic and specific supplementary classes.

1.2.1 Generic class specification

1.2.1.1 SupplementaryMetadata

Purpose

Upper class for all the metadata classes in Supplementary Metamodel.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&abstract;SupplementaryMetadata"
    rdfs:label="abstract:SupplementaryMetadata">
  <rdfs:subClassOf rdf:resource="&rdfs;Resource"/>
</rdfs:Class>
```

1.2.1.2 SupplementaryEntity

Purpose

Defines an metadata entity in supplementary metamodel that can have supplementary or external metadata to describe the entity.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&abstract;SupplementaryEntity"
```

```
    rdfs:label="abstract:SupplementaryEntity">
  <rdfs:subClassOf rdf:resource="&abstract;SupplementaryMetadata"/>
</rdfs:Class>
```

1.2.1.3 SupplementaryEntityMetadata

Purpose

Upper level category class for metadata datatypes that are used to describe the metadata entities.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&abstract;SupplementaryEntityMetadata"
    rdfs:label="abstract:SupplementaryEntityMetadata">
  <rdfs:subClassOf rdf:resource="&abstract;SupplementaryMetadata"/>
</rdfs:Class>
```

1.2.1.4 SupplementaryProfile

Purpose

Upper class for all the classes which describe the profile of all entities in the Metamodel

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&abstract;SupplementaryProfile"
    rdfs:label="abstract:SupplementaryProfile">
  <rdfs:subClassOf rdf:resource="&abstract;SupplementaryMetadata"/>
</rdfs:Class>
```

1.2.2 Community related class specifications

1.2.2.1 Community

Purposes

Upper level category for metadata entities of different kind of communities that can have metadata to describe them.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&abstract;Community"
    rdfs:label="abstract:Community">
  <rdfs:subClassOf rdf:resource="&abstract;SupplementaryEntity"/>
</rdfs:Class>
```

1.2.2.2 CommunityMetadata

Purpose

Upper level class for metadata that can be used to describe communities

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&abstract;CommunityMetadata"
    rdfs:label="abstract:CommunityMetadata">
  <rdfs:subClassOf rdf:resource="&abstract;SupplementaryEntityMetadata"/>
</rdfs:Class>
```

1.2.2.3 CommunityProfile

Purpose

Upper level class for profile metadata that can be used to create profiles of communities.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&abstract;CommunityProfile"
    rdfs:label="abstract:CommunityProfile">
  <rdfs:subClassOf rdf:resource="&abstract;SupplementaryProfile"/>
</rdfs:Class>
```

1.2.3 Device related class specification

1.2.3.1 Device

Purpose

Upper level category for metadata entities of different kind of devices that can have metadata to describe them.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&abstract;Device"
    rdfs:label="abstract:Device">
  <rdfs:subClassOf rdf:resource="&abstract;SupplementaryEntity"/>
</rdfs:Class>
```

1.2.3.2 DeviceMetadata

Purpose

Upper level class for metadata that is used to describe devices.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&abstract;DeviceMetadata"
    rdfs:label="abstract:DeviceMetadata">
  <rdfs:subClassOf rdf:resource="&abstract;SupplementaryEntityMetadata"/>
</rdfs:Class>
```

1.2.3.3 DeviceProfile

Purpose

Upper level class for profile metadata that can be used to create profiles of devices.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&abstract;DeviceProfile"
    rdfs:label="abstract:DeviceProfile">
  <rdfs:subClassOf rdf:resource="&abstract;SupplementaryProfile"/>
</rdfs:Class>
```

1.2.4 Network related class specifications

1.2.4.1 Network

Purpose

Upper level category for metadata entities of different kind of networks that can have metadata to describe them.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&abstract;Network"
    rdfs:label="abstract:Network">
  <rdfs:subClassOf rdf:resource="&abstract;SupplementaryEntity"/>
</rdfs:Class>
```

1.2.4.2 NetworkMetadata

Purpose

Upper level class for metadata that is used to describe networks.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&abstract;NetworkMetadata"
    rdfs:label="abstract:NetworkMetadata">
  <rdfs:subClassOf rdf:resource="&abstract;SupplementaryEntityMetadata"/>
</rdfs:Class>
```

1.2.4.3 NetworkProfile

Purpose

Upper level class for profile metadata that can be used to create profiles of networks.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&abstract;NetworkProfile"
    rdfs:label="abstract:NetworkProfile">
```

```
  <rdfs:subClassOf rdf:resource="&abstract;SupplementaryProfile"/>
</rdfs:Class>
```

1.2.5 Service related class specification

1.2.5.1 Service

Purpose

Upper level category for metadata entities of different kind of services that can have metadata to describe them.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&abstract;Service"
    rdfs:label="abstract:Service">
  <rdfs:subClassOf rdf:resource="&abstract;SupplementaryEntity"/>
</rdfs:Class>
```

1.2.5.2 ServiceMetadata

Purpose

Upper level class for metadata that can be used to provide information about services

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&abstract;ServiceMetadata"
    rdfs:label="abstract:ServiceMetadata">
  <rdfs:subClassOf rdf:resource="&abstract;SupplementaryEntityMetadata"/>
</rdfs:Class>
```

1.2.5.3 ServiceProfile

Purpose

Upper level class for profile metadata that can be used to provide information about services profile

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&abstract;ServiceProfile"
    rdfs:label="abstract:ServiceProfile">
  <rdfs:subClassOf rdf:resource="&abstract;SupplementaryProfile"/>
</rdfs:Class>
```

1.2.6 User related class specifications

This section specifies the classes in abstract part of the Supplementary Metamodel

TDB : Insert an image to clarify the organization of User related Supplementary Metamodel

1.2.6.1 User

Purpose

Upper level category for metadata entities of different kind of system users that can have metadata to describe them.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&abstract;User"
    rdfs:label="abstract:User">
  <rdfs:subClassOf rdf:resource="&abstract;SupplementaryEntity"/>
</rdfs:Class>
```

1.2.6.2 UserMetadata

Purpose

Upper level class for metadata that can be used to describe system users.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&abstract;UserMetadata"
    rdfs:label="abstract:UserMetadata">
  <rdfs:subClassOf rdf:resource="&abstract;SupplementaryEntityMetadata"/>
</rdfs:Class>
```

1.2.6.3 UserProfile

Purpose

Upper level class for metadata that can be used to create profiles for users.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&abstract;UserProfileMetadata"
    rdfs:label="abstract:UserProfileMetadata">
  <rdfs:subClassOf rdf:resource="&abstract;UserMetadata"/>
</rdfs:Class>
```

1.2.7 Property specifications

This section specified the properties in the abstract part of the Supplementary Metamodel. Mainly, two categories of properties have been identified:

- properties that link supplementary entities (subclasses of SupplementaryEntity) to their profiles and descriptions (subclasses of SupplementaryEntityMetadata),
- properties that introduce external metadata format into the description of supplementary entities.

Specific properties for each type of supplementary entity where defined in order to master the association coherency. For instance, CommunityProfile instances can only be associated with Community instances.

1.2.7.1 Generic supplementary properties

i. entityUID

Purpose

An URI identifying the entity within the system

Origin

System

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;entityUID"
    rdfs:label="abstract:abstract;entityUID ">
  <rdfs:domain rdf:resource="&abstract;SupplementaryEntity"/>
  <rdfs:subPropertyOf abstract:simpleSupplementaryMetadata"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

ii. hasProfile

Purpose

Associates the SupplementaryProfile to the SupplementaryEntity

Origin

System

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;hasProfile"
    rdfs:label="abstract:hasProfile">
  <rdfs:range rdf:resource="&abstract;SupplementaryProfile"/>
  <rdfs:domain rdf:resource="&abstract;SupplementaryEntity"/>
</rdf:Property>
```

iii. hasProfileMetadata

Purpose

Associates SupplementaryEntityMetadata to SupplementaryProfile.

Origin

System

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;hasProfileMetadata"
    rdfs:label="abstract:hasProfileMetadata">
  <rdfs:range rdf:resource="&abstract;SupplementaryEntityMetadata"/>
  <rdfs:domain rdf:resource="&abstract;SupplementaryProfile"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;supplementaryProperty"/>
```

```
</rdf:Property>
```

iv. hasSupplementaryExternalMetadata

Purpose

Associates the Supplementary Metamodel instances to the instances of External Metamodel.

Origin

System

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;hasSupplementaryExternalMetadata"
    rdfs:label="abstract:hasSupplementaryExternalMetadata">
  <rdfs:range rdf:resource="&abstract;ExternalSupplementaryMetadata"/>
  <rdfs:domain rdf:resource="&abstract;SupplementaryMetadata"/>
</rdf:Property>
```

v. hasSupplementaryMetadata

Purpose

Upper property that associates SupplementaryEntityMetadata with SupplementaryEntity or more complex SupplementaryEntityMetadata. It serves as a parent property for all specific properties linking the different supplementary entity categories (Community, Device, Service, User) to specific supplementary entities metadata (CommunityMetadata, DeviceMetadata, ServiceMetadata, UserMetadata).

Origin

System

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;hasSupplementaryMetadata"
    rdfs:label="abstract:hasSupplementaryMetadata">
  <rdfs:subPropertyOf rdf:resource="&abstract;supplementaryProperty"/>
  <rdfs:domain rdf:resource="&abstract;SupplementaryEntity"/>
  <rdfs:domain rdf:resource="&abstract;SupplementaryEntityMetadata"/>
  <rdfs:range rdf:resource="&abstract;SupplementaryEntityMetadata"/>
</rdf:Property>
```

vi. simpleProfileMetadata

Purpose

Upper property that associates SupplementaryEntityMetadata with entity profiles.

Not intended to be instanciated.

Origin

System

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;simpleProfileMetadata"
    rdfs:label="abstract:simpleProfileMetadata">
  <rdfs:domain rdf:resource="&abstract;SupplementaryProfile"/>
  <rdfs:range rdf:resource="&xsd;anySimpleType"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;supplementaryProperty"/>
</rdf:Property>
```

vii. simpleSupplementaryMetadata

Purpose

Upper property that associates simple (literal) metadata with SupplementaryEntity and SupplementaryEntityMetadata. It serves as a parent property for all specific properties linking the different supplementary entity categories (Community, Device, Service, User) to specific literal supplementary metadata.

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;simpleSupplementaryMetadata"
    rdfs:label="abstract:simpleSupplementaryMetadata">
  <rdfs:domain rdf:resource="&abstract;SupplementaryEntity"/>
  <rdfs:domain rdf:resource="&abstract;SupplementaryEntityMetadata"/>
  <rdfs:range rdf:resource="&xsd;anySimpleType"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;supplementaryProperty"/>
</rdf:Property>
```

viii. supplementaryProperty

Purpose

Upper property that associates generic supplementary metadata with SupplementaryEntity, SupplementaryProfile or more complex SupplementaryEntityMetadata.

Origin

System

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;supplementaryProperty"
    rdfs:label="abstract:supplementaryProperty">
  <rdfs:domain rdf:resource="&abstract;SupplementaryEntity"/>
  <rdfs:domain rdf:resource="&abstract;SupplementaryProfile"/>
  <rdfs:domain rdf:resource="&abstract;SupplementaryEntityMetadata"/>
  <rdfs:range rdf:resource="&rdfs;Resource"/>
</rdf:Property>
```

1.2.7.2 Community related properties

i. hasCommunityMetadata

Purpose

Upper property that associates CommunityMetadata with CommunityEntity or more complex CommunityMetadata.

Origin

System

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;hasCommunityMetadata"
    rdfs:label="abstract:hasCommunityMetadata">
  <rdfs:subPropertyOf rdf:resource="&abstract;hasSupplementaryMetadata"/>
  <rdfs:domain rdf:resource="&abstract;CommunityEntity"/>
  <rdfs:domain rdf:resource="&abstract;CommunityMetadata"/>
  <rdfs:range rdf:resource="&abstract;CommunityMetadata"/>
</rdf:Property>
```

ii. hasCommunityProfile

Purpose

Upper property that associates CommunityProfile with Community.

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;hasCommunityProfile"
    rdfs:label="abstract:hasCommunityProfile">
  <rdfs:domain rdf:resource="&abstract;Community"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;hasProfile"/>
  <rdfs:range rdf:resource="&abstract;CommunityProfile"/>
</rdf:Property>
```

iii. hasCommunityProfileMetadata

Purpose

Associates CommunityMetadata to CommunityProfile.

Origin

System

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;hasCommunityProfileMetadata"
    rdfs:label="abstract:hasCommunityProfileMetadata">
  <rdfs:range rdf:resource="&abstract;CommunityMetadata"/>
  <rdfs:domain rdf:resource="&abstract;CommunityProfile"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;hasProfileMetadata"/>
</rdf:Property>
```

iv. simpleCommunityMetadata

Purpose

Upper property that associates simple (literal) metadata with CommunityEntity and CommunityMetadata.

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;simpleCommunityMetadata"
    rdfs:label="abstract:simpleCommunityMetadata">
  <rdfs:domain rdf:resource="&abstract;CommunityEntity"/>
  <rdfs:domain rdf:resource="&abstract;CommunityMetadata"/>
  <rdfs:range rdf:resource="&xsd;anySimpleType"/>
  <rdfs:subPropertyOf
    rdf:resource="&abstract;simpleSupplementaryMetadata"/>
</rdf:Property>
```

v. simpleCommunityProfileMetadata

Purpose

Upper property that associates CommunityMetadata with entity profiles.

Origin

System

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;simpleCommunityProfileMetadata"
    rdfs:label="abstract:abstract;simpleCommunityProfileMetadata">
  <rdfs:domain rdf:resource="&abstract;CommunityProfile"/>
  <rdfs:range rdf:resource="&xsd;anySimpleType"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleProfileMetadata"/>
</rdf:Property>
```

1.2.7.3 Device related properties

i. hasDeviceMetadata

Purpose

Upper property that associates DeviceMetadata with DeviceEntity or more complex DeviceMetadata.

Origin

System

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;hasDeviceMetadata"
    rdfs:label="abstract:hasDeviceMetadata">
  <rdfs:subPropertyOf rdf:resource="&abstract;hasSupplementaryMetadata"/>
  <rdfs:domain rdf:resource="&abstract;DeviceEntity"/>
  <rdfs:domain rdf:resource="&abstract;DeviceMetadata"/>
  <rdfs:range rdf:resource="&abstract;DeviceMetadata"/>
</rdf:Property>
```

ii. hasDeviceProfile

Purpose

Upper property that associates DeviceProfile with Device.

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;hasDeviceProfile"
    rdfs:label="abstract:hasDeviceProfile">
  <rdfs:domain rdf:resource="&abstract;Device"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;hasProfile"/>
  <rdfs:range rdf:resource="&abstract;DeviceProfile"/>
</rdf:Property>
```

iii. hasDeviceProfileMetadata

Purpose

Associates DeviceMetadata to DeviceProfile.

Origin

System

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;hasDeviceProfileMetadata"
    rdfs:label="abstract:hasDeviceProfileMetadata">
  <rdfs:range rdf:resource="&abstract;DeviceMetadata"/>
  <rdfs:domain rdf:resource="&abstract;DeviceProfile"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;hasProfileMetadata"/>
</rdf:Property>
```

iv. simpleDeviceMetadata

Purpose

Upper property that associates simple (literal) metadata with DeviceEntity and DeviceMetadata.

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;simpleDeviceMetadata"
    rdfs:label="abstract:simpleDeviceMetadata">
  <rdfs:domain rdf:resource="&abstract;DeviceEntity"/>
  <rdfs:domain rdf:resource="&abstract;DeviceMetadata"/>
  <rdfs:range rdf:resource="&xsd;anySimpleType"/>
  <rdfs:subPropertyOf
    rdf:resource="&abstract;simpleSupplementaryMetadata"/>
</rdf:Property>
```

v. simpleDeviceProfileMetadata

Purpose

Upper property that associates DeviceMetadata with entity profiles.

Origin

System

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;simpleDeviceProfileMetadata"
    rdfs:label="abstract:abstract;simpleDeviceProfileMetadata">
  <rdfs:domain rdf:resource="&abstract;DeviceProfile"/>
  <rdfs:range rdf:resource="&xsd;anySimpleType"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleProfileMetadata"/>
</rdf:Property>
```

vi. usesNetworkReference

Purpose

An URI identifying which network is used by user, device or service.

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;usesNetworkReference"
    rdfs:label="abstract:usesNetworkReference ">
  <rdfs:domain rdf:resource="&abstract;User"/>
  <rdfs:domain rdf:resource="&abstract;Device"/>
  <rdfs:domain rdf:resource="&abstract;Service"/>
  <rdfs:subPropertyOf
    rdf:resource="&abstract;supplementaryMetadataReference"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

1.2.7.4 Network related properties

i. hasNetworkMetadata

Purpose

Upper property that associates NetworkMetadata with NetworkEntity or more complex NetworkMetadata.

Origin

System

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;hasNetworkMetadata"
    rdfs:label="abstract:hasNetworkMetadata">
  <rdfs:subPropertyOf rdf:resource="&abstract;hasSupplementaryMetadata"/>
  <rdfs:domain rdf:resource="&abstract;NetworkEntity"/>
  <rdfs:domain rdf:resource="&abstract;NetworkMetadata"/>
  <rdfs:range rdf:resource="&abstract;NetworkMetadata"/>
</rdf:Property>
```

ii. hasNetworkProfile

Purpose

Upper property that associates NetworkProfile with Network.

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;hasNetworkProfile"
    rdfs:label="abstract:hasNetworkProfile">
  <rdfs:domain rdf:resource="&abstract;Network"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;hasProfile"/>
  <rdfs:range rdf:resource="&abstract;NetworkProfile"/>
</rdf:Property>
```

iii. hasNetworkProfileMetadata

Purpose

Associates NetworkMetadata to NetworkProfile.

Origin

System

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;hasNetworkProfileMetadata"
      rdfs:label="abstract:hasNetworkProfileMetadata">
    <rdfs:range rdf:resource="&abstract;NetworkMetadata"/>
    <rdfs:domain rdf:resource="&abstract;NetworkProfile"/>
    <rdfs:subPropertyOf rdf:resource="&abstract;hasProfileMetadata"/>
</rdf:Property>
```

iv. simpleNetworkMetadata

Purpose

Upper property that associates simple (literal) metadata with NetworkEntity and NetworkMetadata.

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;simpleNetworkMetadata"
    rdfs:label="abstract:simpleNetworkMetadata">
  <rdfs:domain rdf:resource="&abstract;NetworkEntity"/>
  <rdfs:domain rdf:resource="&abstract;NetworkMetadata"/>
  <rdfs:range rdf:resource="&xsd;anySimpleType"/>
  <rdfs:subPropertyOf
    rdf:resource="&abstract;simpleSupplementaryMetadata"/>
</rdf:Property>
```

v. simpleNetworkProfileMetadata

Purpose

Upper property that associates NetworkMetadata with entity profiles.

Origin

System

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;simpleNetworkProfileMetadata"
    rdfs:label="abstract:abstract;simpleNetworkProfileMetadata">
  <rdfs:domain rdf:resource="&abstract;NetworkProfile"/>
  <rdfs:range rdf:resource="&xsd;anySimpleType"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleProfileMetadata"/>
</rdf:Property>
```

1.2.7.5 Service related properties

i. hasServiceMetadata

Purpose

Upper property that associates ServiceMetadata with ServiceEntity or more complex ServiceMetadata.

Origin

System

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;hasServiceMetadata"
    rdfs:label="abstract:hasServiceMetadata">
  <rdfs:subPropertyOf rdf:resource="&abstract;hasSupplementaryMetadata"/>
  <rdfs:domain rdf:resource="&abstract;ServiceEntity"/>
  <rdfs:domain rdf:resource="&abstract;ServiceMetadata"/>
  <rdfs:range rdf:resource="&abstract;ServiceMetadata"/>
</rdf:Property>
```

ii. hasServiceProfile

Purpose

Upper property that associates ServiceProfile with Service.

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;hasServiceProfile"
    rdfs:label="abstract:hasServiceProfile">
  <rdfs:domain rdf:resource="&abstract;Service"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;hasProfile"/>
  <rdfs:range rdf:resource="&abstract;ServiceProfile"/>
</rdf:Property>
```

iii. hasServiceProfileMetadata

Purpose

Associates ServiceMetadata to ServiceProfile.

Origin

System

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;hasServiceProfileMetadata"
    rdfs:label="abstract:hasServiceProfileMetadata">
  <rdfs:range rdf:resource="&abstract;ServiceMetadata"/>
  <rdfs:domain rdf:resource="&abstract;ServiceProfile"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;hasProfileMetadata"/>
</rdf:Property>
```

iv. simpleServiceMetadata

Purpose

Upper property that associates simple (literal) metadata with ServiceEntity and ServiceMetadata.

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;simpleServiceMetadata"
    rdfs:label="abstract:simpleServiceMetadata">
  <rdfs:domain rdf:resource="&abstract;ServiceEntity"/>
  <rdfs:domain rdf:resource="&abstract;ServiceMetadata"/>
  <rdfs:range rdf:resource="&xsd;anySimpleType"/>
  <rdfs:subPropertyOf
    rdf:resource="&abstract;simpleSupplementaryMetadata"/>
</rdf:Property>
```

v. simpleServiceProfileMetadata

Purpose

Upper property that associates ServiceMetadata with entity profiles.

Origin

System

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;simpleServiceProfileMetadata"
    rdfs:label="abstract:abstract;simpleServiceProfileMetadata">
  <rdfs:domain rdf:resource="&abstract;ServiceProfile"/>
  <rdfs:range rdf:resource="&xsd;anySimpleType"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleProfileMetadata"/>
</rdf:Property>
```

vi. usesNetworkReference

See i.

1.2.7.6 User related properties

i. belongsToCommunityReference

Purpose

an URI identifying which Community within the system the user belongs to.

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;belongsToCommunityReference"
    rdfs:label="abstract:belongsToCommunityReference">
  <rdfs:domain rdf:resource="&abstract;User"/>
  <rdfs:subPropertyOf
    rdf:resource="&abstract;supplementaryMetadataReference"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

ii. hasUserMetadata

Purpose

Upper property that associates UserMetadata with UserEntity or more complex UserMetadata.

Origin

System

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;hasUserMetadata"
    rdfs:label="abstract:hasUserMetadata">
  <rdfs:subPropertyOf rdf:resource="&abstract;hasSupplementaryMetadata"/>
  <rdfs:domain rdf:resource="&abstract;UserEntity"/>
  <rdfs:domain rdf:resource="&abstract;UserMetadata"/>
  <rdfs:range rdf:resource="&abstract;UserMetadata"/>
</rdf:Property>
```

iii. hasUserProfile

Purpose

Upper property that associates UserProfile with User.

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;hasUserProfile"
    rdfs:label="abstract:hasUserProfile">
  <rdfs:domain rdf:resource="&abstract;User"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;hasProfile"/>
  <rdfs:range rdf:resource="&abstract;UserProfile"/>
</rdf:Property>
```

iv. hasUserProfileMetadata

Purpose

Associates UserMetadata to UserProfile.

Origin

System

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;hasUserProfileMetadata"
    rdfs:label="abstract:hasUserProfileMetadata">
  <rdfs:range rdf:resource="&abstract;UserMetadata"/>
  <rdfs:domain rdf:resource="&abstract;UserProfile"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;hasProfileMetadata"/>
</rdf:Property>
```

v. simpleUserMetadata

Purpose

Upper property that associates simple (literal) metadata with UserEntity and UserMetadata.

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;simpleUserMetadata"
    rdfs:label="abstract:simpleUserMetadata">
  <rdfs:domain rdf:resource="&abstract;UserEntity"/>
  <rdfs:domain rdf:resource="&abstract;UserMetadata"/>
  <rdfs:range rdf:resource="&xsd;anySimpleType"/>
  <rdfs:subPropertyOf
    rdf:resource="&abstract;simpleSupplementaryMetadata"/>
</rdf:Property>
```

vi. simpleUserProfileMetadata

Purpose

Upper property that associates UserMetadata with entity profiles.

Origin

System

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;simpleUserProfileMetadata"
    rdfs:label="abstract:abstract;simpleUserProfileMetadata">
  <rdfs:domain rdf:resource="&abstract;UserProfile"/>
  <rdfs:range rdf:resource="&xsd;anySimpleType"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleProfileMetadata"/>
</rdf:Property>
```

vii. usesDeviceReference

Purpose

an URI identifying which device within the system is used by user

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;usesDeviceReference"
    rdfs:label="abstract:usesDeviceReference">
  <rdfs:domain rdf:resource="&abstract;User"/>
  <rdfs:subPropertyOf
    rdf:resource="&abstract;supplementaryMetadataReference"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

viii. usesNetworkReference

See i.

1.3 Abstract External Metamodel

This part of the abstract model provides the basic structures that allow the integration of existing standards within the CAM4Home metadata framework. The possibility to include external metadata description in CAM4HOME metadata framework is a key feature as it permits practitioners of CAM4HOME to benefit from existing metadata standards.

Two categories of external metadata descriptions are considered: external core metadata and external supplementary metadata. The external core metadata descriptions are related to core aspects of a CAM Object or a CAM Bundle. The external supplementary metadata descriptions are related to the characterization of supplementary entities. In order to underline the type of external metadata classes that can be considered for integration within the CAM4HOME metadata framewok, we have defined several subclasses for each type of external metadata. Hence, we have at abstract level, core-related external metadata classes that support the integration of content feature metadata or content aggregative metadata. With regard to supplementary-related external metadata classes, we have considered external metadata classes that address the community, the device, the user, etc.

In the following, we describe the base classes for introducing core and supplementary external metadata. Then, we introduce classes that support the introduction of specific core-related external metadata (ExternalContentAggregativeMetadata, ExternalContentCommunityCreatedMetadata, ExternalContentFeatureMetadata). In the third section, we decline the external supplementary class to specific classes addressing respectively community, device, network, service and user metadata. Finally, we present a set of common properties to all external metadata classes (externalSchemaName, externalSchemaURI, externalMetadataURI, metadataValue).

1.3.1 Generic Class specifications

This section specifies the base classes in abstract part of the external metamodel.

1.3.1.1 ExternalMetadata

Purpose

Upper most class of the external metamodel.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&abstract;ExternalMetadata"
```

```
    rdfs:label="abstract:ExternalMetadata">
  <rdfs:subClassOf rdf:resource="&rdfs;Resource"/>
</rdfs:Class>
```

1.3.1.2 ExternalCoreMetadata

Purpose

Category class for external metadata that can be associated with Core Metamodel classes.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&abstract;ExternalCoreMetadata"
    rdfs:label="abstract:ExternalCoreMetadata">
  <rdfs:subClassOf rdf:resource="&abstract;ExternalMetadata"/>
</rdfs:Class>
```

1.3.1.3 ExternalSupplementaryMetadata

Purpose

Upper level class and category for all external metadata format that can be associated with the metadata in Supplementary Metamodel.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&abstract;ExternalSupplementaryMetadata"
    rdfs:label="abstract:ExternalSupplementaryMetadata">
  <rdfs:subClassOf rdf:resource="&abstract;ExternalMetadata"/>
</rdfs:Class>
```

1.3.2 External Core related class specification

This section introduces the abstract external classes that characterize directly CAMObjects and CAMBundles. These external classes compose the abstract external core metamodel.

1.3.2.1 ExternalContentAggregativeMetadata

Purpose

Upper class and category for external metadata formats that can be used to describe content aggregation.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&abstract;ExternalContentAggregativeMetadata"
    rdfs:label="abstract:ExternalContentAggregativeMetadata">
  <rdfs:subClassOf rdf:resource="&abstract;ExternalCoreMetadata"/>
</rdfs:Class>
```

1.3.2.2 ExternalContentCommunityCreatedMetadata

Purpose

Upper class and category for external metadata formats that can be used to provide evaluative information about content.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&abstract;ExternalCommunityCreatedMetadata"
    rdfs:label="abstract:ExternalCommunityCreatedMetadata">
  <rdfs:subClassOf rdf:resource="&abstract;ExternalCoreMetadata"/>
</rdfs:Class>
```

1.3.2.3 ExternalContentFeatureMetadata

Purpose

Upper class and category for external metadata formats that can be used describe the features of content.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&abstract;ExternalContentFeatureMetadata"
    rdfs:label="abstract:ExternalContentFeatureMetadata">
  <rdfs:subClassOf rdf:resource="&abstract;ExternalCoreMetadata"/>
</rdfs:Class>
```

1.3.3 External Supplementary related class specification

This section introduces the abstract external classes that characterize entities involved in the creation and the deployement of CAMObjects and CAMBundles : communities, devices, networks, services, users. These external classes compose the abstract external supplementary metamodel.

1.3.3.1 ExternalCommunityMetadata

Purpose

Upper class and category for all external metadata format that can be used to provide information about communities.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&abstract;ExternalCommunityMetadata"
    rdfs:label="abstract:ExternalCommunityMetadata">
  <rdfs:subClassOf rdf:resource="&abstract;ExternalSupplementaryMetadata"/>
</rdfs:Class>
```

1.3.3.2 ExternalDeviceMetadata

Purpose

Upper class and category for all external metadata format that can be used to provide information about devices.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&abstract;ExternalDeviceMetadata"
    rdfs:label="abstract:ExternalDeviceMetadata">
  <rdfs:subClassOf rdf:resource="&abstract;ExternalSupplementaryMetadata"/>
</rdfs:Class>
```

1.3.3.3 ExternalNetworkMetadata

Purpose

Upper class and category for all external metadata format that can be used to provide information about networks.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&abstract;ExternalNetworkMetadata"
    rdfs:label="abstract:ExternalNetworkeMetadata">
  <rdfs:subClassOf rdf:resource="&abstract;ExternalSupplementaryMetadata"/>
</rdfs:Class>
```

1.3.3.4 ExternalUserMetadata

Purpose

Upper class and category for all external metadata format that can be used to provide information about system users.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&abstract;ExternalUserMetadata"
    rdfs:label="abstract:ExternalUserMetadata">
  <rdfs:subClassOf rdf:resource="&abstract;ExternalSupplementaryMetadata"/>
</rdfs:Class>
```

1.3.3.5 ExternalServiceMetadataFromat

Purpose

Upper class and category for all external metadata format that can be used to provide information about services.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&abstract;ExternalServiceMetadata"
    rdfs:label="abstract:ExternalServiceMetadata">
  <rdfs:subClassOf rdf:resource="&abstract;ExternalSupplementaryMetadata"/>
</rdfs:Class>
```

1.3.4 ExternalMetadata property specifications

This section specifies the properties in the abstract part of the External Metamodel.

1.3.4.1 externalSchemaName

Purpose

Identifies the external metadata encoding schema name contained in the instances.

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;externalSchemaName"
    rdfs:label="abstract:externalSchemaName">
  <rdfs:domain rdf:resource="&abstract;ExternalMetadata"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

1.3.4.2 externalSchemaURI

Purpose

Identifies the URI of the external metadata encoding schema contained in the instances.

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;externalSchemaURI"
    rdfs:label="abstract:externalSchemaURI">
  <rdfs:domain rdf:resource="&abstract;ExternalMetadata"/>
  <rdfs:range rdf:resource="&xsd;anyURI"/>
</rdf:Property>
```

1.3.4.3 externalMetadataURI

Purpose

Identifies the external metadata contained in the instances.

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;externalMetadataURI"
    rdfs:label="abstract:externalMetadataURI">
  <rdfs:domain rdf:resource="&abstract;ExternalMetadata"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;mandatoryProperty"/>
  <rdfs:range rdf:resource="&xsd;anyURI"/>
</rdf:Property>
```

1.3.4.4 metadataValue

Purpose

Contains the external metadata in a syntax specified by the used existing metadata format.

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&abstract;metadataValue"
     rdfs:label="abstract:metadataValue">
    <rdfs:domain rdf:resource="&abstract;ExternalMetadata"/>
    <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

2 Concrete Core Metamodel

This section specifies the classes in the concrete part of the Core Metamodel.

The concrete core metadamodel contains classes and properties that describe the core features of a CAM Object or a CAM Bundle. CAM Object features are represented by CAMElementMetadata instances. The essence of a CAM Object is represented by CAMElement instances.

CAM Bundles are represetend by CAMBundleMetadata instances.

The linkage between the abstract core concepts and the concrete core classes is illustrated in the Figure 8.

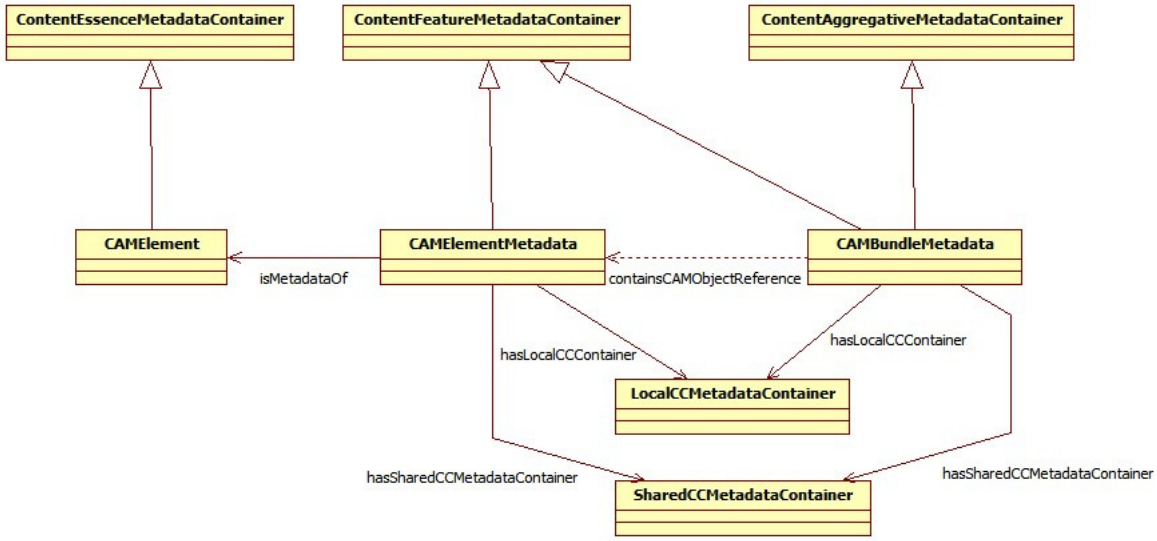

Figure 8 Concrete core classes and their relations with the abstract core level

The CAMElement is a specialization of the ContentEssenceMetadataContainer as it contains direct description of the essence of a CAM Object.

The CAMElementMetadata is a specialization of the ContentFeatureMetadataContainer as it contains description of the features of a CAM Object.

The CAMBundleMetadata is a specialization of the ContentFeatureMetadataContainer and of the ContentAggregativeMetadataContainer as it contains respectively, information about the features of a bundle (seen as an individual deployement unit) and information about the relations between CAM Objects within the bundle.

The CAMElementMetadata and the CAMBundleMetadata can contain also local or shared community created metadata respectively through the properties hasLocalCCContainer and hasSharedLocalCCContainer. These generic containers are declined in containers for user comments, user ratings and social tags.

The link between the feature container of a CAM Object (which is an instance of CAMElementMetadata) and the essence of the CAM Object (which is an instance of CAMElement) is ensured by a specific property of the CAMElementMetadata class called *isMetadataOf*. This property materializes a composition (represented here by a full line), hence the life time of the CAMElement it directly depends of that of the enclosing CAMElementMetadata.

The link between the CAM Bundles and the enclosing CAM Object is implemented by the containsObjectReference property. This property materializes an association (represented here by a dashed line) as the same CAM Object can shared between several bundles and its lifetime is not dependend on any of it.

In the first subsection, we describe the CAMElement class and its properties. In subsection 2, we introduce multimedia-related extensions (audio, video, etc.) of the CAMElement and theirs specific properties. Subsection 3 is consacrated to service-related extensions of the CAMElement and theirs specific properties. The CAMElementMetadata class and its main properties are presented in subsection 4. The subsection 5 and the subsection 6 present respectively, the multimedia-related CAMElementMetadata specializations and the service-related CAMElementMetadata specializations. Finally the subsection 7 introduces the CAMBundleMetadata class, its properties and the relationships that can be defined within a bundle between two objects.

All the subsections are organized as follows. For each class introduced within a subsection, we first describe its RDFS class definition and then we describe its properties.

2.1 CAMElement class specifications

2.1.1 Class definition

2.1.1.1 CAMElement

Purpose

CAMElement regroups properties related to the essence of contents. It is declined in multimedia and service elements.

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&core;CAMElement"
    rdfs:comment="A class for representing a CAMElement"
    rdfs:label="core:CAMElement">
  <rdfs:subClassOf
    rdf:resource="&abstract;ContentEssenceMetadataContainer"/>
</rdfs:Class>
```

2.1.2 Properties

i. essenceFileIdentifier

Purpose

This property provides essence localization information by using the URI mechanism.

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&core;essenceFileIdentifier"
    rdfs:label="core:essenceFileIdentifier">
  <rdfs:domain rdf:resource="&core;CAMElement"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleContentLocalization"/>
  <rdfs:range rdf:resource="&xsd;anyURI"/>
</rdf:Property>
```

2.2 Multimedia-related CAMElement subclasses

2.2.1 MultimediaElement

2.2.1.1 Class definition

Purpose

MultimediaElement regroups properties related to the essence of a multimedia content. It is declined in audio, document, image and video elements.

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&core;MultimediaElement"
    rdfs:label="core:MultimediaElement">
  <rdfs:subClassOf rdf:resource="&core;CAMElement"/>
</rdfs:Class>
```

2.2.1.2 Properties

No specific properties are defined at MultimediaElement with regard to CAMElement.

2.2.2 AudioElement

2.2.2.1 Class definition

Purpose

AudioElement regroups properties related to the essence of an audio content.

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&core;AudioElement"
    rdfs:label="core:AudioElement">
  <rdfs:subClassOf rdf:resource="&core;MultimediaElement"/>
</rdfs:Class>
```

2.2.2.2 Properties

i. audioType

Purpose

This property provides information about the type of audio content (downloadable audio or streaming audio).

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&core;audioType"
    rdfs:label="core:audioType">
  <rdfs:domain rdf:resource="&core;AudioElement"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleEssenceMetadata"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

ii. streamingType

Purpose

This property provides information about the nature of streaming audio content (live or recorded). This property is sharerd with VideoElement class.

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&core;streamingType"
    rdfs:label="core:streamingType">
  <rdfs:domain rdf:resource="&core;AudioElement"/>
  <rdfs:domain rdf:resource="&core;VideoElement"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleEssenceMetadata"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

2.2.3 DocumentElement

2.2.3.1 Class definition

```
<rdfs:Class rdf:about="&core;DocumentElement"
    rdfs:label="core:DocumentElement">
  <rdfs:subClassOf rdf:resource="&core;MultimediaElement"/>
</rdfs:Class>
```

2.2.3.2 Properties

No specific properties are required for DocumentElement with regard to existing properties in MultimediaElement class.

2.2.4 ImageElement

2.2.4.1 Class definition

Purpose

ImageElement regroups properties related to the essence of an audio content.

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&core;ImageElement"
    rdfs:label="core:ImageElement">
  <rdfs:subClassOf rdf:resource="&core;MultimediaElement"/>
</rdfs:Class>
```

2.2.4.2 Properties

No specific properties are required for ImageElement with regard to existing properties in MultimediaElement class.

2.2.5 VideoElement

2.2.5.1 Class definition

Purpose

VideoElement regroups properties related to the essence of an audio content.

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&core;VideoElement"
    rdfs:label="core:VideoElement">
  <rdfs:subClassOf rdf:resource="&core;MultimediaElement"/>
</rdfs:Class>
```

2.2.5.2 Properties

i. streamingType

The **streamingType** property is defined in section ii

ii. videoType

Purpose

This property provides information about the type of video content (downloadable video or streaming video).

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&core;videoType"
    rdfs:label="core:videoType">
  <rdfs:domain rdf:resource="&core;VideoElement"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleEssenceMetadata"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

2.3 Service-related CAMElement subclasses

2.3.1 ServiceElement

2.3.1.1 Class definition

Purpose

ServiceElement regroups properties related to the essence of a service element. It is declined in downloadable application, software service and user service elements.

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&core;ServiceElement"
    rdfs:label="core:ServiceElement">
  <rdfs:subClassOf rdf:resource="&core;CAMElement"/>
</rdfs:Class>
```

2.3.1.2 Properties

i. serviceAccessMethod

Purpose

This property provides information about the service access method.

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&core;serviceAccessMethod"
    rdfs:label="core:serviceAccessMethod">
  <rdfs:domain rdf:resource="&core;ServiceElement"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleEssenceMetadata"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

2.3.2 DowloadableApplicationElement

2.3.2.1 Class definition

Purpose

DownloadableApplicationElement regroups properties related to the essence of a downloable application.

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&core;DownloadableApplicationElement"
    rdfs:label="core:DownloadableApplicationElement">
  <rdfs:subClassOf rdf:resource="&core;ServiceElement"/>
</rdfs:Class>
```

2.3.2.2 Properties

No specific properties are required for DownloadableApplicationElement with regard to existing properties in ServiceElement class.

2.3.3 SoftwareServiceElement

2.3.3.1 Class definition

Purpose

SoftwareServiceElement regroups properties related to the essence of a software service.

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&core;SoftwareServiceElement"
    rdfs:label="core:SoftwareServiceElement">
  <rdfs:subClassOf rdf:resource="&core;ServiceElement"/>
</rdfs:Class>
```

2.3.3.2 Properties

No specific properties are required for SoftwareServiceElement with regard to existing properties in ServiceElement class.

2.3.4 UserServiceElement

2.3.4.1 Class definition

Purpose

UserServiceElement regroups properties related to the essence of a user service.

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&core;UserServiceElement"
    rdfs:label="core:UserServiceElement">
  <rdfs:subClassOf rdf:resource="&core;ServiceElement"/>
</rdfs:Class>
```

2.3.4.2 Properties

No specific properties are required for UserServiceElement with regard to existing properties in ServiceElement class.

2.4 CAMElementMetadata class specifications

2.4.1 Class Definition

Purpose

CAMElementMetadata materialize a container for describing feature and evaluative metadata related to a CAMObject. It is further declined in multimedia element metadata and service element metadata.

The CAMElementMetadata is ContentFeatureContainer as it contains descriptions about the features of content.

The CAMElementMetadata hasCCMetadata (CommunityCreatedMetadata) as it contains evaluations about the content.

The CAMElementMetadata is ContentAggregativeMetadata as it serves in the description of CAMBundleMetadata which is ContentAggregativeContainer.

Origin of metadata

Creator

Metadata Format and RDF Schema Definition

```
<rdfs:Class rdf:about="&core;CAMElementMetadata"
    rdfs:label="core:CAMElementMetadata">
  <rdfs:subClassOf rdf:resource="&abstract;ContentFeatureContainer"/>
  <rdfs:subClassOf
     rdf:resource="&abstract;CommunityCreatedMetadataContainer"/>
  <rdfs:subClassOf rdf:resource="&abstract;ContentAggregativeMetadata"/>
</rdfs:Class>
```

2.4.2 Properties

2.4.2.1 authorReference

Purpose

Container for the attaching the essence authors to CAM Object.

Origin of metadata

Creator

Metadata Format and RDF Schema Definition

```
<rdf:Property rdf:about="&core;authorReference"
    rdfs:label="core:authorReference">
  <rdfs:range rdf:resource="&xsd;string"/>
  <rdfs:domain rdf:resource="&core;CAMElementMetadata"/>
  <rdfs:domain rdf:resource="&core;CAMBundleMetadata"/>
  <rdfs:subPropertyOf
    rdf:resource="&abstract;supplementaryMetadataReference"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;mandatoryProperty"/>
```

```
</rdf:Property>
```

2.4.2.2 camElementMetadataID

Purpose

Identifies the CAMObject family instances. For each CAMObject, the system stores all the evolution of a CAMObject as a series of versions. Each version is associated to a CAMElementMetadata instance. All versions of the same CAMObject share the same CAMElementMetadataID. The distinction between version is indicated by the versionNumber attribute that is presented in section 2.4.2.21. The ID does not include any spaces.

Origin of metadata

System

Metadata Format and RDF Schema Definition

```
<rdf:Property rdf:about="&core;camElementMetadataID"
    rdfs:label="core:camElementMetadataID">
  <rdfs:domain rdf:resource="&core;CAMElementMetadata"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;objectSystemProperty"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;mandatoryProperty"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

Practical example

```
<core:CAMElementMetadata rdf:ID ="01226374">
 <core:CAMElementMetadataID rdf:datatype="xsd:string">
   Element1_CAMElementMetadata
 </core:CAMElementMetadataID>
 ............
</core:CAMElementMetadata>
```

2.4.2.3 copyright

Purpose

Indicates the copyright terms

Origin of metadata

Creator

Metadata Format and RDF Schema Definition

```
<rdf:Property rdf:about="&core;copyright"
      a:maxCardinality="1"
    rdfs:label="core:copyright">
  <rdfs:domain rdf:resource="&core;CAMBundleMetadata"/>
  <rdfs:domain rdf:resource="&core;CAMElementMetadata"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleFeatureMetadata"/>
```

```
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

Practical example

```
<core:CAMElementMetadata rdf:ID ="01226374">
  <core:Copyright rdf:datatype="xsd:string">
    free to distribute
  </core:Copyright>
  ..............
</core:CAMElementMetadata>
```

2.4.2.4 creationDateTime

Purpose

Indicates the creation date and time of the CAM Object/CAM Bundle or User Comment.

Origin of metadata

System

Metadata Format and RDF Schema Definition

```
<rdf:Property rdf:about="&core;creationDateTime"
    rdfs:label="core:creationDateTime">
  <rdfs:domain rdf:resource="&core;UserComment"/>
  <rdfs:domain rdf:resource="&core;CAMBundleMetadata"/>
  <rdfs:domain rdf:resource="&core;CAMElementMetadata"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;genericSystemProperty"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;mandatoryProperty"/>
  <rdfs:range rdf:resource="&xsd;dateTime"/>
</rdf:Property>
```

Practical example

```
<core:CAMElementMetadata rdf:ID ="01226374">
  <core:CreationDateTime rdf:datatype="xsd:dateTime">
    2008-11-25T11:00
  </core:CreationDateTime>
  ..............
</CAMElementMetadata>
```

2.4.2.5 creatorReference

Purpose

The value of CreatorReference corresponds either to the entityUID of the author if registred or to the URI of an author page if not registred with CAM4Home

Origin of metadata

System

Metadata Format and RDF Schema Definition

```
<rdf:Property rdf:about="&core;creatorReference"
    rdfs:label="core:creatorReference">
  <rdfs:domain rdf:resource="&core;CAMElementMetadata"/>
  <rdfs:domain rdf:resource="&core;CAMBundleMetadata"/>
  <rdfs:subPropertyOf
    rdf:resource="&abstract;supplementaryMetadataReference"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;mandatoryProperty"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

Practical example

```
<core:VideoElementMetadata rdf:ID="98754512_VEM">
  ...
  <core:creatorReference rdf:datatype="xsd:string">
      http://www.cam4home-itea.org/members/mb
  </core:creatorReference>
  ...
</core:VideoElementMetadata>
```

2.4.2.6 description

Purpose

Textual description of the CAM Object. This property is also shared with CAMBundleMetadata, ContentGenre, ExecutionRequirement and AppearingConcept classes.

Origin of metadata

Creator

Metadata Format and RDF Schema Definition

```
<rdf:Property rdf:about="&core;description"
    rdfs:label="core:description">
  <rdfs:domain rdf:resource="&core;CAMBundleMetadata"/>
  <rdfs:domain rdf:resource="&core;CAMElementMetadata"/>
  <rdfs:domain rdf:resource="&core;ContentGenre"/>
  <rdfs:domain rdf:resource="&core;ExecutionRequirement"/>
  <rdfs:domain rdf:resource="&core;AppearingConcept"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleFeatureMetadata"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

Practical example

```
<core:CAMElementMetadata rdf:ID ="01226374">
  <core:Description>
    Dummy element for illustrating the encodings of different metadata
  </core:Description >
  ............
</core:CAMElementMetadata>
```

2.4.2.7 hasCCContainer

Purpose

Generic container for the attachment of local and/or shared community created metadata to CAM Object and CAM Bundle.

Not intented to be instantiated.

Origin of metadata

Creator

Metadata Format and RDF Schema Definition

```
<rdf:Property rdf:about="&core;hasCCContainer"
    rdfs:label="core:hasCCContainer">
  <rdfs:domain rdf:resource="&core;CAMBundleMetadata"/>
  <rdfs:domain rdf:resource="&core;CAMElementMetadata"/>
  <rdfs:range rdf:resource="&abstract;CommunityCreatedMetadataContainer"/>
</rdf:Property>
```

2.4.2.8 hasCoreExternalMetadata

Purpose

Container for the attachment of external metadata to CAM Object.

Origin of metadata

Creator or system (if automatically generated)

Metadata Format and RDF Schema Definition

```
<rdf:Property rdf:about="&core;hasCoreExternalMetadata"
    rdfs:label="core:hasCoreExternalMetadata">
  <rdfs:domain rdf:resource="&core;CAMElementMetadata"/>
  <rdfs:domain rdf:resource="&core;CAMBundleMetadata"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;hasCoreExternalMetadata"/>
  <rdfs:range rdf:resource="&abstract;ExternalCoreMetadata"/>
</rdf:Property>
```

2.4.2.9 hasLocalCCContainer

Purpose

Generic container for the attachment of local community created metadata to CAM Object and CAM Bundle.

Not intented to be instantiated.

Origin of metadata

Creator

Metadata Format and RDF Schema Definition

```
<rdf:Property rdf:about="&core;hasLocalCCContainer"
    rdfs:label="core:hasLocalCCContainer">
  <rdfs:domain rdf:resource="&core;CAMBundleMetadata"/>
  <rdfs:domain rdf:resource="&core;CAMElementMetadata"/>
  <rdfs:range rdf:resource="&abstract; LocalCCMetadataContainer/>
  <rdfs:subPropertyOf rdf:resource="&abstract;hasCCContainer"/>
</rdf:Property>
```

2.4.2.10 hasLocalSocialTags

Purpose

Container for attaching multiple SocialTag to a CAM Object/CAM Bundle.

Origin of metadata

Creator, User

Metadata Format and RDF Schema Definition

```
<rdf:Property rdf:about="&core;hasLocalSocialTags"
    rdfs:label="core:hasLocalSocialTags">
  <rdfs:domain rdf:resource="&core;CAMBundleMetadata"/>
  <rdfs:domain rdf:resource="&core;CAMElementMetadata"/>
  <rdfs:range rdf:resource="&core;LocalSocialTags"/>
  <rdfs:subPropertyOf rdf:resource="&core;hasLocalCCMetadataContainer"/>
</rdf:Property>
```

The definitions of **LocalSocialTags** class and its properties are provided here bellow:

LocalSocialTags rdf class definition

```
<rdfs:Class rdf:about="&core;LocalSocialTags"
   rdfs:label="core:LocalSocialTags">
  <rdfs:subClassOf rdf:resource="&abstract;LocalCCMetadataContainer"/>
</rdfs:Class>
```

hasSocialTag property

```
<rdfs:Property rdf:about="&core;hasSocialTag"
    rdfs:label="core:hasSocialTag">
  <rdfs:subPropertyOf rdf:resource="&abstract;hasCCMetadata">
  <rdfs:domain rdf:resource="&core;LocalSocialTags"/>
  <rdfs:domain rdf:resource="&core;SharedSocialTags"/>
  <rdfs:range rdf:resource="&core;SocialTag"/>
</rdfs:Property>
```

Further details about the encoding of **SocialTag** is available here bellow.

SocialTag rdf class definition:

```
<rdfs:Class rdf:about="&core;SocialTag"
    rdfs:comment="A class for representing a SocialTag"
    rdfs:label="core:SocialTag">
```

```
  <rdfs:subClassOf rdf:resource="&abstract;CommunityCreatedMetadata"/>
</rdfs:Class>
```

tagValue property of Social Tag

```
<rdf:Property rdf:about="&core;tagValue"
    rdfs:label="core:tagValue">
  <rdfs:domain rdf:resource="&core;SocialTag"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;mandatoryProperty"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

Practical example

```
<core:SocialTag rdf:ID="Sport">
  <core:TagValue rdf:datatype="xsd:string">Sport</core:TagValue >
</core:SocialTag>
<core:SocialTag rdf:ID="Football">
  <core:TagValue rdf:datatype="xsd:string">Sport</core:TagValue>
</core:SocialTag>
```

```
<core:VideoElementMetadata rdf:ID ="0122635">
  ...
  <core:hasLocalSocialTags>
    <core:LocalSocialTags>
      <core:hasSocialTag rdf:resource="#Sport"/>
      <core:hasSocialTag rdf:resource="#Football"/>
    </core:LocalSocialTags>
  </core:hasLocalSocialTags>
  ...
</core:VideoElementMetadata>
```

2.4.2.11 hasLocalUserComments

Purpose

Container for attaching multiple UserComments to a CAM Object/CAM Bundle.

A UserComment is composed of the comment itself, a reference to the User entity that made the comment and the creation date and time of the comment.

Origin of metadata

User

Metadata Format and RDF Schema Definition

```
<rdf:Property rdf:about="&core;hasLocalUserComments"
    rdfs:label="core:hasLocalUserComments">
  <rdfs:domain rdf:resource="&core;CAMBundleMetadata"/>
  <rdfs:domain rdf:resource="&core;CAMElementMetadata"/>
  <rdfs:range rdf:resource="&core;LocalUserComments"/>
  <rdfs:subPropertyOf rdf:resource="&core;hasLocalCCMetadataContainer"/>
```

```
</rdf:Property>
```

The definitions of **LocalUserComments** class and its properties are provided here bellow:

LocalUserComments rdf class definition.

```
<rdfs:Class rdf:about="&core;LocalUserComments"
    rdfs:label="core:LocalUserComments">
  <rdfs:subClassOf rdf:resource="&abstract;LocalCCMetadataContainer"/>
</rdfs:Class>
```

hasUserComment property

```
<rdfs:Property rdf:about="&core;hasUserComment"
    rdfs:label="core:hasUserComment">
  <rdfs:subPropertyOf rdf:resource="&abstract;hasCCMetadata">
  <rdfs:domain rdf:resource="&core;LocalUserComments"/>
  <rdfs:domain rdf:resource="&core;SharedUserComments"/>
  <rdfs:range rdf:resource="&core;UserComment"/>
</rdfs:Property>
```

Further description of **UserComment** and its properties (comment, creationDateTime and userReference) are available here bellow:

```
<rdfs:Class rdf:about="&core;UserComment"
    rdfs:comment="A class for representing a UserComment"
    rdfs:label="core:UserComment">
  <rdfs:subClassOf rdf:resource="&abstract;CommunityCreatedMetadata"/>
</rdfs:Class>
```

```
<rdf:Property rdf:about="&core;comment"
    rdfs:label="core:comment">
  <rdfs:domain rdf:resource="&core;UserComment"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;mandatoryProperty"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

```
<rdf:Property rdf:about="&core;dateTime"
    rdfs:label="core:dateTime">
  <rdfs:domain rdf:resource="&core;UserComment"/>
  <rdfs:domain rdf:resource="&core;UserRating"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;mandatoryProperty"/>
  <rdfs:range rdf:resource="&xsd;dateTime"/>
</rdf:Property>
```

```
<rdf:Property rdf:about="&core;userReference"
    rdfs:label="core:userReference">
  <rdfs:domain rdf:resource="&core;UserComment"/>
  <rdfs:domain rdf:resource="&core;UserRating"/>
  <rdfs:subPropertyOf
    rdf:resource="&abstract;supplementaryMetadataReference"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;mandatoryProperty"/>
```

```
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

Practical example

```
<core:UserComment rdf:ID="04578987_UC">
  <core:comment>Please update your video</core:comment>
  <core:creationDateTime>2008-11-22T11:22</core:creationDateTime>
  <core:userReference>
    http://www.cam4home-itea.org/external/ks0983
  </core:userReference>
</core:UserComment>
```

```
<core:VideoElementMetadata rdf:ID ="0122635">
  ...
  <core:hasLocalUserComments>
    <core:LocalUserComments>
      <core:hasUserComment rdf:ressource="#04578987_UC"/>
    </core:LocalUserComments>
  </core:hasLocalUserComments>
  ...
</core:VideoElementMetadata>
```

2.4.2.12 hasLocalUserRatings

Purpose

Container for attaching multiple UserRatings to a CAM Object/CAM Bundle.

A UserRating is composed of the rating itself, a reference to the User entity that made the rating.

Origin of metadata

User

Metadata Format and RDF Schema Definition

```
<rdf:Property rdf:about="&core;hasLocalUserRatings"
    rdfs:label="core:hasLocalUserRatings">
  <rdfs:domain rdf:resource="&core;CAMBundleMetadata"/>
  <rdfs:domain rdf:resource="&core;CAMElementMetadata"/>
  <rdfs:range rdf:resource="&core;LocalUserRatings"/>
  <rdfs:subPropertyOf rdf:resource="&core;hasLocalMetadataCCContainer"/>
</rdf:Property>
```

The definitions of **LocalUserRatings** class and its properties are provided here bellow:

LocalUserRatings rdf class definition

```
<rdfs:Class rdf:about="&core;LocalUserRatings"
    rdfs:label="core:LocalUserRatings">
  <rdfs:subClassOf rdf:resource="&abstract;LocalCCMetadataContainer"/>
</rdfs:Class>
```

hasUserRating property

```
<rdfs:Property rdf:about="&core;hasUserRating"
    rdfs:label="core:hasUserRating">
  <rdfs:subPropertyOf rdf:resource="&abstract;hasCCMetadata">
  <rdfs:domain rdf:resource="&core;LocalUserComments"/>
  <rdfs:domain rdf:resource="&core;SharedUserComments"/>
  <rdfs:range rdf:resource="&core;UserRating"/>
</rdfs:Property>
```

Further description of **UserRating** and its properties (rate, dateTime, userReference) are available here bellow:

```
<rdfs:Class rdf:about="&core;UserRating"
    rdfs:comment="A class for representing a UserRating"
    rdfs:label="core:UserRating">
  <rdfs:subClassOf rdf:resource="&rdfs;CommunityCreatedMetadata"/>
</rdfs:Class>
```

```
<rdf:Property rdf:about="&core;rate"
    rdfs:label="core:Rate">
  <rdfs:domain rdf:resource="&core;UserRating"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;mandatoryProperty"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

The **dateTime** property was defined in section 2.4.2.11.

The **userReference** property was defined in section 2.4.2.10.

Practical example

```
<core:UserRating rdf:ID ="0578978_UR">
  <core:rate rdf:datatype="xsd:integer">1</core:rate >
  <core:userReference>
    http://www.cam4home-itea.org/external/ks0983
  </core:uReference>
</core:UserRating>
```

```
<core:ImageElementMetadata rdf:ID ="129834">
  ...
  <core:hasLocalUserRatings>
    <core:LocalUserRatings>
      <core:hasUserRating rdf:ressource ="#0578978_UR"/>
      ...
    </core:LocalUserRatings>
  </core:hasLocalUserRatings>
  ...
</core:ImageElementMetadata>
```

2.4.2.13 hasSharedCCContainer

Purpose

Generic container for the attachment of shared community created metadata to CAM Object and CAM Bundle.

Not intented to be instantiated.

Origin of metadata

Creator

Metadata Format and RDF Schema Definition

```
<rdf:Property rdf:about="&core;hasSharedCCContainer"
    rdfs:label="core:hasSharedCCContainer">
  <rdfs:domain rdf:resource="&core;CAMBundleMetadata"/>
  <rdfs:domain rdf:resource="&core;CAMElementMetadata"/>
  <rdfs:range rdf:resource="&abstract;SharedCCMetadataContainer/>
  <rdfs:subPropertyOf rdf:resource="&abstract;hasCCContainer"/>
</rdf:Property>
```

2.4.2.14 hasSharedSocialTags

Purpose

Container for attaching multiple SocialTag to a CAM Object/CAM Bundle.

Origin of metadata

Creator

Metadata Format and RDF Schema Definition

```
<rdf:Property rdf:about="&core;hasSharedSocialTags"
    rdfs:label="core:hasSharedSocialTags">
  <rdfs:domain rdf:resource="&core;CAMBundleMetadata"/>
  <rdfs:domain rdf:resource="&core;CAMElementMetadata"/>
  <rdfs:range rdf:resource="&core;SharedSocialTags"/>
  <rdfs:subPropertyOf rdf:resource="&core;hasSharedCCMetadataContainer"/>
</rdf:Property>
```

The definition of **SharedSocialTags** class is provided here bellow:

```
<rdfs:Class rdf:about="&core;SharedSocialTags"
    rdfs:label="core:SharedSocialTags">
  <rdfs:subClassOf rdf:resource="&abstract;SharedCCMetadataContainer"/>
</rdfs:Class>
```

The definition of **hasSocialTag** property is available in 2.4.2.10.

The definition of **serverURI** and **retrievedDate** are available in 1.1.1.3.

Practical example

```
<core:SocialTag rdf:ID="Sport">
  <core:TagValue rdf:datatype="xsd:string">Sport</core:TagValue >
</core:SocialTag>
<core:SocialTag rdf:ID="Football">
  <core:TagValue rdf:datatype="xsd:string">Sport</core:TagValue >
</core:SocialTag>
```

```
<core:VideoElementMetadata rdf:ID ="0122635">
  ...
  <core:hasSharedSocialTags>
    <core:SharedSocialTags>
      <core:serverURI rdf:datatype=”&xsd;anyURI”>
        http://www.cam4home-itea.org/dynamicMetadata/ID12345/socialTags
      </core:serverURI>
      <core:retrieveDate rdf:datatype=”&xsd;datetime”>
        2008-11-22T11:22
      </core:retrieveDate>
      <core:hasSocialTag rdf:resource="#Sport"/>
      <core:hasSocialTag rdf:resource="#Football"/>
    </core:SharedSocialTags>
  </core:hasSharedSocialTags>
  ...
</core:VideoElementMetadata>
```

2.4.2.15 hasSharedUserComments

Purpose

Container for attaching multiple UserComments to a CAM Object/CAM Bundle.

A UserComment is composed of the comment itself, a reference to the User entity that made the comment and the creation date and time of the comment.

Origin of metadata

Creator

Metadata Format and RDF Schema Definition

```
<rdf:Property rdf:about="&core;hasSharedUserComments"
    rdfs:label="core:hasSharedUserComments">
  <rdfs:domain rdf:resource="&core;CAMBundleMetadata"/>
  <rdfs:domain rdf:resource="&core;CAMElementMetadata"/>
  <rdfs:range rdf:resource="&core;SharedUserComments"/>
  <rdfs:subPropertyOf rdf:resource=“&core;hasSharedCCMetadataContainer"/>
</rdf:Property>
```

The definition of **SharedUserComments** class is provided here bellow:

```
<rdfs:Class rdf:about="&core;SharedUserComments"
    rdfs:label="core:SharedUserComments">
```

```
  <rdfs:subClassOf rdf:resource="&abstract;SharedCCMetadataContainer"/>
</rdfs:Class>
```

The definition of **hasUserComment** property is available in 2.4.2.10.

The definition of **serverURI** and **retrievedDate** are available in 1.1.1.3.

Practical example

```
<core:UserComment rdf:ID="04578987_UC">
  <core:comment>Please update your video</core:comment>
  <core:creationDateTime>2008-11-22T11:22</core:creationDateTime>
  <core:userReference>
    http://www.cam4home-itea.org/external/ks0983
  </core:userReference>
</core:UserComment>
```

```
<core: VideoElementMetadata rdf:ID ="0122635">
  ...
  <core:hasSharedUserComments>
    <core:SharedUserComments>
      <core:serverURI rdf:datatype=”&xsd;anyURI”>
         http://www.cam4home-itea.org/dynamicMetadata/ID12345/userComments
      </core:serverURI>
      <core:retrieveDate rdf:datatype=”&xsd;datetime”>
         2008-11-22T11:22
      </core:retrieveDate>
      <core:hasUserComment rdf:resource="#04578987_UC"/>
    </core:SharedUserComments>
  </core:hasSharedUserComments>
  ...
</core:VideoElementMetadata>
```

2.4.2.16 hasSharedUserRatings

Origin of metadata

Creator

Metadata Format and RDF Schema Definition

```
<rdf:Property rdf:about="&core;hasSharedUserRatings"
    rdfs:label="core:hasSharedUserRatings">
  <rdfs:domain rdf:resource="&core;CAMBundleMetadata"/>
  <rdfs:domain rdf:resource="&core;CAMElementMetadata"/>
  <rdfs:range rdf:resource="&core;SharedUserRatings"/>
  <rdfs:subPropertyOf rdf:resource=“&core;hasSharedCCMetadataContainer"/>
</rdf:Property>
```

The definition of SharedUserRatings class is provided here below:

```
<rdfs:Class rdf:about="&core;SharedUserRatings"
    rdfs:label="core:SharedUserRatings">
  <rdfs:subClassOf rdf:resource="&abstract;SharedCCMetadataContainer"/>
</rdfs:Class>
```

The definition of **hasUserRating** property is available in 2.4.2.12.

The definition of **serverURI** and **retrievedDate** are available in 1.1.1.3.

Practical example

```
<core:UserRating rdf:ID ="0578978_UR">
  <core:rate rdf:datatype="xsd:integer">1</core:rate >
  <core:userReference>
    http://www.cam4home-itea.org/external/ks0983
  </core:uReference>
</core:UserRating>
```

```
<core:AudioElementMetadata rdf:ID ="0122635">
  ...
  <core:hasSharedUserRatings>
    <core:SharedUserUserRatings>
      <core:serverURI rdf:datatype=”&xsd;anyURI”>
        http://www.cam4home-itea.org/dynamicMetadata/ID12345/userRatings
      </core:serverURI>
      <core:retrieveDate rdf:datatype=”&xsd;datetime”>
        2008-11-22T11:22
      </core:retrieveDate>
      <core:hasUserUserRating rdf:resource="#0578978_UR"/>
    </core:SharedUserRatings>
  </core:hasSharedUserRatings>
  ...
</core:AudioElementMetadata>
```

2.4.2.17 isMetadataOf

Purposes

This property links the CAMElementMetadata instance to the essence of CAM Object. The essence is embedded into CAMElement instances.

CAMElement class is declined in MultimediaElement and ServiceElement. These classes are further more declined in AudioElement,VideoElement, ImageElement, DocumentElement and respectively, UserServiceElement, SoftwareServiceElement, DownloadableApplicationElement.

Origin of metadata

Creator

Metadata Format and RDF Schema Definition

```
<rdf:Property rdf:about="&core;isMetadataOf"
    rdfs:label="core:isMetadataOf">
  <rdfs:range rdf:resource="&core;CAMElement"/>
```

```
  <rdfs:domain rdf:resource="&core;CAMElementMetadata"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;objectSystemProperty"/>
</rdf:Property>
```

Practical example

```
<core:VideoElementMetadata rdf:ID="98754512_VEM">
  ...
  <core:isMetadataOf>
    <core:VideoElement rdf:ID="2145789_V">
      <core:videoType>Streaming </core:videoType>
      <core:streamingType>Recorded</core:streamingType>
      <core:essenceFileIdentifier>
        http://fr.youtube.com/watch?v=5iD9thjv_Mg
      </core:essenceFileIdentifier>
    </core:VideoElement>
  </core:isMetadataOf>
  ...
</core:VideoElementMetadata>
```

2.4.2.18 legalNotice

Purpose

Detailed textual description of the CAM Object usage legal terms.

Origin of metadata

Creator

Metadata Format and RDF Schema Definition

```
<rdf:Property rdf:about="&core;legalNotice"
    rdfs:label="core:legalNotice">
  <rdfs:domain rdf:resource="&core;CAMBundleMetadata"/>
  <rdfs:domain rdf:resource="&core;CAMElementMetadata"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleFeatureMetadata"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

Practical example

```
<core:VideoElementMetadata rdf:ID="98754512_VEM">
  ...
  <core:legalNotice rdf:datatype="xsd:string">
    Free content
  </core:legalNotice>
  ...
</core:VideoElementMetadata>
```

2.4.2.19 title

Purpose

Indicates the title of the CAM Object

Origin of metadata

Creator

Metadata Format and RDF Schema definition

```
<rdf:Property rdf:about="&core;title"
    rdfs:label="core:title">
  <rdfs:domain rdf:resource="&core;CAMBundleMetadata"/>
  <rdfs:domain rdf:resource="&core;CAMElementMetadata"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleFeatureMetadata"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

Practical example

```
<core:VideoElementMetadata rdf:ID="98754512_VEM">
  ...
  <core:title rdf:datatype="xsd:string">
    Dummy video
  </core:title>
  ...
</core:VideoElementMetadata>
```

2.4.2.20 validated

Purpose

Indicates the validity of CAMElementMetadata.

Only valid CAMElementMetadata is designated as CAMObject.

Origin of metadata

System, Creator.

Metadata Format and RDF Schema Definition

```
<rdf:Property rdf:about="&core;validated"
    rdfs:label="core:validated">
  <rdfs:domain rdf:resource="&core;CAMBundleMetadata"/>
  <rdfs:domain rdf:resource="&core;CAMElementMetadata"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;mandatoryProperty"/>
  <rdfs:range rdf:resource="&xsd;boolean"/>
</rdf:Property>
```

Practical example

```
<core:VideoElementMetadata rdf:ID="98754512_VEM">
  ...
  <core:validated rdf:datatype="xsd:boolean">
    true
  </core:validated>
  ...
</core:VideoElementMetadata>
```

2.4.2.21 versionNumber

Purpose

Indicates the version number of the CAMObject.

Origin of metadata

System, Creator

Metadata Format and RDF Schema Definition

```
<rdf:Property rdf:about="&core;versionNumber"
    rdfs:label="core:versionNumber">
  <rdfs:domain rdf:resource="&core;CAMBundleMetadata"/>
  <rdfs:domain rdf:resource="&core;CAMElementMetadata"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;genericSystemProperty"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;mandatoryProperty"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

Practical example

```
<core:VideoElementMetadata rdf:ID="98754512_VEM">
  ...
  <core:versionNumber rdf:datatype="xsd:string">
    1
  </core:versionNumber>
  ...
</core:VideoElementMetadata>
```

2.5 Multimedia-related CAMElementMetadata subclasses

Considering the fact the all the multimedia related subclasses share the same set of properties, we will first describe the class hierarchy and then present all the properties related to multimedia content.

2.5.1 Class definition

2.5.1.1 MultimediaElementMetadata

Purpose

MultimediaElementMetadata materialize a container for describing feature and evaluative metadata related to a multimedia CAMObject. It is further declined in audio, document, image, video metadata elements.

Origin of metadata

Creator

Metadata Format and RDF Schema Definition

```
<rdfs:Class rdf:about="&core;MultimediaElementMetadata"
    rdfs:label="core:MultimediaElementMetadata">
  <rdfs:subClassOf rdf:resource="&core;CAMElementMetadata"/>
</rdfs:Class>
```

2.5.1.2 AudioElementMetadata

Purpose

AudioElementMetadata materialize a container for describing feature and evaluative metadata related to an audio CAMObject.

Origin of metadata

Creator

Metadata Format and RDF Schema Definition

```
<rdfs:Class rdf:about="&core;AudioElementMetadata"
    rdfs:label="core:AudioElementMetadata">
  <rdfs:subClassOf rdf:resource="&core;MultimediaElementMetadata"/>
</rdfs:Class>
```

2.5.1.3 DocumentElementMetadata

Purpose

DocumentElementMetadata materialize a container for describing feature and evaluative metadata related to an document CAMObject.

Origin of metadata

Creator

Metadata Format and RDF Schema Definition

```
<rdfs:Class rdf:about="&core;DocumentElementMetadata"
    rdfs:label="core:DocumentElementMetadata">
  <rdfs:subClassOf rdf:resource="&core;MultimediaElementMetadata"/>
</rdfs:Class>
```

2.5.1.4 ImageElementMetadata

ImageElementMetadata materialize a container for describing feature and evaluative metadata related to an image CAMObject.

Origin of metadata

Creator

Metadata Format and RDF Schema Definition

```
<rdfs:Class rdf:about="&core;ImageElementMetadata"
    rdfs:label="core:ImageElementMetadata">
  <rdfs:subClassOf rdf:resource="&core;MultimediaElementMetadata"/>
</rdfs:Class>
```

2.5.1.5 VideoElementMetadata

VideoElementMetadata materialize a container for describing feature and evaluative metadata related to a video CAMObject.

Origin of metadata

Creator

Metadata Format and RDF Schema Definition

```
<rdfs:Class rdf:about="&core;VideoElementMetadata"
    rdfs:label="core:VideoElementMetadata">
  <rdfs:subClassOf rdf:resource="&core;MultimediaElementMetadata"/>
</rdfs:Class>
```

2.5.2 Properties

2.5.2.1 hasAppearingConcepts

Purpose

The AppearingConcept class describes a concept that is either automatically or manually detected from a multimedia content. The concept can be either an identifiable object, e.g. a person, or a more general or abstract thing, such as nature or sports. The concept can be named, described and linked to a related URI, e.g. in case of a person to the person's homepage or Facebook profile.

In case of an object, the location of the object can be defined using the four spatial location properties: spatialLocationLeft, spatialLocationTop, spatialLocationRight, spatialLocationBottom. These properties allow to specify a bounding box around the object in question. Origin (point 0,0) should be considered to be at the top left corner of the image area.

In case of a video file the spatial location of the object is possibly constantly changing. The spatialLocationTimePoint property allows to define the point in time when the object in question was in the spatial location specified by the spatial location properties. This way a preview of the object can be shown.

For video and audio content the temporal location of the concept can be defined using the beginTimePoint and endTimePoint properties. These properties define the begin and end time point of the concept in seconds from the beginning of the media file.

Origin of metadata

Content annotation service or any other service capable of producing concepts

Metadata Format and RDF Schema Definition

```
<rdf:Property rdf:about="&core;hasAppearingConcepts"
    rdfs:label="core:hasAppearingConcepts">
  <rdfs:range rdf:resource="&core;AppearingConcept"/>
  <rdfs:domain rdf:resource="&core;MultimediaElementMetadata"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;hasFeatureMetadata"/>
</rdf:Property>
```

The definitions of **AppearingConcept** class and associated properties are presented below :

```
<rdfs:Class rdf:about="&core;AppearingConcept"
      rdfs:comment="A class for representing an AppearingConcept"
      rdfs:label="core:AppearingConcept">
  <rdfs:subClassOf rdf:resource="&abstract;ContentFeatureMetadata"/>
</rdfs:Class>
```

```
<rdf:Property rdf:about="&core;beginTimePoint"
    rdfs:label="core:beginTimePoint">
  <rdfs:domain rdf:resource="&core;AppearingConcept"/>
  <rdfs:domain rdf:resource="&core;ContextMetadata"/>
  <rdfs:range rdf:resource="&xsd;float"/>
</rdf:Property>
```

The **description** property definition is available in section 2.4.2.5

```
<rdf:Property rdf:about="&core;endTimePoint"
     rdfs:label="core:endTimePoint">
  <rdfs:domain rdf:resource="&core;AppearingConcept"/>
  <rdfs:domain rdf:resource="&core;ContextMetadata"/>
  <rdfs:range rdf:resource="&xsd;float"/>
</rdf:Property>
```

```
<rdf:Property rdf:about="&core;name"
    rdfs:label="core:name">
  <rdfs:domain rdf:resource="&core;AppearingConcept"/>
  <rdfs:domain rdf:resource="&core;ContentGenre"/>
  <rdfs:domain rdf:resource="&core;EssenceFileMetadataEntry"/>
  <rdfs:domain rdf:resource="&core;ExecutionRequirement"/>
  <rdfs:domain rdf:resource="&core;FeatureDefinition"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;mandatoryProperty"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

```
<rdf:Property rdf:about="&core;spatialLocationLeft"
  rdfs:label="core:spatialLocationLeft">
  <rdfs:domain rdf:resource="&core;AppearingConcept"/>
  <rdfs:range rdf:resource="&xsd;integer"/>
</rdf:Property>
```

```
<rdf:Property rdf:about="&core;spatialLocationTop"
  rdfs:label="core:spatialLocationTop">
  <rdfs:domain rdf:resource="&core;AppearingConcept"/>
  <rdfs:range rdf:resource="&xsd;integer"/>
</rdf:Property>
```

```
<rdf:Property rdf:about="&core;spatialLocationRight"
  rdfs:label="core:spatialLocationRight">
  <rdfs:domain rdf:resource="&core;AppearingConcept"/>
  <rdfs:range rdf:resource="&xsd;integer"/>
</rdf:Property>
```

```
<rdf:Property rdf:about="&core;spatialLocationBottom"
  rdfs:label="core:spatialLocationBottom">
  <rdfs:domain rdf:resource="&core;AppearingConcept"/>
  <rdfs:range rdf:resource="&xsd;integer"/>
</rdf:Property>
```

```
<rdf:Property rdf:about="&core;spatialLocationTimePoint"
    rdfs:label="core:spatialLocationLocationTimePoint">
  <rdfs:domain rdf:resource="&core;AppearingConcept"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

```
<rdf:Property rdf:about="&core;uri"
    rdfs:label="core:uri">
  <rdfs:domain rdf:resource="&core;AppearingConcept"/>
  <rdfs:range rdf:resource="&xsd;anyURI"/>
</rdf:Property>
```

```
<rdf:Property rdf:about="&core;uriDescription"
    rdfs:label="core:uriDescription">
  <rdfs:domain rdf:resource="&core;AppearingConcept"/>
  <rdfs:range rdf:resource="&xsd;anyURI"/>
</rdf:Property>
```

Practical example

Example AppearingConcept structure with Person concept:

```
<core:VideoElementMetadata rdf:ID=”98754512_VEM”>
  <core:hasAppearingConcepts>
    <core:AppearingConcept rdf:ID="internalID">
```

```
      <core:name rdf:datatype="&xsd;string">
        Person
      </core:name>
      <core:description rdf:datatype="&xsd;string">
        Description of the concept, e.g. name of the person
      </core:description>
      <core:uri rdf:datatype="&xsd;anyURI">
        http://www.facebook.com/personsUserProfile
      </core:uri>
      <core:uriDescription rdf:dataType="&xsd;string">
        Description of the URI, e.g. “Link to the person's facebook
profile"
      </core:uriDescription>
      <core:spatialLocationLeft rdf:datetype=”&xsd;int”>
        20
      </core:spatialLocationLeft>
      <core:spatialLocationTop rdf:datetype=”&xsd;int”>
        100
      </core:spatialLocationTop>
      <core:spatialLocationRight rdf:datetype=”&xsd;int”>
        150
      </core:spatialLocationRight>
      <core:spatialLocationBottom rdf:datetype=”&xsd;int”>
        180
      </core:spatialLocationBottom>
      <core:spatialLocationTimePoint rfd:datatype="&xsd;integer">
        165.27 <!-- In seconds from the beginning of the media file -->
      </core:spatialLocationTimePoint>
      <core:beginTimePoint rdf:datatype="&xsd;integer">
        125.35 <!-- In seconds from the beginning of the media file -->
      </core:beginTimePoint>
      <core:endTimePoint rdf:datatype="&xsd;integer">
        211.52 <!-- In seconds from the beginning of the media file -->
      </core:endTimePoint>
    </core:AppearingConcept>
  </core:hasAppearingConcepts>
</core:VideoElementMetadata>
```

2.5.2.2 hasContentGenres

Purpose

Metadata container defining the genre categories to which the content of the essence can be assimilated.

Origin of metadata

Creator, Annotation Services

Metadata Format and RDF Schema Definition

```
<rdf:Property rdf:about="&core;hasContentGenres"
    rdfs:label="core:hasContentGenres">
  <rdfs:range rdf:resource="&core;ContentGenre"/>
  <rdfs:domain rdf:resource="&core;MultimediaElementMetadata"/>
```

```
  <rdfs:subPropertyOf rdf:resource="&abstract;hasFeatureMetadata"/>
</rdf:Property>
```

Detailed definition of **ContentGenre** class and associated properties are presented here below.

```
<rdfs:Class rdf:about="&core;ContentGenre"
    rdfs:comment="A class for representing an Author ContentGenre"
    rdfs:label="core:ContentGenre">
  <rdfs:subClassOf rdf:resource="&abstract;ContentFeatureMetadata"/>
</rdfs:Class>
```

The **description** property definition is available in section 2.4.2.5

The n**ame** property definition is available in section 2.5.2.1

```
<rdf:Property rdf:about="&core;originatingSpecificationURI"
    rdfs:label="core:originatingSpecificationURI">
  <rdfs:domain rdf:resource="&core;ContentGenre"/>
  <rdfs:domain rdf:resource="&core;EssenceFileMetadataEntry"/>
  <rdfs:domain rdf:resource="&core;ExecutionRequirement"/>
  <rdfs:domain rdf:resource="&core;FeatureDefinition"/>
  <rdfs:range rdf:resource="&xsd;anyURI"/>
</rdf:Property>
```

Practical example

```
<core:ContentGenre rdf:ID="sports">
  <core:originatingSpecificationURI>
    urn:mpeg:mpeg7:cs:GenreCS:2001
  <core:originatingSpecificationURI>
  <core:name rdf:datatype="xsd:string">Sports</core:name>
  <core:description rdf:datatype="xsd:string">
    Media contents about sport activities and athletes
  </core:description>
</core:ContentGenre>
```

```
<core:VideoElementMetadata rdf:ID="98754512_VEM">
  ...
  <genres rdf:resource="#sports">
  ...
</core:VideoElementMetadata>
```

2.5.2.3 hasContextMetadatas

Purpose

The ContextMetadata class describes a context that is either automatically or manually associated to a multimedia content. D2.1 defines ContextMetadata with the following properties: date, gpsLocation, locationName, timeDeterminant, beginTimePoint, endTimePoint.

Origin of metadata

Creator, Annotation Services

Metadata Format and RDF Schema Definition

```
<rdf:Property rdf:about="&core;hasContextMetadatas"
    rdfs:label="core:hasContextMetadatas">
  <rdfs:range rdf:resource="&core;ContextMetadata"/>
  <rdfs:domain rdf:resource="&core;MultimediaElementMetadata"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;hasFeatureMetadata"/>
</rdf:Property>
```

Detailed definition of **ContextMetadata** class and associated properties are defined here below.

```
<rdfs:Class rdf:about="&core;ContextMetadata"
    rdfs:comment="A class for representing a ContextMetadata"
    rdfs:label="core:ContextMetadata">
  <rdfs:subClassOf rdf:resource="&abstract;ContentFeatureMetadata"/>
</rdfs:Class>
```

```
<rdf:Property rdf:about="&core;date"
    rdfs:label="core:date">
  <rdfs:domain rdf:resource="&core;ContextMetadata"/>
  <rdfs:range rdf:resource="&xsd;date"/>
</rdf:Property>
```

```
<rdf:Property rdf:about="&core;gpsLocation"
    rdfs:label="core:gpsLocation">
  <rdfs:domain rdf:resource="&core;ContextMetadata"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

```
<rdf:Property rdf:about="&core;locationName"
    rdfs:label="core:locationName">
  <rdfs:domain rdf:resource="&core;ContextMetadata"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

```
<rdf:Property rdf:about="&core;timeDeterminant"
    rdfs:label="core:timeDeterminant">
  <rdfs:domain rdf:resource="&core;ContextMetadata"/>
  <rdfs:range rdf:resource="&rdfs;Literal"/>
</rdf:Property>
```

The **beginTimePoint** and **endTimePoint** properties are already described in section 2.5.2.1

Practical example

```
<core:VideoElementMetadata rdf:ID="98754512_VEM">
  ...
  <core:hasContextsInEssence>
    <core:ContextMetadata>
```

```
      <core:gosLocation rdf:datatype="xsd:string>
        N 51.2986° - W 116.9632°
      </core:gpsLocation>
      <core:locationName rdf:datatype="xsd:string">
         France, Lille
      </core:locationName>
      <core:date rdf:datatype="xsd:date">2008-11-25</core:date>
    </core:ContextMetadata>
  </core:hasContextsInEssence>
  ...
</core:VideoElementMetadata>
```

2.5.2.4 hasEssenceFileMetadataEntries

Purpose

The purpose of this container is to attach several information elements related to the essence encoding. These elements are composed among others of : Mime-type, Content-size

They are encoded as pairs of (name, value). We have chosen this encoding in order to take into account a wide variety of essence properties. Following the Classification Scheme solution proposed notably in MPEG-7, we proposed a set of controlled term in order to organize the essence properties that are manageable by the metadata framework.

The values are encoded as &rdfs;Literal; in order to support also the encoding of complex values for a given metadata entry.

Origin of metadata

Creator, System, any service Creating CAM Objects

Metadata Format and RDF Schema Definition

```
<rdf:Property rdf:about="&core;hasEssenceFileMetadataEntries"
    rdfs:label="core:hasEssenceFileMetadataEntries">
  <rdfs:range rdf:resource="&core;EssenceFileMetadataEntry"/>
  <rdfs:domain rdf:resource="&core;MultimediaElementMetadata"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;hasFeatureMetadata"/>
</rdf:Property>
```

Detailed definitions of **EssenceFileMetadataEntry** and its properties are presented here below :

```
<rdfs:Class rdf:about="&core;EssenceFileMetadataEntry"
    rdfs:comment="A class for representing an EssenceFileMetadataEntry"
    rdfs:label="core:EssenceFileMetadataEntry">
  <rdfs:subClassOf rdf:resource="&abstract;ContentFeatureMetadata"/>
</rdfs:Class>
```

The **name** property definition is available in section 2.5.2.1

```
<rdf:Property rdf:about="&core;value"
    rdfs:label="core:value">
  <rdfs:domain rdf:resource="&core;EssenceFileMetadataEntry"/>
```

```
  <rdfs:domain rdf:resource="&core;ExecutionRequirement"/>
  <rdfs:domain rdf:resource="&core;FeatureDefinition"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;mandatoryProperty"/>
  <rdfs:range rdf:resource="&rdfs;Literal"/>
</rdf:Property>
```

The **originatingSpecificationURI** property definition is available in section 2.5.2.2

Practical example

```
<core:EssenceFileMetadataEntry>
  <core:name rdf:datatype="&xsd;string">contentMimeType</name>
  <core:value rdf:datatype="&xsd;string">video/x-msvideo</value>
</core:EssenceFileMetadataEntry>
```

```
<core:EssenceFileMetadataEntry>
  <core:name rdf:datatype="&xsd;string">contentSize</name>
  <core:value rdf:datatype="&xsd;int">91814</value>
</core:EssenceFileMetadataEntry>
```

2.5.2.5 thumbnail

Purpose

The purpose of this property is to attach a thumbnail image to a MultimediaElementMetadata. It contains the URI of the thumbnail image.

Origin of metadata

Creator, System, any service Creating CAM Objects

Metadata Format and RDF Schema Definition

```
<rdf:Property rdf:about="&core;thumbnail"
    rdfs:label="core: thumbnail ">
  <rdfs:range rdf:resource="&xsd;anyURI"/>
  <rdfs:domain rdf:resource="&core;MultimediaElementMetadata"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleFeatureMetadata"/>
</rdf:Property>
```

2.6 Service-related CAMElementMetadata subclasses

Considering the fact the all the service related subclasses share the same set of properties, we will first describe the class hierarchy and then present all the properties related to services.

2.6.1 Class definitions

2.6.1.1 ServiceElementMetadata

Purpose

ServiceElementMetadata materialize a container for describing feature and evaluative metadata related to a service CAMObject. It is further declined in downloadable application, software service and user service elements.

Origin of metadata

Creator

Metadata Format and RDF Schema Definition

```
<rdfs:Class rdf:about="&core;ServiceElementMetadata"
   rdfs:label="core:ServiceElementMetadata">
  <rdfs:subClassOf rdf:resource="&core;CAMElementMetadata"/>
</rdfs:Class>
```

2.6.1.2 DownloadableApplicationElementMetadata

Purpose

DownloadableApplicationElementMetadata materialize a container for describing feature and evaluative metadata related to a download application CAMObject.

Origin of metadata

Creator

Metadata Format and RDF Schema Definition

```
<rdfs:Class rdf:about="&core;DownloadableApplicationElementMetadata"
   rdfs:label="core:DownloadableApplicationElementMetadata">
  <rdfs:subClassOf rdf:resource="&core;ServiceElementMetadata"/>
</rdfs:Class>
```

2.6.1.3 SoftwareServiceElementMetadata

Purpose

SoftwareServiceElementMetadata materialize a container for describing feature and evaluative metadata related to a software service CAMObject.

Origin of metadata

Creator

Metadata Format and RDF Schema Definition

```
<rdfs:Class rdf:about="&core;SoftwareServiceElementMetadata"
```

```
   rdfs:label="core:SoftwareServiceElementMetadata">
  <rdfs:subClassOf rdf:resource="&core;ServiceElementMetadata"/>
</rdfs:Class>
```

2.6.1.4 UserServiceElementMetadata

Purpose

UserServiceElementMetadata materialize a container for describing feature and evaluative metadata related to a user service CAMObject.

Origin of metadata

Creator

Metadata Format and RDF Schema Definition

```
<rdfs:Class rdf:about="&core;UserServiceElementMetadata"
   rdfs:label="core:UserServiceElementMetadata">
  <rdfs:subClassOf rdf:resource="&core;ServiceElementMetadata"/>
</rdfs:Class>
```

2.6.2 Properties

2.6.2.1 hasExecutionRequirements

Purpose

Container regrouping all requirements related to service consumption.

Origin of metadata

Creator, Annotation Service

Metadata Format and RDF Schema Definition

```
<rdf:Property rdf:about="&core;hasExecutionRequirements"
    rdfs:label="core:hasExecutionRequirements">
  <rdfs:range rdf:resource="&core;ExecutionRequirement"/>
  <rdfs:domain rdf:resource="&core;ServiceElementMetadata"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;hasFeatureMetada"/>
</rdf:Property>
```

Detailed definition of ExecutionRequirement class and associated properties are presented here below:

```
<rdfs:Class rdf:about="&core;ExecutionRequirement"
    rdfs:comment="A class for representing an ExecutionRequirement"
    rdfs:label="core:ExecutionRequirement">
  <rdfs:subClassOf rdf:resource="&abstract;ContentFeatureMetadata"/>
</rdfs:Class>
```

The **description** property definition is available in section 2.4.2.5

The n**ame** property definition is available in section 2.5.2.1

The **value** property definition is available in section 2.5.2.4

The **originatingSpecificationURI** property definition is available in section 2.5.2.2

Practical example

```
<core:ServiceElementMetadata rdf:ID="5789412_SEM">
  <core:hasExecutionRequirements>
    <core:ExecutionRequirement>
      <core:name rdf:datatype="xsd:string">MinimumRAM</core:name>
      <core:value rdf:datatype="xsd:string">128Mo</core:value>
    </core:ExecutionRequirement>
  </core:hasExecutionRequirements>
</core:ServiceElementMetadata>
```

2.7 CAMBundleMetadata class specifications

2.7.1 Class definition

Purpose

CAMBundleMetada materializes a container for describing feature, aggregative and evaluative metadata related to a CAMBundle.

Origin of metadata

Creator

Metadata Format and RDF Schema Definition

```
<rdfs:Class rdf:about="&core;CAMBundleMetadata"
    rdfs:label="core:CAMBundleMetadata">
  <rdfs:subClassOf rdf:resource="&abstract;ContentAggregativeContainer"/>
  <rdfs:subClassOf rdf:resource="&abstract;ContentFeatureContainer"/>
</rdfs:Class>
```

2.7.2 Properties

2.7.2.1 authorReference

See section 2.4.2.1

2.7.2.2 camBundleMetadataID

Purpose

Identifies the CAMBundle family instances. For each CAMBundle, the system stores all the evolution of the CAMBundle as a series of versions. Each version is associated to a CAMBundleMetadata instance. All versions of the same CAMBundle share the same CAMBundleMetadataID. The distinction between versions is indicated by the VersionNumber attribute that is presented in section 2.7.2.25. The ID does not include any spaces.

Origin of metadata

System

Metadata Format and RDF Schema Definition

```
<rdf:Property rdf:about="&core;camBundleMetadataID"
    rdfs:label="core:camBundleMetadataID">
  <rdfs:domain rdf:resource="&core;CAMBundleMetadata"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;bundleSystemProperty"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;mandatoryProperty"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

Practical example

```
<core:CAMBundleMetadata rdf:ID="04578912_CBM">
  ...
  <core:camBundleMetadataID rdf:datatype="xsd:string">
    014788751_CB
  </core:camBundleMetadataID>
  ...
</core:CAMBundleMetadata>
```

2.7.2.3 containsCAMObjectsReference

Purpose

Associates CAM Objects (instances of CAMElementMetadata) to a CAM Bundle. For each CAMObject, one must indicate the CAMObject family ID and version Number. The reference of an object is composed by the object family ID (camElementID) followed by a # and then the version number (e.g. “OBJ1_VEM#1”).

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&core;containsCAMObjectReference"
    rdfs:label="core:containsCAMObjectReference">
  <rdfs:domain rdf:resource="&core;CAMBundleMetadata"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;coreMetadataReference"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

Practical example

```
<core:containsCAMObjectReference>
  <rdf:Bag>
     <rdf:li rdf:datatype="xsd:string">OBJ1_VEM#1</rdf:li>
     <rdf:li rdf:datatype="xsd:string">OBJ3_IEM#2</rdf:li>
  </rdf:Bag>
</core:containsCAMObjectReference>
```

In this example two objects are aggregated in a bundle. OBJ1 a video element metadata in version 1 and OBJ2 an image element metadata in version 2.

2.7.2.4 copyright

See section 2.4.2.3

2.7.2.5 contributorReference

Use and purpose

This metadata entry determines entities that have contributed to the current version of the bundle.

Origin of metadata

Domain of the bundle creator, Range of the bundle

Metadata Format and RDF Schema Definition

```
<rdf:Property rdf:about="&core;contributorReference"
    rdfs:label="core:contributorReference">
  <rdfs:domain rdf:resource="&core;CAMBundleMetadata"/>
  <rdfs:subPropertyOf
    rdf:resource="&abstract;supplementaryMetadataReference"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

2.7.2.6 consumerReference

Use and purpose

This metadata entry indicates list of consumers that the bundle has been delivered to, the value includes name of the consumer and a reference to his/her profile, e.g. Name | URL to profile.

Origin of metadata

Domain of the bundle consumer, Range of the bundle.

Metadata Format and RDF Schema Definition

```
<rdf:Property rdf:about="&core;consumerReference"
    rdfs:label="core:consumerReference">
  <rdfs:domain rdf:resource="&core;CAMBundleMetadata"/>
```

```
  <rdfs:subPropertyOf
    rdf:resource="&abstract;supplementaryMetadataReference"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

2.7.2.7 creationDateTime

See section 2.4.2.4

2.7.2.8 creatorReference

See section 2.4.2.5.

2.7.2.9 description

See section 2.4.2.5

2.7.2.10 distributorReference

Use and purpose

This metadata entry determines name of the bundle distributor. For example the value is a link to the author's user profile.

Origin of metadata

Domain of the bundle distributor. Range of the bundle.

Metadata Format and RDF Schema Definition

```
<rdf:Property rdf:about="&core;distributorReference"
    rdfs:label="core: distributorReference">
  <rdfs:domain rdf:resource="&core;CAMBundleMetadata"/>
  <rdfs:subPropertyOf
     rdf:resource="&abstract;supplementaryMetadataReference"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

2.7.2.11 hasCoreExternalMetadata

See section 2.4.2.8.

2.7.2.12 hasLocalSocialTags

See section 2.4.2.10

2.7.2.13 hasLocalUserComments

See section 2.4.2.10.

2.7.2.14 hasLocalUserRatings

See section 2.4.2.12.

2.7.2.15 hasRelationships property

Use and purpose

This metadata entry associates qualitative or quantitative relations between CAMObjects within a CAMBundle. Relation types are defined with regard to a given vocabulary (or classification scheme). The relationship classes are presented in section 2.7.3.

Origin of metadata

Any service capable of creating cam bundles.

Metadata Format and RDF Schema Definition

```
<rdf:Property rdf:about="&core;hasRelationships"
    rdfs:label="core:hasRelationships">
  <rdfs:domain rdf:resource="&core;CAMBundleMetadata"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;hasAggregativeMetadata"/>
  <rdfs:range rdf:resource="&core;Relationship"/>
</rdf:Property>
```

2.7.2.16 hasSharedSocialTags

See section 2.4.2.14

2.7.2.17 hasSharedUserComments

See section 2.4.2.14.

2.7.2.18 hasSharedUserRatings

See section 2.4.2.16.

2.7.2.19 legalNotice

See section 2.4.2.18.

2.7.2.20 targetCommunityReference

Use and purpose

This metadata entry determines list of communities that the bundle is mainly targeted to. The value can be links to user or community profiles on user and community profiling server.

Origin of metadata

defined by the bundle creator.

Metadata Format and RDF Schema Definition

```
<rdf:Property rdf:about="&core;targetCommunityReference"
    rdfs:label="core:targetCommunityReference">
  <rdfs:domain rdf:resource="&core;CAMBundleMetadata"/>
  <rdfs:subPropertyOf
    rdf:resource="&abstract;supplementaryMetadataReference"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

2.7.2.21 targetDeviceReference

Purpose

Indicates the device entities for which the bundle was designed.

Origin

Creator

Metadata Format and RDF Schema Definition

```
<rdf:Property rdf:about="&core;targetDeviceReference"
    rdfs:label="&core;targetDeviceReference">
  <rdfs:domain rdf:resource="&core;CAMBundleMetadata"/>
  <rdfs:subPropertyOf
    rdf:resource="&abstract;supplementaryMetadataReference"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

Practical example

```
<core:CAMBundleMetadata ...>
  <core:targetDeviceReference>
            1267538_DEVICE
  <core:targetDeviceReference>

  ...
</core:CAMBundleMetadata>
```

2.7.2.22 targetDomains

Use and purpose

This metadata entry determines network domains in which the bundle is feasible to distribute. For example if the contents and applications are applicable for mobile domain as the contents referenced in the bundle are all small sized.

Origin of metadata

defined by the bundle creator.

Metadata Format and RDF Schema Definition

```
<rdf:Property rdf:about="&supplementary;targetDomains"
    rdfs:label="&supplementary;targetDomains">
  <rdfs:domain rdf:resource="&core;CAMBundleMetadata"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleFeatureMetadata"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

2.7.2.23 title

See section 2.4.2.19.

2.7.2.24 validated

Purpose

Indicates the validity of CAMBundleMetadata.

Only valid CAMBundleMetadata is addressed as CAMBundle.

Origin of metadata

Bundle Creator

Metadata Format and RDF Schema Definition

See section 2.4.2.20

Practical example of metadata entry

```
<core:CAMBundleMetadata rdf:ID="04578912_CBM">
  ...
  <core:validated rdf:datatype="xsd:boolean">
    true
  </core:validated>
  ...
</core:CAMBundleMetadata>
```

2.7.2.25 versionNumber

Purpose

Indicates the version number of a CAMBundleMetadata within a CAMBundle family.

Origin of metadata

System

Metadata Format and RDF Schema Definition

See section 2.4.2.21

Practical example of metadata entry

```
<core:CAMBundleMetadata rdf:ID="04578912_CBM">
```

```
  ...
  <core:versionNumber rdf:datatype="xsd:string">
    1
  </core:versionNumbers>
  ...
</core:CAMBundleMetadata>
```

2.7.3 Relationships between CAMObjects within a CAMBundle

In D2.1 relations between CAMObjects within a CAMBundle were only superficially defined with ObjectRelationship. Here we propose that the relations, similar to MPEG-7, contain Source, Target and RelationType properties as string values. Having the relation's type as a freely fillable property field gives these entries high functionality but also demands common rules for usage, e.g. in the form of agreed-on relations.

We suggest the usage of controlled terms defined in well identified classification schemes in order to have a better understanding of the relation designated by a given concept. This will notably allow the reuse the entire set of relations defined in MPEG-7 or any other standards defining specific classification schemes.

In contrast to MPEG-7, we also take into account the creation of quantitative relationships having specific parameters. For this kind of relationship, we define subclasses of Relationship class described by appropriate parameters. The list of qualitative relations that were not available in external classification scheme but needed within the project are included in CAM4HOME classification schemes presented here below:

```
<ClassificationScheme
     uri="urn:c4h:cs:SemanticRelationCS:2008"
      domain="//BundleRelationships/SemanticRelation">

    <Term termID="metaDescriptionOf">
        <Definition>When a CAM Object content is meant as a descriptive
metadata of another Element(e.g. CAM Object #2 is a review of the film that
has the trailer in CAM Object #1)</Definition>
    </Term>

    <Term termID="sameEvent">
        <Definition>When a CAM Object is created in the same event with
another CAM object (eg : Image A is taken with Video B in new year 2008
</Definition>
    </Term>

    <Term termID="sameDate">
        <Definition>When a CAM Object is taken at the same date with
another CAM Object </Definition>
    </Term>

    <Term termID="sameTheme">
        <Definition>When a CAM Object is about the same subject with
another CAM Object</Definition>
    </Term>

    <Term termID="sameTime">
        <Definition> Object A After Object B indicates that A must be
played at the same time B </Definition>
    </Term>

    <Term termID="alternative">
```

```
        <Definition>A is alternative of B if they deliver the same content.
This relation contains parameters describing the physical features that
changes between A and B (color, resolution, etc.) </Definition>
    </Term>

    <Term termID="anteriorTo">
        <Definition> This relation has a parameter time which indicate the
laps of time in seconds between the creation of a and b</Definition>
    </Term>

    <Term termID="posteriorTo">
        <Definition> This relation has a parameter time which indicate the
laps of time in seconds betwwen the creation of a and b</Definition>
    </Term>

    <Term termID="partOf">
        <Definition>This relation has a parameter Time which indicate a
frame when the image appears in the video clip</Definition>
    </Term>

    <Term termID="derivativeOf">
        <Definition>When a CAM Object Element is a derivative work of
another. Derivation description can also be added (e.g. CAM Object #2 is a
re-mix of the CAM Object #1)</Definition>
    </Term>

    <Term termID="sequel">
        <Definition>A is sequel of B. </Definition>
    </Term>

    <Term termID="renders">
        <Definition>Rendering relation: an object will render the
representation of another object inside itself (a web page with a video
rendered in with a plug-in)</Definition>
    </Term>


    <Term termID="containsAdvertisement">
        <Definition> When Ad Object B is insert in Object A (eg: video
which contains an Ad image). This relation contains parameters describing
where to put the Ad (Position) and the times (when to put it and how long)
</Definition>
    </Term>

    <Term termID="isAdvertisementOf">
        <Definition> When an Object A is an advertisement of another Object
B</Definition>
    </Term>

</ClassificationScheme>
```

Relations are defined at version level (CAMElementMetadataID#VersionNumber for CAMElementMetadata).

The section is organized as follows: a first subsection details the definition of the upper Relationship class. The subsequent sections presents specialization of Relationship class: advertises, alternative, anterior/posterior to, derivative of, part of and presentation relationships. We present them in alphabetical order.

2.7.3.1 Relationship class

Use and purpose

This metadata class represents quantitative and qualitative relations between CAMObjects within a CAMBundle. This class support the expression of n-ary relations directed (p sources to r targets) or undirected (n sources equally concerned by the relation). This distinction between directed/undirected relations is introduced by the value of *directional* parameter. For each CAMObject, one must indicate the CAMObject family ID and version Number. The reference of an object is composed by the object family ID (camElementID) followed by a # and then the version number (e.g. "OBJ1_VEM#1").

Origin of metadata

Any service capable of creating CAM bundles.

Metadata Format and RDF Schema Definition

```
<rdfs:Class rdf:about="&core;Relationship"
    rdfs:label="core:Relationship">
  <rdfs:subClassOf rdf:resource="&abstract;ContentAggregativeMetadata"/>
</rdfs:Class>
```

```
<rdf:Property rdf:about="&core;directional"
   rdfs:comment="value between true ou false"
   rdfs:label="core:directional">
  <rdfs:domain rdf:resource="&core;Relationship"/>
  <rdfs:range rdf:resource="&xsd;boolean"/>
</rdf:Property>
```

```
<rdf:Property rdf:about="&core;relationshipStrength"
    rdfs:comment="value between 0 and 1"
    rdfs:label="core:relationshipStrength">
  <rdfs:domain rdf:resource="&core;Relationship"/>
  <rdfs:range rdf:resource="&xsd;float"/>
</rdf:Property>
```

```
<rdf:Property rdf:about="&core;relationshipType"
    rdfs:label="core:relationshipType">
  <rdfs:domain rdf:resource="&core;Relationship"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

```
<rdf:Property rdf:about="&core;sourceReference"
    rdfs:label="core:sourceReference">
  <rdfs:range rdf:resource="&xsd;string"/>
  <rdfs:domain rdf:resource="&core;Relationship"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;coreMetadataReference"/>
```

```
</rdf:Property>
```

```
<rdf:Property rdf:about="&core;targetReference"
    rdfs:label="core:targetReference">
  <rdfs:range rdf:resource="&xsd;string"/>
  <rdfs:domain rdf:resource="&core;Relationship"/>
 <rdfs:subPropertyOf rdf:resource="&abstract;coreMetadataReference"/>
</rdf:Property>
```

Practical example of metadata entry

```
<core:hasRelationships
   xmlns:mpeg7_temp="urn:mpeg:mpeg7:cs:TemporalRelationCS:2001">
  <core:Relationship rdf:about="relationship_1">
   <core:directional rdf:datatype="&xsd;boolean">true</core:directional>
   <core:relationshipType>&mpeg7_temp;before</<core:relationshipType>
   <core:sourceReference>0324732_VEM#1</core:sourceReference>
   <core:targetReference>0362545_VEM#5</core:targetReference>
  </core:Relationship>
  ...
</core:hasRelationships>
```

2.7.3.2 AdvertisesRelationship

Purpose

A CAM Object for advertisement to be included on top of an image or video may be created by the advertiser. The creation may also involve attached web pages, allowing rapid buy. All this metadata is encapsulated into the ContainsAdvertisement parameters: adType, rapidBuyURL, cueTones (inspired by SCTE35 specification: cuePoint (s), cueLength(s)), ad-position (ad-position-top x ad-position-left), ad-resolution (ad-height x ad-width).

Origin of metadata

Advertisment Service?, Advertisment Provider?, creator

Metadata Format and RDF Schema Definition

```
<rdfs:Class rdf:about="&core;AdvertisesRelationship"
    rdfs:label="core:AdvertisesRelationship">
  <rdfs:subClassOf rdf:resource="&core;Relationship"/>
</rdfs:Class>
```

```
<rdf:Property rdf:about="&core;adHeight"
    rdfs:label="core:adHeight">
  <rdfs:domain rdf:resource="&core;AdvertisesRelationship"/>
  <rdfs:range rdf:resource="&xsd;integer"/>
</rdf:Property>
```

```
<rdf:Property rdf:about="&core;adPositionLeft"
    rdfs:label="core:adPositionLeft">
  <rdfs:domain rdf:resource="&core;AdvertisesRelationship"/>
```

```
  <rdfs:range rdf:resource="&xsd;integer"/>
</rdf:Property>
```

```
<rdf:Property rdf:about="&core;adPositionTop"
    rdfs:label="core:adPositionTop">
  <rdfs:domain rdf:resource="&core;AdvertisesRelationship"/>
  <rdfs:range rdf:resource="&xsd;integer"/>
</rdf:Property>
```

```
<rdf:Property rdf:about="&core;adWidth"
    rdfs:label="core:adWidth">
  <rdfs:domain rdf:resource="&core;AdvertisesRelationship"/>
  <rdfs:range rdf:resource="&xsd;integer"/>
</rdf:Property>
```

```
<rdf:Property rdf:about="&core;adType"
   rdfs:label="core:adType">
  <rdfs:domain rdf:resource="&core;AdvertisesRelationship"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

```
<rdf:Property rdf:about="&core;rapidBuyURL"
    rdfs:label="core:adType">
  <rdfs:domain rdf:resource="&core;AdvertisesRelationship"/>
  <rdfs:range rdf:resource="&xsd;anyURI"/>
</rdf:Property>
```

```
<rdf:Property rdf:about="&core;hasCueTones"
    rdfs:label="core:adType">
  <rdfs:domain rdf:resource="&core;AdvertisesRelationship"/>
  <rdfs:range rdf:resource="&core;CueTone"/>
</rdf:Property>
```

```
<rdfs:Class rdf:about="&core;CueTone"
      rdfs:label="core:CueTone">
  <rdfs:subClassOf rdf:resource="&rdfs;ContentFeatureMetadata"/>
</rdfs:Class>
```

```
<rdf:Property rdf:about="&core;cuePoint"
    rdfs:label="core:cuePoint">
  <rdfs:domain rdf:resource="&core;CueTone"/>
  <rdfs:range rdf:resource="&xsd;float"/>
</rdf:Property>
```

```
<rdf:Property rdf:about="&core;cueLength"
    rdfs:label="core:cueLength">
  <rdfs:domain rdf:resource="&core;CueTone"/>
  <rdfs:range rdf:resource="&xsd;float"/>
```

```
</rdf:Property>
```

2.7.3.3 AlternativeRelationship

Purpose

This relation indicates whether an object is an alternative representation of another object. The parameters of the relation informs on the list of features changed: dimensions, language, frame rate, quality.

Origin of metadata

Annotation Service

Metadata Format and RDF Schema Definition

```
<rdfs:Class rdf:about="&core;AlternativeRelationship"
    rdfs:label="core:AlternativeRelationship">
  <rdfs:subClassOf rdf:resource="&core;Relationship"/>
</rdfs:Class>
```

```
<rdf:Property rdf:about="&core;hasFeaturesChanged"
    rdfs:label="core:featuresChanged">
  <rdfs:domain rdf:resource="&core;AlternativeRelationship"/>
  <rdfs:range rdf:resource="&core;ContentFeatureDefinition"/>
</rdf:Property>
```

```
<rdfs:Class rdf:about="&core;FeatureDefinition"
    rdfs:label="core:FeatureDefinition">
  <rdfs:subClassOf rdf:resource="&rdfs;ContentFeatureMetadata"/>
</rdfs:Class>
```

The **name** property definition is available in section 2.5.2.1

The **value** property definition is available in section 2.5.2.4

The **originatingSpecificationURI** property definition is available in section 2.5.2.2

Practical example

```
<core:AlternativeRelationship
   xmlns:c4h=" urn:c4h:cs:SemanticRelationCS:2008">
   <core:directional rdf:datatype="&xsd;boolean">true</core:directional>
   <core:relationshipType>&c4h;alernative</core:relationshipType>
   <core:sourceReferencerdf:resource="InternalID1_VideoElementMetadata"/>
   <core:targetReference rdf:resource="InternalID2_VideoElementMetadata"/>
   <core:hasFeaturesChanged>
      <core:FeatureDefinition>
        <core:featureName>language</core:featureName>
        <core:featureValue>English</core:featureValue>
      </core:FeatureDefinition>
      ...
   </core:hasFeaturesChanged>
</core:AlternativeRelationship>
```

2.7.3.4 AnteriorToRelationship, PosteriorToRelationship

Purpose

Materialize the chronologic sequence relationship between the multimedia objects of a same type. Time between the creation of the two multimedia objects.

The parameter **time** (positive value measured in seconds) indicates the laps of time in seconds between the creation of object A and B. The nature of the relation AnteriorTo or PosteriorTo states whether A was created before B or vice-versa.

Origin of metadata

Annotation Service

Metadata Format and RDF Schema Definition

```
<rdfs:Class rdf:about="&core;AnteriorToRelationship"
    rdfs:label="core:AnteriorToRelationship">
  <rdfs:subClassOf rdf:resource="&core;Relationship"/>
</rdfs:Class>
```

```
<rdfs:Class rdf:about="&core;PosteriorToRelationship"
    rdfs:label="core:PosteriorToRelationship">
  <rdfs:subClassOf rdf:resource="&core;Relationship"/>
</rdfs:Class>
```

```
<rdf:Property rdf:about="&core;time"
    rdfs:label="core:time">
  <rdfs:domain rdf:resource="&core;AnteriorToRelationship"/>
  <rdfs:domain rdf:resource="&core;PartOfRelationship"/>
  <rdfs:domain rdf:resource="&core;PosteriorToRelationship"/>
  <rdfs:range rdf:resource="&xsd;time"/>
</rdf:Property>
```

Practical example

```
<core:AnteriorToRelationship
   xmlns:c4h="urn:c4h:cs:SemanticRelationCS:2008">
   <core:directional rdf:datatype="&xsd;boolean">true</core:directional>
   <core:relationshipType>&c4h;anteriorTo</c4h:relationshipType>
   <core:sourceReferencerdf:resource="InternalID1_ImageElementMetadata"/>
   <core:targetReference rdf:resource="InternalID2_ImageElementMetadata"/>
   <core:timeDifference rdf:datatype="&xsd;time">1</core:timeDifference>
</core:AnteriorToRelationship>
```

```
<core:PosteriorToRelationship
   xmlns:c4h="urn:c4h:cs:SemanticRelationCS:2008">
   <core:directional rdf:datatype="&xsd;boolean">true</core:directional>
   <core:relationshipType>&c4h;posteriorTo</c4h:relationshipType>
   <core:sourceReferencerdf:resource="InternalID2_ImageElementMetadata"/>
   <core:targetReference rdf:resource="InternalID1_ImageElementMetadata"/>
```

```
   <core:timeDifference rdf:datatype="&xsd;time">1</core:timeDifference>
</core:PosteriorToRelationship>
```

2.7.3.5 DerivativeOfRelationship

Purpose

When a CAM Object is a derivative work of another. Derivation description can also be added (e.g. CAM Object #2 is a re-mix of the CAM Object #1). Hence, we introduce a derivativeType parameter to the DerivativeOf relation.

Origin of metadata

AnnotationService

Metadata Format and RDF Schema Definition

```
<rdfs:Class rdf:about="&core;DerivativeOfRelationship"
    rdfs:label="core:DerivativeOfRelationship">
  <rdfs:subClassOf rdf:resource="&core;Relationship"/>
</rdfs:Class>
```

```
<rdf:Property rdf:about="&core;derivativeType"
    rdfs:label="core:derivativeType">
  <rdfs:domain rdf:resource="&core;DerivativeOfRelationship"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

Practical example

```
<core:DerivativeOfRelationship
   xmlns:c4h="urn:c4h:cs:SemanticRelationCS:2008">
   <core:directional rdf:datatype="&xsd;boolean">true</core:directional>
   <core:relationshipType>&c4h;derivativeOf</c4h:relationshipType>
   <core:sourceReferencerdf:resource="InternalID1_AudioElementMetadata"/>
   <core:targetReference rdf:resource="InternalID2_AudioElementMetadata"/>
   <core:derivativeType rdf:datatype="&xsd;string">
      re-mix
   </core:derivativeType>
</core:DerivativeOfRelationship>
```

2.7.3.6 PartOfRelationship class

Purpose

This relation has a parameter time which indicates a frame when the image appears in the video clip.

Origin of metadata

AnnotationService

Metadata Format and RDF Schema Definition

```
<rdfs:Class rdf:about="&core;PartOfRelationship"
    rdfs:label="core:PartOfRelationship">
  <rdfs:subClassOf rdf:resource="&core;Relationship"/>
</rdfs:Class>
```

The **time** property already described in 2.7.3.4

Practical example

```
<core:PartOfRelationship
   xmlns:c4h="urn:c4h:cs:SemanticRelationCS:2008">
   <core:directional rdf:datatype="&xsd;boolean">true</core:directional>
   <core:relationshipType>&c4h;partOf</c4h:relationshipType>
   <core:sourceReferencerdf:resource="InternalID1_ImageElementMetadata"/>
   <core:targetReference rdf:resource="InternalID1_VideoElementMetadata"/>
   <core:time rdf:datatype="&xsd;time">00:01:12.764</core:time>
</core:PartOfRelationship>
```

2.7.3.7 RepresentedAsRelationship class

Use and purpose

This class represents presentation relations between CAMObjects within a CAMBundle, A specific CAMObject contains the information about the presentation of others CAMObjects inside the same bundle This object can be a flash application (DownloadableApplicationElementMetadata) or SMIL description (which can be modelled following the creator view as a DocumentElementMetadata or a DownloadableApplicationElementMetadata).

Origin of metadata

Any service capable of creating cam bundles.

Metadata Format and RDF Schema Definition

```
<rdfs:Classrdf:about="&core;RepresentedAsRelationship"
    rdfs:label="core:RepresentaedAsRelationship">
  <rdfs:subClassOf rdf:resource="&core;Relationship"/>
</rdfs:Class>
```

3 Concrete Supplementary Metamodel

This section specifies the classes in concrete part of the Supplementary Metamodel.

The Figure 9 illustrates how the community related classes (belonging to the concrete supplementary metamodel) are related to corresponding abstract supplementary classes. The abstract Community class is specialized by the C4HCommunity which contains one or several C4HCommunityProfile(s). The C4HCommunityProfile is a specialization of the abstract CommunityProfile class. An abstract CommunityProfile can contains structured CommunityMetadata through the usage of the hasCommunityProfileMetadata property. The CommunityMetadata class and the hasCommunityProfileMetadata property are specialized in order to include a specific structured community metadata (C4HCommunityPreferenceDescription) in a community profile description by using the hasCommunityPreferenceDescription property.

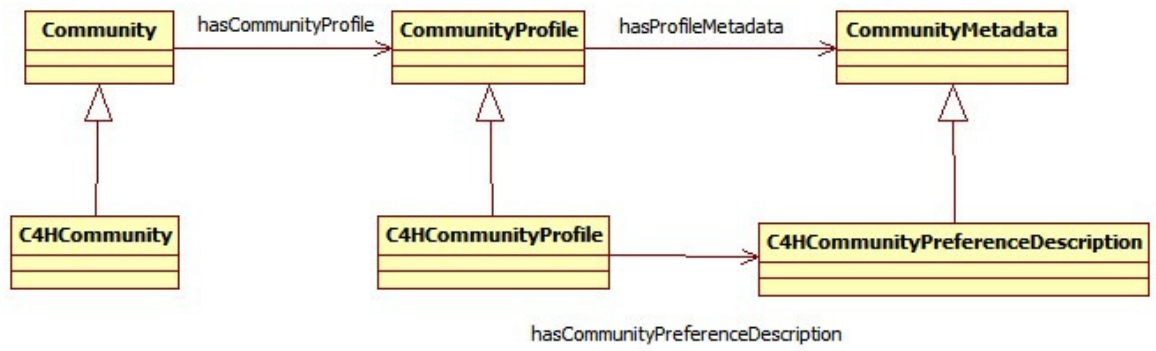

Figure 9 Concrete (supplementary) community-related classes and theirs relations with the abstract supplementary level

The same methology was applied for introducing concrete classes and properties for entities such devices, networks, platform services and users starting from the abstract level.

This section is organized as follows. First, we present community and community profile related classes and theirs properties. Then, we present device and device profile related classes and theirs properties. In the third section, we introduce network and network profile related classes and properties. The fourth section is dedicated to service and service profile related classes and properties. Finally, we present a sections describing the user and the user profile related classes and properties.

3.1 Community related classes

This section is organized as follows. First, we present C4HCommunity and C4HCommunityProfile classes. Secondly, we introduce the hasCommunityProfile property that associates a C4HCommunityProfile to a C4HCommunity entity.

3.1.1 Class definition

3.1.1.1 C4HCommunity

Purpose

Class for representing a CAM4Home communities

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&supplementary;C4HCommunity"
    rdfs:label="supplementary:C4HCommunity">
  <rdfs:subClassOf rdf:resource="&abstract;Community"/>
</rdfs:Class>
```

3.1.1.2 C4HCommunityProfile

Purpose

Class to describe a profile of a CAM4Home community

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&supplementary;C4HCommunityProfile"
   rdfs:label="supplementary:C4HCommunityProfile">
  <rdfs:subClassOf rdf:resource="&abstract;CommunityProfile"/>
</rdfs:Class>
```

3.1.1.3 C4HCommunityPreferenceDescription

Purpose

Class to describe the preferences of a CAM4Home community

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&supplementary;C4HCommunityPreferenceDescription"
   rdfs:label="supplementary:C4HCommunityPreferenceDescription">
  <rdfs:subClassOf rdf:resource="&abstract;CommunityMetadata"/>
</rdfs:Class>
```

3.1.2 C4HCommunity properties

This section specifies the properties in Community related Supplementary Metamodel

3.1.2.1 hasC4HCommunityProfile

Purpose

Associates a CAM4Home specific community profile to a CAM4Home community metadata entity

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;hasC4HCommunityProfile"
    rdfs:label="supplementary:hasC4HCommunityProfile">
  <rdfs:domain rdf:resource="&supplementary;C4HCommunity"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;hasCommunityProfile"/>
  <rdfs:range rdf:resource="&supplementary;C4HCommunityProfile"/>
</rdf:Property>
```

3.1.2.2 hasCommunityPreferenceDescription

Purpose

Associates a CAM4Home specific community preference description to a CAM4Home community profile

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;hasCommunityPreferenceDescription"
    rdfs:label="supplementary:hasCommunityPreferenceDescription">
  <rdfs:domain rdf:resource="&supplementary;C4HCommunityProfile"/>
  <rdfs:subPropertyOf
    rdf:resource="&abstract:hasCommunityProfileMetadata"/>
  <rdfs:range
     rdf:resource="&supplementary;C4HCommunityPreferenceDescription"/>
</rdf:Property>
```

3.1.2.3 interets

Use and purpose

This metadata entry presents subjects that the CAM4Home community is interested in such as sports, dogs, cats, movies, etc.

Origin of metadata

Domain of the interest, Range of the user and community.

Metadata Format and RDF Schema Definition

```
<rdf:Property rdf:about="&supplementary;interests"
    rdfs:label="supplementary:interests">
  <rdfs:domain
    rdf:resource="&supplementary;C4HCommunityPreferenceDescription"/>
  <rdfs:domain rdf:resource="&supplementary;C4HUserPreferenceDescription"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleUserMetadata"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleCommunityMetadata"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

Practical example of metadata entry

```
<supplementary:C4HCommunityPreferenceDescription ...>
  <supplementary:interests rdf:datatype="&xsd;string">
    sports, dogs, cats
  </supplementary:interests>
</supplementary:C4HCommunityPreferenceDescription>
```

3.2 Device related classes

This section is organized as follows. First, we present C4HDevice and C4HDeviceProfile classes. Secondly, we introduce the hasDeviceProfile property that associates a C4HDeviceProfile to a C4HDevice entity.

3.2.1 Class definitions

3.2.1.1 C4HDevice

Purpose

Class for representing devices used in CAM4Home system.

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&supplementary;C4HDevice"
    rdfs:label="supplementary:C4HDevice">
  <rdfs:subClassOf rdf:resource="&abstract;Device"/>
</rdfs:Class>
```

3.2.1.2 C4HDeviceProfile

Purpose

Class to describe a profile of a CAM4Home device.

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&supplementary;C4HDeviceProfile"
    rdfs:label="supplementary:C4HDeviceProfile">
  <rdfs:subClassOf rdf:resource="&abstract;DeviceProfile"/>
</rdfs:Class>
```

3.2.1.3 C4HHardwareDescription

Class to describe the hardware characteristics of a device used in CAM4Home system.

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&supplementary;C4HHardwareDescription"
    rdfs:label="supplementary:C4HHardwareDescription">
  <rdfs:subClassOf rdf:resource="&supplementary;DeviceMetadata"/>
</rdfs:Class>
```

3.2.1.4 C4HSoftwareDescription

Class to describe the software characteristics of a device used in CAM4Home system.

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&supplementary;C4HSoftwareDescription"
    rdfs:label="supplementary:C4HSoftwareDescription">
  <rdfs:subClassOf rdf:resource="&supplementary;DeviceMetadata"/>
</rdfs:Class>
```

3.2.1.5 C4HDeviceCapabilitiesDescription

Class to describe the capabilities of a device used in CAM4Home system.

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&supplementary;C4HDeviceCapabilitiesDescription"
```

```
    rdfs:label="supplementary:C4HDeviceCapabilitiesDescription">
  <rdfs:subClassOf rdf:resource="&supplementary;DeviceMetadata"/>
</rdfs:Class>
```

3.2.1.6 DeviceIdentification

Purpose

Container for regrouping properties that identify classes of devices within the CAM4Home system.

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&supplementary;DeviceIdentification"
    rdfs:label="supplementary:DeviceIdentification">
  <rdfs:subClassOf rdf:resource="&supplementary;DeviceMetadata"/>
</rdfs:Class>
```

3.2.2 C4HDevice properties

This section specifies the properties in Device related Supplementary Metamodel

3.2.2.1 hasDeviceIdentification

Purpose

Associates a CAM4Home device identification information to a device used in CAM4Home system.

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;hasDeviceIdentification"
    rdfs:label="supplementary:hasDeviceIdentification">
  <rdfs:domain rdf:resource="&supplementary;C4HDevice"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;hasDeviceMetadata"/>
  <rdfs:range rdf:resource="&supplementary;DeviceIdentification"/>
</rdf:Property>
```

3.2.2.2 hasC4HDeviceProfile

Purpose

Associates a CAM4Home specific device profile to a device used in CAM4Home system.

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;hasC4HDeviceProfile"
    rdfs:label="supplementary:hasC4HDeviceProfile">
  <rdfs:domain rdf:resource="&supplementary;C4HDevice"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;hasDeviceProfile"/>
  <rdfs:range rdf:resource="&supplementary;C4HDeviceProfile"/>
</rdf:Property>
```

3.2.3 C4HDeviceProfile properties

3.2.3.1 hasC4HDeviceCapabilities

Purpose

Associates a CAM4Home specific device capabilities device profile to a device used in CAM4Home system.

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;hasC4HDeviceCapabilitities"
  rdfs:label="supplementary:hasC4HDeviceCapabilities">
  <rdfs:domain rdf:resource="&supplementary;C4HDeviceProfile"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;hasDeviceProfileMetadata"/>
  <rdfs:range
    rdf:resource="&supplementary;C4HDeviceCapabilitiesDescription"/>
</rdf:Property>
```

3.2.3.2 hasC4HHardwareDescription

Purpose

Associates a CAM4Home specific hardware device profile to a device used in CAM4Home system.

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;hasC4HHardwareDescription"
    rdfs:label="supplementary:hasC4HHardwareDescription">
  <rdfs:domain rdf:resource="&supplementary;C4HDeviceProfile"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;hasDeviceProfileMetadata"/>
  <rdfs:range rdf:resource="&supplementary;C4HHardwareDescription"/>
</rdf:Property>
```

3.2.3.3 hasC4HSoftwareDescription

Purpose

Associates a CAM4Home specific software device profile to a device used in CAM4Home system.

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;hasC4HSoftwareDescription"
    rdfs:label="supplementary:hasC4HSoftwareDescription">
  <rdfs:domain rdf:resource="&supplementary;C4HDeviceProfile"/>
  <rdfs:subPropertyOf
    rdf:resource="&supplementary;hasDeviceProfileMetadata"/>
  <rdfs:range rdf:resource="&supplementary;C4HSoftwareDescription"/>
</rdf:Property>
```

3.2.4 C4HDeviceCapabilitiesDescription properties

The device capabilities is a supplementary metadata structure that contains information that directly tells about the capabilities of the device. These capabilities can include for example maximum CAMBundle size the device can interpret, maximum network bandwith, maximum video resolution etc.

3.2.4.1 hasAudioCapabilities

Use and purpose

This metadata entry describes audio capabilities of a device

Origin of metadata

CAM4Home client software

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;hasAudioCapabilities"
    rdfs:label="supplementary:hasAudioCapabilities">
  <rdf:domain
    rdf:resource="&supplementary;C4HDeviceCapabilitiesDescription"/>
  <rdf:range rdf:resource="&supplementary;AudioCapabilities"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;hasDeviceMetadata"/>
</rdf:Property>
```

The definition of **AudioCapabilities** class and its properties (**samplingRate**, **bitsPerSample** and **numChannels**) are presented here below.

```
<rdfs:Class rdf:about="&supplementary;AudioCapabilities"
    rdfs:label="supplementary:AudioCapabilities">
  <rdfs:subClassOf
rdf:resource="&supplementary;DeviceMetadata"/>
</rdfs:Class>
```

```
<rdf:Property rdf:about="&supplementary;bitsPerSample"
    rdfs:label="supplementary:bitsPerSample">
  <rdf:domain rdf:resource="&supplementary;AudioCapabilities"/>
  <rdf:subPropertyOf rdf:resource="&abstract;simpleDeviceMetadata"/>
  <rdf:range rdf:resource="&xsd;integer"/>
</rdf:Property>
```

```
<rdf:Property rdf:about="&supplementary;samplingRate"
    rdfs:label="supplementary:samplingRate">
  <rdf:domain rdf:resource="&supplementary;AudioCapabilities"/>
  <rdf:subPropertyOf rdf:resource="&abstract;simpleDeviceMetadata"/>
  <rdf:range rdf:resource="&xsd;float"/>
</rdf:Property>
```

```
<rdf:Property rdf:about="&supplementary;numChannels"
    rdfs:label="supplementary:numChannels">
  <rdf:domain rdf:resource="&supplementary;AudioCapabilities"/>
  <rdf:subPropertyOf rdf:resource="&abstract;simpleDeviceMetadata"/>
  <rdf:range rdf:resource="&xsd;integer"/>
</rdf:Property>
```

Pratical exemple

```
<supplementary:C4HDeviceProfile>
  ...
  <supplementary:hasC4HDeviceCapabilities>
    <supplementary:C4HDeviceCapabilitiesDescription>
      ...
      <supplementary:hasAudioCapabilities>
      <supplementary:AudioCapabilities>
      </supplementary:numChannels>
              4
      </supplementary:numChannels>
      </supplementary:samplingRate>
              22.5
      </supplementary:samplingRate>
      </supplementary:bitsPerSample>
              12
      </supplementary:bitsPerSample>
      <supplementary:AudioCapabilities>
     </supplementary:hasAudioCapabilities>
      ...
    </supplementary:C4HDeviceCapabilitiesDescription>
  </supplementary:hasC4HDeviceCapabilities>
  ...
</supplementary:C4HDeviceProfile>
```

3.2.4.2 hasDisplayCapabilities

Use and purpose

This metadata entry describes the display capabilities

Origin of metadata

CAM4Home client software

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;hasDisplayCapabilities"
    rdfs:label="supplementary:hasDisplayCapabilities">
  <rdf:domain
    rdf:resource="&supplementary;C4HDeviceCapabilitiesDescription"/>
  <rdf:range rdf:resource="&supplementary;DisplayCapabilities"/>
  <rdfs:subPropertyOf rdf:resource-"abstract;hasDeviceMetadata"/>
</rdf:Property>
```

The definition of **DisplayCapabilities** class and its properties (**displaySize**, **numberOfColors**, **typeOfDisplay** and **refreshRate**) are presented here below.

```
<rdfs:Class rdf:about="&supplementary;DisplayCapabilities"
    rdfs:label="supplementary:DisplayCapabilities">
  <rdfs:subClassOf
rdf:resource="&supplementary;DeviceMetadata"/>
</rdfs:Class>
```

```
<rdf:Property rdf:about="&supplementary;displaySize"
    rdfs:label="supplementary:displaySize">
  <rdf:domain rdf:resource="&supplementary;DisplayCapabilities"/>
  <rdf:subPropertyOf rdf:resource="&abstract;simpleDeviceMetadata"/>
  <rdf:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

```
<rdf:Property rdf:about="&supplementary;numberOfColors"
    rdfs:label="supplementary:numberOfColors">
  <rdf:domain rdf:resource="&supplementary;DisplayCapabilities"/>
  <rdf:subPropertyOf rdf:resource="&abstract;simpleDeviceMetadata"/>
  <rdf:range rdf:resource="&xsd;integer"/>
</rdf:Property>
```

```
<rdf:Property rdf:about="&supplementary;typeOfDisplay"
    rdfs:label="supplementary:typeOfDisplay">
  <rdf:domain rdf:resource="&supplementary;DisplayCapabilities"/>
  <rdf:subPropertyOf rdf:resource="&abstract;simpleDeviceMetadata"/>
  <rdf:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

```
<rdf:Property rdf:about="&supplementary;refreshRate"
    rdfs:label="supplementary:refreshRate">
```

```
  <rdf:domain rdf:resource="&supplementary;DisplayCapabilities"/>
  <rdf:subPropertyOf rdf:resource="&abstract;simpleDeviceMetadata"/>
  <rdf:range rdf:resource="&xsd;float"/>
</rdf:Property>
```

```
<supplementary:C4HDeviceProfile>
  ...
  <supplementary:hasC4HDeviceCapabilities>
    <supplementary:C4HDeviceCapabilitiesDescription>
      ...
      <supplementary:hasDisplayCapabilities>
        <supplementary:DisplayCapabilities>
          <supplementary:refreshRate>
              80
          </supplementary:refreshRate>
          </supplementary:typeOfDisplay>
             240*320
          </supplementary:typeOfDisplay>
          </supplementary:numberOfColors>
              256
          </supplementary:numberOfColors>
        <supplementary:DisplayCapabilities>
     </supplementary:hasDisplayCapabilities>
      ...
    </supplementary:C4HDeviceCapabilitiesDescription>
  </supplementary:hasC4HDeviceCapabilities>
</supplementary:C4HDeviceProfile>
```

3.2.4.3 maximumBundleSize

Use and purpose

This metadata entry tells how large CAMBundles the device can interpret. Used to determine if CAMBundle interpreting should be moved to the server side.

Maximum CAMBundle size is expressed as an integer value containing the maximum CAMBundle size in bytes.

Origin of metadata

CAM4Home terminal analysis software.

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;maximumBundleSize"
    rdfs:label="supplementary:maximumBundleSize">
  <rdf:domain
    rdf:resource="&supplementary;C4HDeviceCapabilitiesDescription"/>
  <rdfs:subPropertyOf
    rdf:resource="&abstract;simpleDeviceMetadata"/>
  <rdf:range rdf:resource="&xsd;integer"/>
</rdf:Property>
```

Practical example of metadata entry

```
<supplementary:C4HDeviceProfile>
  ...
  <supplementary:hasC4HDeviceCapabilities>
    <supplementary:C4HDeviceCapabilitiesDescription>
      ...
      <supplementary:maximumBundleSize>
        1000000
      </supplementary:maximumBundleSize>
      ...
    </supplementary:C4HDeviceCapabilitiesDescription>
  </supplementary:hasC4HDeviceCapabilities>
  ...
</supplementary:C4HDeviceProfile>
```

3.2.5 C4HHardwareDescription properties

Hardware profile is supplementary metadata that contains all the information about the hardware in the client device that is relevant in the CAM4HOME platform. This information can include for example CPU type, CPU frequency, number of CPU cores, memory size, storage capacity etc. This information can be used e.g. for user interface and multimedia content adaptation into suitable size for the client device to handle.

3.2.5.1 cpuFrequency

Purpose

Indicates the frequency supported by CPU of the device. The frequency is expressed in Hz.

Origin of metadata

Device provider,Creator

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;cpuFrequency"
    rdfs:label="supplementary:cpuFrequency">
  <rdfs:domain rdf:resource="&supplementary;C4HHardwareDescription"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleDeviceMetadata"/>
  <rdfs:range rdf:resource="&xsd;integer"/>
</rdf:Property>
```

3.2.5.2 cpuType

Purpose

Indicates the CPU type used by the device.

Origin of metadata

Device provider,Creator

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;cpuType"
    rdfs:label="supplementary:cpuType">
  <rdfs:domain rdf:resource="&supplementary;C4HHardwareDescription"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleDeviceMetadata"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

3.2.5.3 memorySize

Purpose

Indicates the total memory size of the device.

Origin of metadata

Device provider,Creator

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;memorySize"
    rdfs:label="supplementary:memorySize">
  <rdfs:domain rdf:resource="&supplementary;C4HHardwareDescription"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleDeviceMetadata"/>
  <rdfs:range rdf:resource="&xsd;integer"/>
</rdf:Property>
```

3.2.5.4 numberOfCores

Purpose

Indicates the number of CPU of the device.

Origin of metadata

Device provider,Creator

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;numberOfCores"
    rdfs:label="supplementary:numberOfCores">
  <rdfs:domain rdf:resource="&supplementary;C4HHardwareDescription"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleDeviceMetadata"/>
  <rdfs:range rdf:resource="&xsd;integer"/>
</rdf:Property>
```

3.2.5.5 storageCapacity

Purpose

Indicates the total storage capacity of the device.

Origin of metadata

Device provider,Creator

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;storageCapacity"
    rdfs:label="supplementary:storageCapacity">
  <rdfs:domain rdf:resource="&supplementary;C4HHardwareDescription"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleDeviceMetadata"/>
  <rdfs:range rdf:resource="&xsd;integer"/>
</rdf:Property>
```

3.2.6 C4HSoftwareDescription properties

The user software profile is supplementary metadata structure that contains information about the software in the client device. This information can be used e.g. for user interface and multimedia content adaptation into suitable format for the client device to interpret.

3.2.6.1 hasAvailableSoftwares

Use and purpose

The purpose of this metadata entry is to list all relevant software available in the client device. This information can be used e.g. in the situations where specific software is needed.

Origin of metadata

CAM4Home client software or user defined.

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;hasAvailableSoftwares"
    rdfs:label="supplementary:hasAvailableSoftwares">
  <rdf:domain rdf:resource="&supplementary;C4HSoftwareDescription"/>
  <rdf:range rdf:resource="&supplementary;AvailableSoftware"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;hasDeviceMetadata"/>
</rdf:Property>
```

The definition of **AvailableSoftware** class and its properties (**name** and **version**) are presented here below.

```
<rdfs:Class rdf:about="&supplementary;AvailableSoftware"
    rdfs:label="supplementary:AvailableSoftware">
  <rdfs:subClassOf rdf:resource="&supplementary;DeviceMetadata"/>
</rdfs:Class>
```

The **name** property definition is available in section 2.5.2.1

```
<rdf:Property rdf:about="&supplementary;version"
    rdfs:label="supplementary:version">
```

```
  <rdf:domain rdf:resource="&supplementary;AvailableSotfware"/>
  <rdf:subPropertyOf rdf:resource="&abstract;simpleDeviceMetadata"/>
  <rdf:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

Practical example

```
<supplementary:C4HDeviceProfile>
  ...
  <supplementary:hasC4HSoftwareDescription>
    <supplementary:C4HSoftwareDescription>
      ...
      <supplementary:hasAvailableSoftwares>
        <supplementary:AvailableSoftware>
          <core:name>Mozilla Firefox</core:name>
          <supplementary:version>3.0.4</supplementary:version>
        </supplementary:AvailableSoftware>
        <supplementary:AvailableSoftware>
          <core:name>OpenOffice.org</core:name>
          <supplementary:version>2.4.1</supplementary:version>
        </supplementary:AvailableSoftware>
        ...
      </supplementary:hasAvailableSoftwares>
      ...
    </supplementary:C4HSoftwareDescription>
  </supplementary:hasC4HSoftwareDescription>
  ...
</supplementary:C4HDeviceProfile>
```

3.2.6.2 hasBrowserCapabilities

Use and purpose

The BrowserCapabilities class contains information about the capabilities of the web browser in the client device. It can be used to determine the format of the web interface shown to the user or if the web interface can be used at all. For example embedded flash playback support and javascript support are defined

Origin of metadata

CAM4Home terminal analysis software or user defined.

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;hasBrowserCapabilities"
    rdfs:label="supplementary:hasBrowserCapabilities">
  <rdf:domain
    rdf:resource="&supplementary;C4HSoftwareDescription"/>
  <rdf:range rdf:resource="&supplementary;BrowserCapabilities"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;hasDeviceMetadata"/>
</rdf:Property>
```

The definition of **BrowserCapabilities** class and its properties (**flashSupport, javascriptSupport**, **sslSupport, hasEmbeddedDecoders**) are presented here below.

```
<rdfs:Class rdf:about="&supplementary;BrowserCapabilities"
    rdfs:label="supplementary:BrowserCapabilities">
  <rdfs:subClassOf
rdf:resource="&supplementary;DeviceMetadata"/>
</rdfs:Class>
```

```
<rdf:Property rdf:about="&supplementary;flashSupport"
    rdfs:label="supplementary:flashSupport">
  <rdf:domain
    rdf:resource="&supplementary;BrowserCapabilities"/>
  <rdfs:subPropertyOf
    rdf:resource="&abstract;simpleDeviceMetadata"/>
  <rdf:range rdf:resource="&xsd;boolean"/>
</rdf:Property>
```

```
<rdf:Property rdf:about="&supplementary;javascriptSupport"
    rdfs:label="supplementary:javascriptSupport">
  <rdf:domain
    rdf:resource="&supplementary;BrowserCapabilities"/>
  <rdfs:subPropertyOf
    rdf:resource="&abstract;simpleDeviceMetadata"/>
  <rdf:range rdf:resource="&xsd;boolean"/>
</rdf:Property>
```

```
<rdf:Property rdf:about="&supplementary;sslSupport"
    rdfs:label="supplementary:sslSupport">
  <rdf:domain
    rdf:resource="&supplementary;BrowserCapabilities"/>
  <rdfs:subPropertyOf
    rdf:resource="&abstract;simpleDeviceMetadata"/>
  <rdf:range rdf:resource="&xsd;boolean"/>
</rdf:Property>
```

```
<rdf:Property rdf:about="&supplementary;hasEmbeddedDecoders"
    rdfs:label="supplementary:hasEmbeddedDecoders">
  <rdf:domain
    rdf:resource="&supplementary;DecodingSystem"/>
  <rdf:domain
    rdf:resource="&supplementary;BrowserCapabilities"/>
  <rdf:range rdf:resource="&supplementary;EmbeddedDecoder"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;hasDeviceMetadata"/>
</rdf:Property>
```

hasEmbbededDecoders is a container for indicating the embedded audio/video decoders of a device. Each decoder is defined by its name and its version.

The *decoder name* belongs to a controlled vocabulary. A set of terms to made up this vocabulary can be found in MPEG-7 ISO 15938-5. Values of first level terms defined in section B.2.34 for video and B.2.3 for audio, and some additional video codec terms defined http://www.dvb.org/metadata/cs/VideoCodecCS.xml by DVB.org, can be used as decoder name values. Some values for video decoder names are: MPEG-1 Video, MPEG-2

Video, MPEG-4 Visual, H264, VC1. Some values for audio decoder names are: MPEG-2 Audio, AC3, MPEG-1 Audio, Linear PCM

The *decoder version* is a string that contains additional information describing the capabilities of the decoder. In the case of MPEG video decoders, this string is made up with the concatenation of the profile and level supported by the decoder, separated with a '@' character. The profile identifies the set of tools defined in the corresponding standard that the decoder supports (types of frames, scalability, slice ordering, etc). The level identifies the range of the parameters that control the tools specified by the profile (maximum frame size, maximum bit rate, maximum buffer size, etc), as defined in the corresponding standard. There is a 1 to n relationship between decoder name and decoder version, that is, a decoder could support several combinations of profile and level. The documents referenced in the description of the decoder name contains third level terms that can be used as a base for a controlled vocabulary for the decoder version.

Examples of values for H264: Baseline profile @ Level 1, Main profile @ Level 3.1, High profile @ Level 5.

Examples of values for MPEG-2 Audio: Low Sampling Rate Layer I, AAC Main Profile, AAC Sampling Rate Scalable Profile.

The definition of **EmbeddedDecoder** class and its properties (**decoderName**, **decoderVersion, decodingBitRate**), are presented here below.

```
<rdfs:Class rdf:about="&supplementary;EmbeddedDecoder"
    rdfs:label="supplementary:EmbeddedDecoder">
  <rdfs:subClassOf rdf:resource="&supplementary;DeviceMetadata"/>
</rdfs:Class>
```

```
<rdf:Property rdf:about="&supplementary;decoderName"
    rdfs:label="supplementary:decoderName">
  <rdf:domain rdf:resource="&supplementary;EmbeddedDecoder"/>
  <rdf:subPropertyOf rdf:resource="&abstract;simpleDeviceMetadata"/>
  <rdf:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

```
<rdf:Property rdf:about="&supplementary;decoderVersion"
    rdfs:label="supplementary:decoderVersion">
  <rdf:domain rdf:resource="&supplementary;EmbeddedDecoders"/>
  <rdf:subPropertyOf rdf:resource="&abstract;simpleDeviceMetadata"/>
  <rdf:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

```
<rdf:Property rdf:about="&supplementary;decodingBitRate"
    rdfs:label="supplementary:decoderVersion">
  <rdf:domain rdf:resource="&supplementary;EmbeddedDecoders"/>
  <rdf:subPropertyOf rdf:resource="&abstract;simpleDeviceMetadata"/>
  <rdf:range rdf:resource="&xsd;float"/>
</rdf:Property>
```

Practical example

```
<supplementary:C4HDeviceProfile>
  ...
  <supplementary:hasC4HSoftwareDescription>
```

```
    <supplementary:C4HSoftwareDescription>
      ...
      <supplementary:hasBrowserCapabilities>
        <supplementary:BrowserCapabilities>
          <supplementary:flashSupport>
            true
          </supplementary:flashSupport>
          <supplementary:javascriptSupport>
            true
          </supplementary:javascriptSupport>
          <supplementary:sslSupport>
            false
          </supplementary:sslSupport>
          ...
        </supplementary:BroserCapabilities>
        ...
      </supplementary:hasBroserCapabilities>
      ...
    </supplementary:C4HSoftwareDescription>
    ...
  </supplementary:hasC4HSoftwareDescription>
</supplementary:C4HDeviceProfile>
```

3.2.6.3 hasDecodingSystems

Use and purpose

The DecodingSystem class contains information about the existing decoding systems (Quicktime, Windows, etc) of a device. Each decoding system is defined by a decoding system UUID (issued from a controlled vocabulary), by a decoding system name and a list of embbeded decoders.

Origin of metadata

CAM4Home terminal analysis software or user defined.

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;hasDecodingSystems"
    rdfs:label="supplementary:hasDecodingSystems">
  <rdf:domain
    rdf:resource="&supplementary;C4HSoftwareDescription"/>
  <rdf:range rdf:resource="&supplementary;DecodingSystem"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;hasDeviceMetadata"/>
</rdf:Property>
```

The definition of **DecodingSystem** class and its properties (**decodingSystemName, decodingSystemUUID** and **hasEmbeddedDecoders**) are presented here below.

```
<rdfs:Class rdf:about="&supplementary;DecodingSystem"
    rdfs:label="supplementary:DecodingSystem">
  <rdfs:subClassOf
rdf:resource="&supplementary;DeviceMetadata"/>
</rdfs:Class>
```

```
<rdf:Property rdf:about="&supplementary;decodingSystemName"
    rdfs:label="supplementary:decodingSystemName">
  <rdf:domain rdf:resource="&supplementary;DecodingSystem"/>
  <rdf:subPropertyOf rdf:resource="&abstract;simpleDeviceMetadata"/>
  <rdf:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

```
<rdf:Property rdf:about="&supplementary;decodingSystemUUID"
    rdfs:label="supplementary:decodingSystemUUID">
  <rdf:domain rdf:resource="&supplementary;DecodingSystem"/>
  <rdf:subPropertyOf rdf:resource="&abstract;simpleDeviceMetadata"/>
  <rdf:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

The **hasEmbbededDecoders** property is already defined in section 3.2.6.2.

3.2.6.4 hasOperatingSystem

Use and purpose

This metadata entry contains the name and version of the operating system currently running on the user device. This information can be used e.g. when delivering software to the client device.

Origin of metadata

CAM4Home client software.

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;hasOperatingSystem"
    rdfs:label="supplementary:hasOperatingSystem">
  <rdf:domain rdf:resource="&supplementary;C4HSoftwareDescription"/>
  <rdf:range rdf:resource="&supplementary;OperatingSystem"/>
</rdf:Property>
```

The definition of **OperatingSystem** class and its properties (**name** and **version**) are presented here below.

```
<rdfs:Class rdf:about="&supplementary;OperatingSystem"
   rdfs:label="supplementary:OperatingSystem">
  <rdfs:subClassOf rdf:resource="&supplementary;DeviceMetadata"/>
</rdfs:Class>
```

The **name** property definition is available in section 2.5.2.1

The **version** property definition is available in section 3.2.6.1.

Practical example of metadata entry

```
<supplementary:C4HDeviceProfile>
```

```
  ...
  <supplementary:hasC4HSoftwareDescription>
    <supplementary:C4HSoftwareDescription>
    ...
      <supplementary:hasOperatingSystem>
        <supplementary:OperatingSystem>
          <core:name>Linux</core:name>
          <supplementary:version>2.6.24-21</supplementary:version>
        </supplementary:OperatingSystem>
      </supplementary:hasOperatingSystem>
      ...
    </supplementary:hasC4HSoftwareDescription>
  </supplementary:C4HSoftwareDescription>
  ...
</supplementary:C4HDeviceProfile>
```

3.2.6.5 hasSupportedFileTypes

Use and purpose

This metadata entry lists all file types supported by the client device. This information can be used to determine which file formats can be interpreted by the device and e.g. transcode video accordingly. These values (supportedFileType) are expressed using mime-type values[1].

Origin of metadata

CAM4Home client software

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;hasSupportedFileTypes"
    rdfs:label="supplementary:hasSupportedFileTypes">
  <rdf:domain
    rdf:resource="&supplementary;C4HSoftwareDescription"/>
  <rdf:range rdf:resource="&supplementary:SupportedFileTypes"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;hasDeviceMetadata"/>
</rdf:Property>
```

The definition of **SupportedFileTypes** class and its property (**supportedFileType**) are presented here below.

```
<rdfs:Class rdf:about="&supplementary;SupportedFileTypes"
    rdfs:label="supplementary:SupportedFileTypes">
  <rdfs:subClassOf rdf:resource="&supplementary;DeviceMetadata"/>
</rdfs:Class>
```

```
<rdf:Property rdf:about="&supplementary;supportedFileType"
    rdfs:label="supplementary:supportedFileType">
  <rdf:domain rdf:resource="&supplementary;SupportedFileTypes"/>
  <rdf:subPropertyOf rdf:resource="&abstract;simpleDeviceMetadata"/>
  <rdf:range rdf:resource="&xsd;string"/>
```

[1] http://www.iana.org/assignments/media-types/

```
</rdf:Property>
```

Practical example

```
<supplementary:C4HDeviceProfile>
  ...
  <supplementary:hasC4HSoftwareDescription>
    <supplementary:C4HSoftwareDescription>
      ...
      <supplementary:hasSupportedFileTypes>
        <supplementary:SupportedFileTypes>
          <supplementary:supportedFileType>
            video/x-msvideo
          </supplementary:supportedFileType>
          <supplementary:supportedFileType>
            image/jpeg
          </supplementary:supportedFileType>
          <supplementary:supportedFileType>
            audio/mpeg
          </supplementary:supportedFileType>
          ...
        </supplementary:SupportedFileTypes>
        ...
      </supplementary:hasSupportedFileTypes>
      ...
    </supplementary:C4HSoftwareDescription>
  </supplementary:hasC4HSoftwareDescription>
  ...
</supplementary:C4HDeviceProfile>
```

3.2.7 DeviceIdentification properties

3.2.7.1 deviceClass

Purpose

Indicates the class of device

Origin of metadata

Device provider,Creator

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;deviceClass"
    rdfs:label="supplementary:deviceClass">
  <rdfs:domain rdf:resource="&supplementary;DeviceIdentification"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleDeviceMetadata"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

3.2.7.2 deviceModel

Purpose

Indicates the model of device

Origin of metadata

Device provider,Creator

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;deviceModel"
    rdfs:label="supplementary:deviceModel">
  <rdfs:domain rdf:resource="&supplementary;DeviceIdentification"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleDeviceMetadata"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

3.2.7.3 deviceVendor

Purpose

Indicates the device vendor

Origin of metadata

Device provider,Creator

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;deviceVendor"
    rdfs:label="supplementary:deviceVendor">
  <rdfs:domain rdf:resource="&supplementary;DeviceIdentification"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleDeviceMetadata"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

3.2.7.4 macAddress

Purpose

Indicates device's MAC address

Origin of metadata

Device provider,Creator

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;macAdress"
    rdfs:label="supplementary:macAdress">
  <rdfs:domain rdf:resource="&supplementary;DeviceIdentification"/>
```

```
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleDeviceMetadata"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

3.3 Network related classes

This section is organized as follows. First, we present C4HNetwork and C4HNetworkProfile classes. Secondly, we introduce the hasNetworkProfile property that associates a C4HNetworkProfile to a C4HNetwork entity.

3.3.1 Class definition

3.3.1.1 C4HNetwork

Purpose

Class for representing a CAM4Home communities

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&supplementary;C4HNetwork"
  rdfs:label="supplementary:C4HNetwork">
  <rdfs:subClassOf rdf:resource="&abstract;Network"/>
</rdfs:Class>
```

3.3.1.2 C4HNetworkProfile

Purpose

Class to describe a profile of a CAM4Home Network

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&supplementary;C4HNetworkProfile"
    rdfs:label="supplementary:C4HNetworkProfile">
  <rdfs:subClassOf rdf:resource="&abstract;NetworkProfile"/>
</rdfs:Class>
```

3.3.1.3 NetworkQualityDescription

Purpose

Class contains the quality description of a CAM4Home Network

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&supplementary;NetworkQualityDescription"
    rdfs:label="supplementary:NetworkQualityDescription>
  <rdfs:subClassOf rdf:resource="&abstract;NetworkMetadata"/>
</rdfs:Class>
```

3.3.2 C4HNetwork properties

This section specifies the properties in Network related Supplementary Metamodel

3.3.2.1 averageDataThroughput

Purpose

Indicates the avearage data throughput.

Origin of metadata

Network observation services

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;averageDataThroughput"
    rdfs:label="supplementary:averageDataThroughput">
  <rdfs:domain rdf:resource="&supplementary;NetworkQualityDescription"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleNetworkMetadata"/>
  <rdfs:range rdf:resource="&xsd;float"/>
</rdf:Property>
```

3.3.2.2 averageReportedPacketsDelayed

Purpose

Indicates the avearage reported delayed packets number.

Origin of metadata

Network observation services

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;averageReportedPacketsDelayed"
    rdfs:label="supplementary:averageReportedPacketsDelayed">
  <rdfs:domain rdf:resource="&supplementary;NetworkQualityDescription"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleNetworkMetadata"/>
  <rdfs:range rdf:resource="&xsd;float"/>
```

```
</rdf:Property>
```

3.3.2.3 averageReportedPacketsJittered

Purpose

Indicates the avearage reported jittered packets number.

Origin of metadata

Network observation services

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;averageReportedPacketsJittered"
    rdfs:label="supplementary:averageReportedPacketsJittered">
  <rdfs:domain rdf:resource="&supplementary;NetworkQualityDescription"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleNetworkMetadata"/>
  <rdfs:range rdf:resource="&xsd;float"/>
</rdf:Property>
```

3.3.2.4 averageReportedPacketsLost

Indicates the avearage reported lost packets number.

Origin of metadata

Network observation services

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;averageReportedPacketsLost"
    rdfs:label="supplementary:averageReportedPacketsLost">
  <rdfs:domain rdf:resource="&supplementary;NetworkQualityDescription"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleNetworkMetadata"/>
  <rdfs:range rdf:resource="&xsd;float"/>
</rdf:Property>
```

3.3.2.5 hasC4HNetworkProfile

Purpose

Associates a CAM4Home specific Network profile to a CAM4Home Network metadata entity

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;hasC4HNetworkProfile"
    rdfs:label="supplementary:hasC4HNetworkProfile">
  <rdfs:domain rdf:resource="&supplementary;C4HNetwork"/>
```

```
  <rdfs:subPropertyOf rdf:resource="&abstract;hasNetworkProfile"/>
  <rdfs:range rdf:resource="&supplementary;C4HNetworkProfile"/>
</rdf:Property>
```

3.3.2.6 hasNetworkQualityDescription

Purpose

Container for associating network quality description elements to a CAM4Home network profile

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;hasNetworkQualityDescription "
    rdfs:label="supplementary:hasNetworkQualityDescription">
  <rdfs:range rdf:resource="&supplementary;NetworkQualityDescription"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;hasNetworkProfileMetadata"/>
  <rdfs:domain rdf:resource="&supplementary;C4HNetworkProfile"/>
</rdf:Property>
```

3.3.2.7 lastReportedPacketsDelayed

Purpose

Indicates the last known number of delayed packets.

Origin of metadata

Network observation services

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;lastReportedPacketsDelayed"
    rdfs:label="supplementary:lastReportedPacketsDelayed">
  <rdfs:domain rdf:resource="&supplementary;NetworkQualityDescription"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleNetworkMetadata"/>
  <rdfs:range rdf:resource="&xsd;integer"/>
</rdf:Property>
```

3.3.2.8 lastReportedPacketsJittered

Purpose

Indicates the last known number of jittered packets.

Origin of metadata

Network observation services

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;lastReportedPacketsJittered"
    rdfs:label="supplementary:lastReportedPacketsJittered">
  <rdfs:domain rdf:resource="&supplementary;NetworkQualityDescription"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleNetworkMetadata"/>
  <rdfs:range rdf:resource="&xsd;integer"/>
</rdf:Property>
```

3.3.2.9 lastReportedPacketsLost

Purpose

Indicates the last known number of lost packets.

Origin of metadata

Network observation services

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;lastReportedPacketsLost"
    rdfs:label="supplementary:lastReportedPacketsLost">
  <rdfs:domain rdf:resource="&supplementary;NetworkQualityDescription"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleNetworkMetadata"/>
  <rdfs:range rdf:resource="&xsd;integer"/>
</rdf:Property>
```

3.3.2.10 maxDataThroughput

Purpose

Indicates the maximum data trhoughput observed of this network.

Origin of metadata

Network observation services

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;maxDataThroughput"
    rdfs:label="supplementary:maxDataThroughput">
  <rdfs:domain rdf:resource="&supplementary;NetworkQualityDescription"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleNetworkMetadata"/>
  <rdfs:range rdf:resource="&xsd;integer"/>
</rdf:Property>
```

3.3.2.11 minDataThroughput

Purpose

Indicates the minimum data trhoughput observed of this network.

Origin of metadata

Network observation services

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;minDataThroughput"
    rdfs:label="supplementary:minDataThroughput">
  <rdfs:domain rdf:resource="&supplementary;NetworkQualityDescription"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleNetworkMetadata"/>
  <rdfs:range rdf:resource="&xsd;integer"/>
</rdf:Property>
```

3.3.2.12 networkType

Purpose

This attribute describes the type of the network used by CAM4Home system.

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;networkType"
    rdfs:label="supplementary:networkType">
  <rdfs:domain rdf:resource="&supplementary;C4HNetworkProfile"/>
  <rdfs:subPropertyOf
    rdf:resource="&abstract;simpleNetworkProfileMetadata"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

3.4 Service related classes

This section is organized as follows. The first section introduces C4HService entity, C4HServiceDescription classes and theirs subclasses. We start by detailing in paragraphs 3.4.1.1-3.4.1.5 of the first section the C4HService class and its specializations (C4HSoftwareService,C4HDomainSpecificService, C4HPlatformService and C4HUserService). We continue the first section by presenting the C4HServiceDescription class (3.4.1.6).

The second section enumerates the C4HService properties.

The third section introduces the C4HServiceDescription properties.

3.4.1 Class definition

3.4.1.1 C4HService

Purpose

Class for representing services on CAM4Home Service platform.

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&supplementary;C4HService"
    rdfs:label="supplementary:C4HService">
  <rdfs:subClassOf rdf:resource="&abstract;Service"/>
</rdfs:Class>
```

3.4.1.2 C4HSoftwareService

Purpose

Class for software services on CAM4Home Service Platform.

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&supplementary;C4HSoftwareService"
    rdfs:label="supplementary:C4HSoftwareService">
  <rdfs:subClassOf rdf:resource="&supplementary;C4HService"/>
</rdfs:Class>
```

3.4.1.3 C4HDomainSpecificService

Purpose

Class for Domain Specific type services on CAM4Home Service Platform. See [R-20] for service categorization.

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&supplementary;C4HDomainSpecificService"
    rdfs:label="supplementary:C4HDomainSpecificService">
  <rdfs:subClassOf rdf:resource="&supplementary;C4HSoftwareService"/>
</rdfs:Class>
```

3.4.1.4 C4HPlatformService

Purpose

Class for Platform Service type services on CAM4Home Service Platform. See [R-20] for service categorization.

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&supplementary;C4HPlatformService"
    rdfs:label="supplementary:C4HPlatformService">
  <rdfs:subClassOf rdf:resource="&supplementary;C4HSoftwareService"/>
</rdfs:Class>
```

3.4.1.5 C4HUserService

Purpose

Class for User Service type services on CAM4Home Service Platform. See [R-20] for service categorization.

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&supplementary;C4HUserService"
    rdfs:label="supplementary:C4HUserService">
  <rdfs:subClassOf rdf:resource="&supplementary;C4HService"/>
</rdfs:Class>
```

3.4.1.6 C4HServiceDescription

Purpose

Class for service descriptions of CAM4Home services.

Origin of metadata

Service provider

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&supplementary;C4HServiceDescription"
    rdfs:label="supplementary:C4HServiceDescription">
  <rdfs:subClassOf rdf:resource="&abstract;ServiceProfile"/>
</rdfs:Class>
```

3.4.2 C4HService properties

This section specifies the properties in C4HService class.

3.4.2.1 hasC4HServiceDescriptionMetadata

Purpose

Associates a CAM4Home specific service description to a CAM4Home software ans user service service

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;hasC4HServiceDescriptionMetadata"
    rdfs:label="supplementary:hasC4HServiceDescriptionMetadata">
  <rdfs:domain rdf:resource="&supplementary;C4HUserService"/>
  <rdfs:domain rdf:resource="&supplementary;C4HSoftwareService"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;hasServiceProfile"/>
  <rdfs:range rdf:resource="&supplementary;C4HServiceDescription"/>
</rdf:Property>
```

3.4.3 C4HServiceDescription properties

This section specifies the properties in C4HServiceDescription class.

3.4.3.1 hasServiceControlInterface

Purpose

Descriptor of service's control interface. Might include interface format and the interface as raw data.

Origin of metadata

Service Provider

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;hasServiceControlInterface"
    rdfs:label="supplementary:hasServiceControlInterface">
  <rdfs:range rdf:resource="&external;SoftwareServiceContentDescription"/>
  <rdfs:domain rdf:resource="&supplementary;C4HServiceDescription"/>
  <rdfs:subPropertyOf
    rdf:resource="&abstract;hasSupplementaryExternalMetadata"/>
</rdf:Property>
```

3.4.3.2 hasServiceEndPoints

Purpose

List of EndPoints provided by a service.

Origin of metadata

Service Provider

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;hasServiceEndPoints"
    rdfs:label="supplementary:hasServiceEndPoints">
  <rdfs:domain rdf:resource="&supplementary;C4HServiceDescription"/>
```

```
  <rdfs:subPropertyOf
    rdf:resource="&abstract;hasServiceProfileMetadata"/>
  <rdfs:range rdf:resource="&supplementary;C4HServiceEndPoint"/>
</rdf:Property>
```

The definition of the **C4HServiceEndPoint** is presented here below. It contains the following properties:

- **serviceEndPointAsynchronous** – true if the EndPoint supports asynchronous communication.
- **serviceEndPointBidirectional** – true if the EndPoint supports bidirectional communication.
- **serviceEndPointBuffered** – true if the EndPoint supports buffered communication.
- **serviceEndPointID** – unique identifier of an EndPoint.
- **serviceEndPointName** – name of an EndPoint
- **serviceEndPointOrdered** – true if the EndPoint guarantees ordered processing of requests.
- **serviceEndPointOwnerID** – unique identifier of the owner of the EndPoint.
- **serviceEndPointParallel** – true if the EndPoint can handle multiple parallel requests.
- **serviceEndPointProtocol** – communication protocol supported by this EndPoint. E.g. “soap"
- **serviceEndPointProtocolVersion** – the version of the communication protocol supported by this EndPoint. E.g. “1.1"
- **serviceEndPointType** – enumerated EndPoint type, one of the following: service, management, client, fault.
- **serviceEndPointURI** – the URI pointing to the EndPoint host address and port.

```
<rdfs:Class rdf:about="&supplementary;C4HServiceEndPoint"
    rdfs:label="supplementary:C4HServiceEndPoint">
  <rdfs:subClassOf rdf:resource="&abstract;ServiceMetadata"/>
</rdfs:Class>
```

```
<rdf:Property rdf:about="&supplementary;serviceEndPointAsynchronous"
    rdfs:label="supplementary:serviceEndPointAsynchronous">
  <rdfs:domain rdf:resource="&supplementary;C4HServiceEndPoint"/>
  <rdfs:subPropertyOf rdf:resource="&supplementary;simpleServiceMetadata"/>
  <rdfs:range rdf:resource="&xsd;boolean"/>
</rdf:Property>
```

```
<rdf:Property rdf:about="&supplementary;serviceEndPointBidirectional"
    rdfs:label="supplementary:serviceEndPointBidirectional">
  <rdfs:domain rdf:resource="&supplementary;C4HServiceEndPoint"/>
  <rdfs:subPropertyOf rdf:resource="&supplementary;simpleServiceMetadata"/>
  <rdfs:range rdf:resource="&xsd;boolean"/>
</rdf:Property>
```

```
<rdf:Property rdf:about="&supplementary;serviceEndPointBuffered"
    rdfs:label="supplementary:serviceEndPointBuffered">
  <rdfs:domain rdf:resource="&supplementary;C4HServiceEndPoint"/>
```

```
  <rdfs:subPropertyOf rdf:resource="&supplementary;simpleServiceMetadata"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

```
<rdf:Property rdf:about="&supplementary;serviceEndPointID"
    rdfs:label="supplementary:serviceEndPointID">
  <rdfs:domain rdf:resource="&supplementary;C4HServiceEndPoint"/>
  <rdfs:subPropertyOf rdf:resource="&supplementary;simpleServiceMetadata"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

```
<rdf:Property rdf:about="&supplementary;serviceEndPointName"
    rdfs:label="supplementary:serviceEndPointName">
  <rdfs:domain rdf:resource="&supplementary;C4HServiceEndPoint"/>
  <rdfs:subPropertyOf rdf:resource="&supplementary;simpleServiceMetadata"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

```
<rdf:Property rdf:about="&supplementary;serviceEndPointOrdered"
    rdfs:label="supplementary:serviceEndPointOrdered">
  <rdfs:domain rdf:resource="&supplementary;C4HServiceEndPoint"/>
  <rdfs:subPropertyOf rdf:resource="&supplementary;simpleServiceMetadata"/>
  <rdfs:range rdf:resource="&xsd;boolean"/>
</rdf:Property>
```

```
<rdf:Property rdf:about="&supplementary;serviceEndPointOwnerID"
    rdfs:label="supplementary:serviceEndPointOwnerID">
  <rdfs:domain rdf:resource="&supplementary;C4HServiceEndPoint"/>
  <rdfs:subPropertyOf rdf:resource="&supplementary;simpleServiceMetadata"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

```
<rdf:Property rdf:about="&supplementary;serviceEndPointParallel"
    rdfs:label="supplementary:serviceEndPointParallel">
  <rdfs:domain rdf:resource="&supplementary;C4HServiceEndPoint"/>
  <rdfs:subPropertyOf rdf:resource="&supplementary;simpleServiceMetadata"/>
  <rdfs:range rdf:resource="&xsd;boolean"/>
</rdf:Property>
```

```
<rdf:Property rdf:about="&supplementary;serviceEndPointProtocol"
    rdfs:label="supplementary:serviceEndPointProtocol">
  <rdfs:domain rdf:resource="&supplementary;C4HServiceEndPoint"/>
  <rdfs:subPropertyOf rdf:resource="&supplementary;simpleServiceMetadata"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

```
<rdf:Property rdf:about="&supplementary;serviceEndPointProtocolVersion"
    rdfs:label="supplementary:serviceEndPointProtocolVersion">
  <rdfs:domain rdf:resource="&supplementary;C4HServiceEndPoint"/>
```

```
  <rdfs:subPropertyOf rdf:resource="&supplementary;simpleServiceMetadata"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

```
<rdf:Property rdf:about="&supplementary;serviceEndPointType"
    rdfs:label="supplementary:serviceEndPointType">
  <rdfs:domain rdf:resource="&supplementary;C4HServiceEndPoint"/>
  <rdfs:subPropertyOf rdf:resource="&supplementary;simpleServiceMetadata"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

```
<rdf:Property rdf:about="&supplementary;serviceEndPointURI"
    rdfs:label="supplementary:serviceEndPointURI">
  <rdfs:domain rdf:resource="&supplementary;C4HServiceEndPoint"/>
  <rdfs:subPropertyOf rdf:resource="&supplementary;simpleServiceMetadata"/>
  <rdfs:range rdf:resource="&xsd;anyURI"/>
</rdf:Property>
```

3.4.3.3 hasServiceInterface

Purpose

Descriptor of the interface a service provides to its clients. Might include interface format and the interface as raw data.

Origin of metadata

Service Provider

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;hasServiceInterface"
    rdfs:label="supplementary:hasServiceInterface">
  <rdfs:range rdf:resource="&external;SoftwareServiceContentDescription"/>
  <rdfs:domain rdf:resource="&supplementary;C4HServiceDescription"/>
  <rdfs:subPropertyOf
    rdf:resource="&abstract;hasSupplementaryExternalMetadata"/>
</rdf:Property>
```

3.4.3.4 hasServiceManagementInterface

Purpose

Descriptor of the management interface of a service. Might include interface format and the interface as raw data.

Origin of metadata

Service Provider

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;serviceManagementInterface"
    rdfs:label="supplementary:serviceManagementInterface">
  <rdfs:range rdf:resource="&external;SoftwareServiceContentDescription"/>
  <rdfs:domain rdf:resource="&supplementary;C4HServiceDescription"/>
  <rdfs:subPropertyOf
    rdf:resource="&abstract;hasSupplementaryExternalMetadata"/>
</rdf:Property>
```

3.4.3.5 hasServiceProperties

Purpose

Custom, provider-specific properties for the service. Specified as key-value pairs, e.g. “supportedFileType"="jpg"

Origin of metadata

Service Provider

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;hasServiceProperties"
    rdfs:label="supplementary:hasServiceProperties">
  <rdfs:domain rdf:resource="&supplementary;C4HServiceDescription"/>
  <rdfs:subPropertyOf
    rdf:resource="&abstract;hasServiceProfileMetadata"/>
  <rdfs:range rdf:resource="&supplementary;C4HServiceProperty"/>
</rdf:Property>
```

C4HServiceProperty class is defined below. It contains a **servicePropertyKey** and a **servicePropertyValue**

```
<rdfs:Class rdf:about="&supplementary;C4HServiceProperty"
    rdfs:label="supplementary:C4HServiceProperty">
  <rdfs:subClassOf rdf:resource="&abstract;ServiceMetadata"/>
</rdfs:Class>
```

```
<rdf:Property rdf:about="&supplementary;servicePropertyKey"
    rdfs:label="supplementary:servicePropertyKey">
  <rdfs:domain rdf:resource="&supplementary;C4HServiceProperty"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleServiceMetadata"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

```
<rdf:Property rdf:about="&supplementary;servicePropertyValue"
    rdfs:label="supplementary:servicePropertyValue">
  <rdfs:domain rdf:resource="&supplementary;C4HServiceProperty"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleServiceMetadata"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

3.4.3.6 hasServiceQualityDeclaration

Purpose

Description of a service's quality attributes.

Origin of metadata

Service Provider

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;hasServiceQualityDeclaration"
    rdfs:label="supplementary:hasServiceQualityDeclaration">
  <rdfs:domain rdf:resource="&supplementary;C4HServiceDescription"/>
  <rdfs:subPropertyOf
    rdf:resource="&abstract;hasServiceProfileMetadata"/>
  <rdfs:range rdf:resource="&supplementary;C4HServiceQualityDeclaration"/>
</rdf:Property>
```

The **C4HServiceQualityDeclaration** class and its properties is defined here below. It contains the following properties:

- **serviceMaxExecutionTime** - defines how long does it by maximum take to execute a service request from the moment of receiving to the moment before sending response. Unit: milliseconds
- **serviceMaxLatency** – defines the maximum time it takes a message to reach from client to service or vice-versa. Unit: milliseconds
- **serviceMaxThroughput –** the number of requests the service can process per second.
- **serviceReliability** – Defines the proportion of processed requests that are processed succesfully. Unit: percentage
- **serviceResponseTime** – the maximum time it should take from sending a request to receive a response.
- **serviceScalability** - Service's ability not to get overloaded by multiple parallel requests. Higher value states the probability to receive a response in time. Unit: probability.
- **serviceTimeliness** - The proportion of the processed requests that are processed within the agreed response time (maxResponseTime) Unit: percentage

```
<rdfs:Class rdf:about="&supplementary;C4HServiceQualityDeclaration"
    rdfs:label="supplementary:C4HServiceQualityDeclaration">
  <rdfs:subClassOf rdf:resource="&abstract;ServiceMetadata"/>
</rdfs:Class>
```

```
<rdf:Property rdf:about="&supplementary;serviceMaxExecutionTime"
    rdfs:label="supplementary:serviceMaxExecutionTime">
  <rdfs:domain rdf:resource="&supplementary;C4HServiceQualityDeclaration"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleServiceMetadata"/>
  <rdfs:range rdf:resource="&xsd;integer"/>
</rdf:Property>
```

```
<rdf:Property rdf:about="&supplementary;serviceMaxLatency"
```

```
    rdfs:label="supplementary:serviceMaxLatency">
  <rdfs:domain rdf:resource="&supplementary;C4HServiceQualityDeclaration"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleServiceMetadata"/>
  <rdfs:range rdf:resource="&xsd;integer"/>
</rdf:Property>
```

```
<rdf:Property rdf:about="&supplementary;serviceMaxThroughput"
    rdfs:label="supplementary:serviceMaxThroughput">
  <rdfs:domain rdf:resource="&supplementary;C4HServiceQualityDeclaration"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleServiceMetadata"/>
  <rdfs:range rdf:resource="&xsd;float"/>
</rdf:Property>
```

```
<rdf:Property rdf:about="&supplementary;serviceReliability"
    rdfs:label="supplementary:serviceReliability">
  <rdfs:domain rdf:resource="&supplementary;C4HServiceQualityDeclaration"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleServiceMetadata"/>
  <rdfs:range rdf:resource="&xsd;float"/>
</rdf:Property>
```

```
<rdf:Property rdf:about="&supplementary;serviceResponseTime"
    rdfs:label="supplementary:serviceResponseTime">
  <rdfs:domain rdf:resource="&supplementary;C4HServiceQualityDeclaration"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleServiceMetadata"/>
  <rdfs:range rdf:resource="&xsd;integer"/>
</rdf:Property>
```

```
<rdf:Property rdf:about="&supplementary;serviceScalability"
    rdfs:label="supplementary:serviceScalability">
  <rdfs:domain rdf:resource="&supplementary;C4HServiceQualityDeclaration"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleServiceMetadata"/>
  <rdfs:range rdf:resource="&xsd;float"/>
</rdf:Property>
```

```
<rdf:Property rdf:about="&supplementary;serviceTimeliness"
     rdfs:label="supplementary:serviceTimeliness">
  <rdfs:domain rdf:resource="&supplementary;C4HServiceQualityDeclaration"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleServiceMetadata"/>
  <rdfs:range rdf:resource="&xsd;float"/>
</rdf:Property>
```

3.4.3.7 hasServiceSemanticDescription

Purpose

A placeholder for possible semantic service description in future versions of the CAM4Home service platform.

Origin of metadata

Service Provider

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;hasServiceSemanticDescription"
    rdfs:label="supplementary:hasServiceSemanticDescription">
  <rdfs:domain rdf:resource="&supplementary;C4HServiceDescription"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;hasServiceProfileMetadata"/>
  <rdfs:range rdf:resource="&supplementary;C4HServiceSemanticDescription"/>
</rdf:Property>
```

The definition of **C4HServiceSemanticDescription** class is presented here below. No properties were yet defined.

```
<rdfs:Class rdf:about="&supplementary;C4HServiceSemanticDescription"
    rdfs:label="supplementary:C4HServiceSemanticDescription">
  <rdfs:subClassOf rdf:resource="&abstract;ServiceMetadata"/>
</rdfs:Class>
```

3.4.3.8 serviceC4H_ID

Purpose

Unique identifier of a CAM4Home service.

Origin of metadata

Service Provider

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;serviceC4H_ID"
    rdfs:label="supplementary:serviceC4H_ID">
  <rdfs:domain rdf:resource="&supplementary;C4HServiceDescription"/>
  <rdfs:subPropertyOf
    rdf:resource="&abstract;simpleServiceProfileMetadata"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

3.4.3.9 serviceDependencies

Purpose

Describes service's dependencies to other CAM4Home services with a list of serviceC4H_ID's.

Origin of metadata

Service Provider

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;serviceDependencies"
    rdfs:label="supplementary:serviceDependencies">
  <rdfs:domain rdf:resource="&supplementary;C4HServiceDescription"/>
  <rdfs:subPropertyOf
```

```
    rdf:resource="&abstract;simpleServiceProfileMetadata"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

3.4.3.10 serviceDetailedDescription

Purpose

A human-readable, more detailed description of the service.

Origin of metadata

Service Provider

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;serviceDetailedDescription"
    rdfs:label="supplementary:serviceDetailedDescription">
  <rdfs:domain rdf:resource="&supplementary;C4HServiceDescription"/>
  <rdfs:subPropertyOf
    rdf:resource="&abstract;simpleServiceProfileMetadata"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

3.4.3.11 serviceName

Purpose

Name of a service.

Origin of metadata

Service Provider

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;serviceName"
    rdfs:label="supplementary:serviceName">
  <rdfs:domain rdf:resource="&supplementary;C4HServiceDescription"/>
  <rdfs:subPropertyOf
    rdf:resource="&abstract;simpleServiceProfileMetadata"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

3.4.3.12 serviceProvider

Purpose

Name of a service provider.

Origin of metadata

Service Provider

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;serviceProvider"
    rdfs:label="supplementary:serviceProvider">
  <rdfs:domain rdf:resource="&supplementary;C4HServiceDescription"/>
  <rdfs:subPropertyOf
    rdf:resource="&abstract;simpleServiceProfileMetadata"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

3.4.3.13 serviceProviderC4H_ID

Purpose

Unique identifier of a service provider.

Origin of metadata

Service Provider

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;serviceProviderC4H_ID"
    rdfs:label="supplementary:serviceProviderC4H_ID">
  <rdfs:domain rdf:resource="&supplementary;C4HServiceDescription"/>
  <rdfs:subPropertyOf
    rdf:resource="&abstract;simpleServiceProfileMetadata"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

3.4.3.14 serviceShortDescription

Purpose

A human-readable, short description of the service.

Origin of metadata

Service Provider

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;serviceShortDescription"
    rdfs:label="supplementary:serviceShortDescription">
  <rdfs:domain rdf:resource="&supplementary;C4HServiceDescription"/>
  <rdfs:subPropertyOf
    rdf:resource="&abstract;simpleServiceProfileMetadata"/>
  <rdfs:range rdf:resource="&&xsd;string"/>
</rdf:Property>
```

3.4.3.15 serviceVersion

Purpose

The version of the service.

Origin of metadata

Service Provider

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;serviceVersion"
    rdfs:label="supplementary:serviceVersion">
  <rdfs:domain rdf:resource="&supplementary;C4HServiceDescription"/>
  <rdfs:subPropertyOf
    rdf:resource="&abstract;simpleServiceProfileMetadata"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

3.5 User entity related classes definitions

This section is organized as follows. The first section introduces C4HUser entity, C4HUserProfile classes and theirs subclasses. We start by detailing in paragraphs 3.5.1.1-3.5.1.4 of the first section the C4HUser class and its specializations (Advertiser,CommunityMember, ProfessionalProducer). We continue the first section by paragraphs (3.5.1.5-3.5.1.8) presenting the C4HUserProfile class and its specializations (C4HUserPreferenceProfile, C4HUserEnvironmentProfile and C4HUserPersonalProfile).

The second and third sections enumerate respectively C4HUser and CommunityMember classes properties.

The fourth, fifth, seven and eight section introduce respectively the C4HUserProfile, C4HUserEnvironmentProfile, C4HUserPersonalProfile and C4HUserEnvironmentProfile classes properties.

3.5.1 Class definitions

3.5.1.1 C4HUser

Purpose

Generic class for CAM4Home system users.

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&supplementary;C4HUser"
    rdfs:label="supplementary:C4HUser">
  <rdfs:subClassOf rdf:resource="&abstract;User"/>
</rdfs:Class>
```

3.5.1.2 Advertiser

Purpose

Class for special type of CAM4Home system users whose role related to content is advertiser.

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&supplementary;Advertiser"
    rdfs:label="supplementary:Advertiser">
  <rdfs:subClassOf rdf:resource="&supplementary;C4HUser"/>
</rdfs:Class>
```

3.5.1.3 CommunityMember

Purpose

Class for special type of CAM4Home system users whose role related to content is a community member.

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&supplementary;CommunityMember"
    rdfs:label="supplementary:CommunityMember">
  <rdfs:subClassOf rdf:resource="&supplementary;C4HUser"/>
</rdfs:Class>
```

3.5.1.4 ProfessionalProducer

Purpose

Class for special type of CAM4Home system users whose role related to content is professional producer

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&supplementary;ProfessionalProducer"
    rdfs:label="supplementary:ProfessionalProducer">
  <rdfs:subClassOf rdf:resource="&supplementary;C4HUser"/>
</rdfs:Class>
```

3.5.1.5 C4HUserProfile

Purpose

Generic class for describing a user profile of a CAM4Home system user.

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&supplementary;C4HUserProfile"
    rdfs:label="supplementary:C4HUserProfile">
  <rdfs:subClassOf rdf:resource="&abstract;UserProfile"/>
</rdfs:Class>
```

3.5.1.6 C4HUserPreferenceDescription

Purpose

Class for describing a user preference profile of a CAM4Home system user.

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&supplementary;C4HUserPreferenceDescription"
    rdfs:label="supplementary:C4HUserPreferenceDescription ">
  <rdfs:subClassOf rdf:resource="&abstract;UserMetadata"/>
</rdfs:Class>
```

3.5.1.7 C4HUserEnvironmentDescription

Purpose

Class for describing a user environment profile of a CAM4Home system user.

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&supplementary;C4HUserEnvironmentDescription"
    rdfs:label="supplementary:C4HUserEnvironmentDescription ">
  <rdfs:subClassOf rdf:resource="&supplementary;UserMetadata"/>
</rdfs:Class>
```

3.5.1.8 C4HUserPersonalDescription

Purpose

Class for describing a user personal profile of a CAM4Home system user.

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&supplementary;C4HUserPersonalDescription"
    rdfs:label="supplementary:C4HUserPersonalDescription ">
  <rdfs:subClassOf rdf:resource="&supplementary;UserMetadata"/>
</rdfs:Class>
```

3.5.2 C4HUser properties

3.5.2.1 hasC4HUserProfile

Purpose

Associates a CAM4Home specific user profile to a CAM4Home system user metadata entity.

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;hasC4HUserProfile"
    rdfs:label="supplementary:hasC4HUserProfile">
  <rdfs:domain rdf:resource="&supplementary;C4HUser"/>
  <rdfs:range rdf:resource="&supplementary;C4HUserProfile"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;hasUserProfile"/>
</rdf:Property>
```

3.5.3 C4HUserProfile properties

3.5.3.1 externalUserProfileReference

Purpose

Provides a link to a CAM4Home system user's user profile that is outside the system and available in network location.

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;externalUserProfileReference"
    rdfs:label="supplementary:externalUserProfileReference">
  <rdfs:domain rdf:resource="&core;C4HUserProfile"/>
  <rdfs:subPropertyOf
    rdf:resource="&abstract;simpleUserProfileMetadata"/>
  <rdfs:range rdf:resource="&rdfs;Literal"/>
</rdf:Property>
```

3.5.3.2 hasUserPersonalDescription

Purpose

Provides the description of User Profile Environement

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;hasUserPersonalDescription"
    rdfs:label="supplementary:hasUserPersonalDescription">
  <rdfs:domain rdf:resource="&Supplementary;C4HUserProfile"/>
  <rdfs:subPropertyOf
    rdf:resource="&abstract;hasUserProfileMetadata"/>
  <rdfs:range rdf:resource="C4HUserPersonalDescription"/>
</rdf:Property>
```

3.5.3.3 hasUserPreferenceDescription

Purpose

Provides the description of User Prereference

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;hasUserPreferenceDescription"
    rdfs:label="supplementary:hasUserPreferenceDescription">
  <rdfs:domain rdf:resource="&supplementary;C4HUserProfile"/>
  <rdfs:subPropertyOf
    rdf:resource="&abstract;hasUserProfileMetadata"/>
  <rdfs:range rdf:resource="&rdfs;C4HUserPreferenceDescription"/>
</rdf:Property>
```

3.5.3.4 hasUserEnvironementDescription

Purpose

Provides the description of User Profile Environement

Origin of metadata

Creator

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;hasUserEnvironmentDescription"
    rdfs:label="supplementary:hasUserEnvironmentDescription">
  <rdfs:domain rdf:resource="&supplementary;C4HUserProfile"/>
  <rdfs:subPropertyOf
    rdf:resource="&abstract;hasUserProfileMetadata"/>
  <rdfs:range rdf:resource="&rdfs;C4HUserEnvironementDescription"/>
</rdf:Property>
```

3.5.4 C4HUserEnvironmentDescription properties

3.5.4.1 luminosityLevel

Use and purpose

This metadata entry indicates the user's environement luminosity level (cd/m2).

Origin of metadata

Environment observation service

Metadata Format and RDF Schema Definition

```
<rdf:Property rdf:about="&supplementary;luminosityLevel"
    rdfs:label="&supplementary;luminosityLevel">
 <rdfs:domain rdf:resource="&supplementary;C4HUserEnvironmentDescription"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleUserMetadata"/>
  <rdfs:range rdf:resource="&xsd;float"/>
</rdf:Property>
```

Practical example of metadata entry

```
<supplementary:C4HUserEnvironmentDescription ...>
  <supplementary:luminosityLevel rdf:datatype="&xsd;float">
    42
  </supplementary:luminosityLevel>
</supplementary:C4HUserEnvironmentDescription>
```

3.5.4.2 noiseLevel

Use and purpose

This metadata entry indicates the user's environement noise level (db)

Origin of metadata

Environment observation service

Metadata Format and RDF Schema Definition

```
<rdf:Property rdf:about="&supplementary;noiseLevel"
    rdfs:label="&supplementary;noiseLevel">
 <rdfs:domain rdf:resource="&supplementary;C4HUserEnvironmentDescription"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleUserMetadata"/>
  <rdfs:range rdf:resource="&xsd;float"/>
</rdf:Property>
```

Practical example of metadata entry

```
<supplementary:C4HUserEnvironmentDescription ...>
  <supplementary:noiseLevel rdf:datatype="&xsd;string">
    15
  </supplementary:noiseLevel>
</supplementary:C4HUserEnvironmentDescription>
```

3.5.4.3 temperature

Use and purpose

This metadata entry indicates the user's environement temperature (°C).

Origin of metadata

Environment observation service

Metadata Format and RDF Schema Definition

```
<rdf:Property rdf:about="&supplementary;temperature"
    rdfs:label="&supplementary;temperature">
  <rdfs:domain
    rdf:resource="&supplementary;C4HUserEnvironmentDescription"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleUserMetadata"/>
  <rdfs:range rdf:resource="&xsd;float"/>
</rdf:Property>
```

Practical example of metadata entry

```
<supplementary:C4HUserEnvironmentDescription ...>
  <supplementary:temperature rdf:datatype="&xsd;float">
    23.3
  </supplementary:temperature>
</C4HUserEnvironmentDescription >
```

3.5.5 C4HUserPersonalDescription properties

3.5.5.1 homeLocation

Use and purpose

This metadata entry presents information about geo-location for where user lives. The value could be just country, town or even coordinates

Origin of metadata

Domain of the interest, Range of the user.

Metadata Format and RDF Schema Definition

```
<rdf:Property rdf:about="&supplementary;homeLocation"
    rdfs:label="&supplementary;homeLocation">
  <rdfs:domain rdf:resource="&supplementary;C4HUserPersonalDescription"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleUserMetadata"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

Practical example of metadata entry

```
<supplementary:C4HUserPersonalDescription ...>
  <supplementary:homeLocation rdf:datatype="&xsd;string">
    13 rue Chance,59000 Lille, FRANCE
  </supplementary:homeLocation>
</supplementary:C4HUserPersonalDescription>
```

3.5.5.2 userBirthDate

Use and purpose

This metadata entry presents information about birth date of the user. The value could be used for age restricted material

Origin of metadata

Domain of the interest, Range of the user.

Metadata Format and RDF Schema Definition

```
<rdf:Property rdf:about="&supplementary;userBirthDate"
    rdfs:label="&supplementary;userBirthDate">
  <rdfs:domain rdf:resource="&supplementary;C4HUserPersonalDescription"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleUserMetadata"/>
  <rdfs:range rdf:resource="&xsd;dateTime"/>
</rdf:Property>
```

Practical example of metadata entry

```
<supplementary:C4HUserPersonalDescription ...>
```

```
  <supplementary:userBirthDate rdf:datatype="&xsd;date">
    2007-07-01
  </supplementary:userBirthDate>
</supplementary:C4HUserPersonalDescription>
```

3.5.5.3 userName

Use and purpose

This metadata entry indicates the user's name.

Origin of metadata

Domain of the interest, Range of the user.

Metadata Format and RDF Schema Definition

```
<rdf:Property rdf:about="&supplementary;userName"
    rdfs:label="&supplementary;userName">
  <rdfs:domain rdf:resource="&supplementary;C4HUserPersonalDescription"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleUserMetadata"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

Practical example of metadata entry

```
<supplementary:C4HUserPersonalDescription ...>
  <supplementary:userName rdf:datatype="&xsd;string">
    John Doe
  </supplementary:userName>
</supplementary:C4HUserPersonalDescription>
```

3.5.5.4 userNickName

Use and purpose

This metadata entry indicates the user's NickName

Origin of metadata

Domain of the interest, Range of the user.

Metadata Format and RDF Schema Definition

```
<rdf:Property rdf:about="&supplementary;userNickName"
    rdfs:label="&supplementary;userNickName">
  <rdfs:domain rdf:resource="&supplementary;C4HUserPersonalDescription"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleUserMetadata"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

Practical example of metadata entry

```
<supplementary:C4HUserPersonalDescription ...>
  <supplementary:userNickName rdf:datatype="&xsd;string">
    sousou
  </supplementary:userNickName >
</supplementary:C4HUserPersonalDescription>
```

3.5.5.5 userWebLink

Use and purpose

This metadata entry presents links to users' homepage or other sites that users want to promote.

Origin of metadata

Domain of the interest, Range of the user.

Metadata Format and RDF Schema Definition

```
<rdf:Property rdf:about="&supplementary;userWebLink"
    rdfs:label="&supplementary;userWebLink">
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleUserMetadata"/>
  <rdfs:domain rdf:resource="&supplementary;C4HUserPersonalDescription"/>
  <rdfs:range rdf:resource="&xsd;anyURI"/>
</rdf:Property>
```

Practical example of metadata entry

```
<supplementary:C4HUserPersonalDescription ...>
  <supplementary:userWebLink rdf:datatype="&xsd;string">
    http://www.facebook.com/people/Gc-Coookie/1421303981
  </supplementary:userWebLink>
</supplementary:C4HUserPersonalDescription>
```

3.5.6 C4HUserPreferenceDescription properties

3.5.6.1 hasPreferredMedia

Use and purpose

The purpose of this metadata entry is to list the preferred media for a user

Origin of metadata

CAM4Home user

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;hasPreferredMedia"
    rdfs:label="supplementary:hasPreferredMedia">
  <rdf:domain rdf:resource="&supplementary;C4HUserPreferenceDescription"/>
  <rdf:range rdf:resource="&supplementary;PreferredMedia"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;hasUserMetadata"/>
```

```
</rdf:Property>
```

The definition of **PreferredMedia** class and its properties (**mediaMimeType** and **preferenceOrder**) are presented here below. The **mediaMimeType** value is expressed using the values retained by IANA[2] for describing file types.

```
<rdfs:Class rdf:about="&supplementary;PreferredMedia"
    rdfs:label="supplementary:PreferredMedia">
  <rdfs:subClassOf rdf:resource="&supplementary;UserMetadata"/>
</rdfs:Class>
```

```
<rdf:Property rdf:about="&supplementary;mediaMimeType"
    rdfs:label="supplementary:mediaMimeType">
  <rdf:domain rdf:resource="&supplementary;PreferredMedia"/>
  <rdf:subPropertyOf rdf:resource="&abstract;simpleUserMetadata"/>
  <rdf:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

```
<rdf:Property rdf:about="&supplementary;preferenceOrder"
    rdfs:label="supplementary:preferenceOrder">
  <rdf:domain rdf:resource="&supplementary;PreferredMedia"/>
 <rdf:domain rdf:resource="&supplementary;PreferredChannel"/>
  <rdf:subPropertyOf rdf:resource="&abstract;simpleUserMetadata"/>
  <rdf:range rdf:resource="&xsd;integer"/>
</rdf:Property>
```

Practical example

```
<supplementary:C4HUserProfile>
  ...
  <supplementary:hasUserPreferenceDescription>
    <supplementary:C4HUserPreferenceDescription>
      ...
      <supplementary:hasPreferredMedia>
        <supplementary:PreferredMedia>
          <supplementary:mediaMimeType>
            image/jpg
          </supplementary:mediaMimeType>
          <supplementary:preferenceOrder>1</supplementary:preferenceOrder>
        </supplementary:PreferredMedia>
        <supplementary:PreferredMedia>
          <supplementary:mediaMimeType>
            image/gif
          </supplementary:mediaMimeType>
          <supplementary:preferenceOrder>2</supplementary:preferenceOrder>
        </supplementary:PreferredMedia>
        ...
      </supplementary:hasPreferredMedia>
      ...
    </supplementary:C4HUserPreferenceDescription>
```

[2] http://www.iana.org/assignments/media-types/

```
  </supplementary:hasUserPreferenceDescription>
  ...
</supplementary:C4HUserProfile>
```

3.5.6.2 hasPreferredChannel

Use and purpose

The purpose of this metadata entry is to list of preferred channels for a user.

Origin of metadata

CAM4Home user

Metadata format and RDF Schema definition

```
<rdf:Property rdf:about="&supplementary;hasPreferredChannel"
    rdfs:label="supplementary:hasPreferredChannel">
  <rdf:domain rdf:resource="&supplementary;C4HUserPreferenceDescription"/>
  <rdf:range rdf:resource="&supplementary;PreferredChannel"/>
  <rdf:subPropertyOf rdf:resource="&abstract;hasUserMetadata"/>
</rdf:Property>
```

The definition of **PreferredMedia** class and its properties (**preferenceOrder** and **channelType** – audio, visual, textual) are presented here below.

```
<rdfs:Class rdf:about="&supplementary;PreferredChannel"
    rdfs:label="supplementary:PreferredChannel">
  <rdfs:subClassOf rdf:resource="&supplementary;UserMetadata"/>
</rdfs:Class>
```

preferenceOrder is defined in section 3.5.6.1.

```
<rdf:Property rdf:about="&supplementary;channelType"
    rdfs:label="supplementary:channelType ">
  <rdf:domain rdf:resource="&supplementary;PreferredChannel"/>
  <rdf:subPropertyOf rdf:resource="&abstract;simpleUserMetadata"/>
  <rdf:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

Practical example

```
<supplementary:C4HUserProfile>
  ...
  <supplementary:hasUserPreferenceDescription>
    <supplementary:C4HUserPreferenceDescription>
      ...
      <supplementary:hasPreferredChannel>
        <supplementary:PreferredChannel>
```

```
          <supplementary:channelType>Audio</supplementary:channelType>
          <supplementary:preferenceOrder>1</supplementary:preferenceOrder>
        </supplementary:PreferredChannel>
        ...
      </supplementary:hasPreferredChannel>
      ...
    </supplementary:C4HUserPreferenceDescription>
  </supplementary:hasUserPreferenceDescription>
  ...
</supplementary:C4HUserProfile>
```

3.5.6.3 interests

See section 3.1.2.3.

3.5.6.4 presenceInformation

Use and purpose

This metadata entry presents information about the presence of the user.

Origin of metadata

Domain of the presence, Range of the user.

Metadata Format and RDF Schema Definition

```
<rdf:Property rdf:about="&supplementary;presenceInformation"
    rdfs:label="&supplementary;presenceInformation">
  <rdfs:domain rdf:resource="&supplementary;C4HUserPreferenceDescription"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleUserMetadata"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

Practical example of metadata entry

```
<supplementary:C4HUserPreferenceDescription ...>
  <supplementary:presenceInformation rdf:datatype="&xsd;string">
    available
  </supplementary:presenceInformation>
</supplementary:C4HUserPreferenceDescription>
```

3.5.6.5 preferenceState

Use and purpose

This metadata entry presents states that describes user's current willingness to receive content, capability to interact with the system and preference for how much she/he wants the system to disturb her/him.

Origin of metadata

Range of the user.

Metadata Format and RDF Schema Definition

```
<rdf:Property rdf:about="&supplementary;presenceInformation"
    rdfs:label="&supplementary;presenceInformation">
  <rdfs:domain rdf:resource="&supplementary;C4HUserPreferenceDescription"/>
  <rdfs:subPropertyOf rdf:resource="&abstract;simpleUserMetadata"/>
  <rdfs:range rdf:resource="&xsd;string"/>
</rdf:Property>
```

Practical example of metadata entry

```
<supplementary:C4HUserPreferenceDescription ...>
  <supplementary:preferenceState rdf:datatype="&xsd;string">
    available
  </supplementary:preferenceState>
</supplementary:C4HUserPreferenceDescription>
```

4 Concrete External Metamodel

The concrete external model serves as a directory of existing standards that are considered relevant for CAM4HOME metadata framework practicionars. Standards are organized with regard to the fact that they contain metadata about the core features (5.1) or about the supplementary entities (5.2).

The set of concrete external classes is not exhaustive. Still, other standards can still be integrated within the CAM4HOME metadata framework by the usage of the generic classes (ExternalCoreMetadata or ExternalSupplementaryMetadata) and the generic properties (externalSchemaName, externalSchemaURI, etc.).

4.1 Core-related External Metadata classes

4.1.1 Generic Multimedia-related External Metadata classes

4.1.1.1 MultimediaContentMetadata

Purpose

Category for external metadata format that can be used to provide information about multimedia content.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&external;MultimediaContentMetadata"
     rdfs:label="external:MultimediaContentMetadata">
    <rdfs:subClassOf
rdf:resource="&abstract;ExternalContentFeatureMetadata"/>
</rdfs:Class>
```

4.1.1.2 AudioContentMetadata

Purpose

Category for external metadata format that can be used to provide information about audio content.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&external;AudioContentMetadata"
    rdfs:label="external:AudioContentMetadata">
  <rdfs:subClassOf rdf:resource="&external;MultimediaContentMetadata"/>
</rdfs:Class>
```

4.1.1.3 DocumentContentMetadata

Purpose

Category for external metadata format that can be used to provide information about document type of content.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&external;DocumentContentMetadata"
    rdfs:label="external:DocumentContentMetadata">
  <rdfs:subClassOf rdf:resource="&external;MultimediaContentMetadata"/>
</rdfs:Class>
```

4.1.1.4 ImageContentMetadata

Purpose

Category for external metadata format that can be used to provide information about image content.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&external;ImageContentMetadata"
    rdfs:label="external:ImageContentMetadata">
  <rdfs:subClassOf rdf:resource="&external;MultimediaContentMetadata"/>
</rdfs:Class>
```

4.1.1.5 VideoContentMetadata

Purpose

Category for external metadata format that can be used to provide information about video content.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&external;VideoContentMetadata"
    rdfs:label="external:VideoContentMetadata">
  <rdfs:subClassOf rdf:resource="&external;MultimediaContentMetadata"/>
</rdfs:Class>
```

4.1.1.6 StreamingAudioContentMetadata

Purpose

Category for external metadata format that can be used to provide information about streaming audio content.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&external;StreamingAudioContentMetadata"
    rdfs:label="external:StreamingAudioContentMetadata">
  <rdfs:subClassOf rdf:resource="&external;AudioContentMetadata"/>
</rdfs:Class>
```

4.1.1.7 StreamingVideoContentMetadata

Purpose

Category for external metadata format that can be used to provide information about streaming video content.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&external;StreamingVideoContentMetadata"
    rdfs:label="external:StreamingVideoContentMetadata">
  <rdfs:subClassOf rdf:resource="&external;VideoContentMetadata"/>
</rdfs:Class>
```

4.1.2 Audio-related External Metadata classes

4.1.2.1 DVB-SI_StreamingAudioMetadata

Purpose

Container class for DVB-SI (Digital Video Broadcasting specification for Service Information) [R-4] formatted audiostream metadata.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&external;DVB-SI_StreamingAudioMetadata"
    rdfs:label="external:DVB-SI_StreamingAudioMetadata">
  <rdfs:subClassOf rdf:resource="&external;StreamingAudioContentMetadata"/>
</rdfs:Class>
```

4.1.2.2 MHEG-5_StreamingAudioMetadata

Purpose

Container class for MHEG-5 (Multimedia and Hypermedia information coding Experts Group standard) [R-5] formatted audiostream metadata.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&external;MHEG-5_StreamingAudioMetadata"
    rdfs:label="external:MHEG-5_StreamingAudioMetadata">
  <rdfs:subClassOf rdf:resource="&external;StreamingAudioContentMetadata"/>
</rdfs:Class>
```

4.1.2.3 MPEG-21_AudioMetadata

Purpose

Container class for MPEG-21 (Moving Pictures Experts Group standard) [R-2] formatted audio metadata.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&external;MPEG-21_AudioMetadata"
    rdfs:label="external:MPEG-21_AudioMetadata">
  <rdfs:subClassOf rdf:resource="&external;AudioContentMetadata"/>
</rdfs:Class>
```

4.1.2.4 MPEG-7_AudioMetadata

Purpose

Container class for MPEG-7 (Moving Pictures Experts Group standard) [R-3]formatted audio metadata.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&external;MPEG-7_AudioMetadata"
    rdfs:label="external:MPEG-7_AudioMetadata">
  <rdfs:subClassOf rdf:resource="&external;AudioContentMetadata"/>
</rdfs:Class>
```

4.1.2.5 VOD_AudioMetadata

Purpose

Container class for VOD (Video on Demand) [R-6] formatted audio metadata.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&external;VOD_AudioMetadata"
    rdfs:label="external:VOD_AudioMetadata">
  <rdfs:subClassOf rdf:resource="&external;AudioContentMetadata"/>
</rdfs:Class>
```

4.1.3 Image-related External Metadata classes

4.1.3.1 DIG35_ImageMetadata

Purpose

Container class for DIG35 (DIG35 Metadata for Digital Images) [R-7] formatted image metadata.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&external;DIG35_ImageMetadata"
    rdfs:label="external:DIG35_ImageMetadata">
```

```
  <rdfs:subClassOf rdf:resource="&external;ImageContentMetadata"/>
</rdfs:Class>
```

4.1.3.2 EXIF_ImageMetadata

Purpose

Container class for EXIF (Exchangeable Image File Format) [R-8] formatted image metadata.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&external;EXIF_ImageMetadata"
    rdfs:label="external:EXIF_ImageMetadata">
  <rdfs:subClassOf rdf:resource="&external;ImageContentMetadata"/>
</rdfs:Class>
```

4.1.3.3 IPTC-IIM_ImageMetadata

Purpose

Container class for IPTC-IIM (IPTC Information Interchange Model) [R-9] formatted image metadata.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&external;IPTC-IIM_ImageMetadata"
    rdfs:label="external:IPTC-IIM_ImageMetadata">
  <rdfs:subClassOf rdf:resource="&external;ImageContentMetadata"/>
</rdfs:Class>
```

4.1.3.4 MPEG-7_ImageMetadata

Purpose

Container class for MPEG-7 (Moving Pictures Experts Group standard) [R-3] formatted image metadata.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&external;MPEG-7_ImageMetadata"
    rdfs:label="external:MPEG-7_ImageMetadata">
  <rdfs:subClassOf rdf:resource="&external;ImageContentMetadata"/>
</rdfs:Class>
```

4.1.3.5 MPEG-21_ImageMetadata

Purpose

Container class for MPEG-21 (Moving Pictures Experts Group standard) [R-2] formatted image metadata.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&external;MPEG-21_ImageMetadata"
```

```
    rdfs:label="external:MPEG-21_ImageMetadata">
  <rdfs:subClassOf rdf:resource="&external;ImageContentMetadata"/>
</rdfs:Class>
```

4.1.3.6 XMP_ImageMetadata

Purpose

Container class for XMP (Extensible Metadata Platform) [R-10] formatted image metadata.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&external;XMP_ImageMetadata"
    rdfs:label="external:XMP_ImageMetadata">
  <rdfs:subClassOf rdf:resource="&external;ImageContentMetadata"/>
</rdfs:Class>
```

4.1.4 Video-related External Metadata classes

4.1.4.1 AAF_VideoMetadata

Purpose

Container class for AAF (Advaced Authoring Format) [R-11] formatted video metadata.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&external;AAF_VideoMetadata"
    rdfs:label="external:AAF_VideoMetadata">
  <rdfs:subClassOf rdf:resource="&external;VideoContentMetadata"/>
</rdfs:Class>
```

4.1.4.2 DVB-SI_StreamingVideoMetadata

Purpose

Container class for DVB-SI SI (Digital Video Broadcasting specification for Service Information) [R-4] formatted metadata for streaming video.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&external;DVB-SI_StreamingVideoMetadata"
    rdfs:label="external:DVB-SI_StreamingVideoMetadata">
  <rdfs:subClassOf
    rdf:resource="&external;StreamingVideoContentMetadata"/>
</rdfs:Class>
```

4.1.4.3 MHEG-5_StreamingVideoMetadata

Purpose

Container class for MHEG-5 (Multimedia and Hypermedia information coding Expert Group standard) [R-5] formatted metadata for streaming video.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&external;MHEG-5_StreamingVideoMetadata"
    rdfs:label="external:MHEG-5_StreamingVideoMetadata">
  <rdfs:subClassOf rdf:resource="&external;StreamingVideoContentMetadata"/>
</rdfs:Class>
```

4.1.4.4 MPEG-21_VideoMetadata

Purpose

Container class for MPEG-21 (Moving Pictures Experts Group standard) [R-2] formatted video metadata.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&external;MPEG-21_VideoMetadata"
    rdfs:label="external:MPEG-21_VideoMetadata">
  <rdfs:subClassOf rdf:resource="&external;VideoContentMetadata"/>
</rdfs:Class>
```

4.1.4.5 MPEG-7_VideoMetadata

Purpose

Container class for MPEG-7 (Moving Pictures Experts Group standard) [R-3] formatted video metadata.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&external;MPEG-7_VideoMetadata"
    rdfs:label="external:MPEG-7_VideoMetadata">
  <rdfs:subClassOf rdf:resource="&external;VideoContentMetadata"/>
</rdfs:Class>
```

4.1.4.6 MXF_VideoMetadata

Purpose

Container class for MXF (Material eXchange Format) [R-12] formatted video metadata.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&external;MXF_VideoMetadata"
    rdfs:label="external:MXF_VideoMetadata">
  <rdfs:subClassOf rdf:resource="&external;VideoContentMetadata"/>
</rdfs:Class>
```

4.1.4.7 P-Meta_VideoMetadata

Purpose

Container class for P-Meta (European Broadcasting Union's Metadata library standard) [R-13] formatted video metadata.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&external;P-Meta_VideoMetadata"
    rdfs:label="external:P-Meta_VideoMetadata">
  <rdfs:subClassOf rdf:resource="&external;VideoContentMetadata"/>
</rdfs:Class>
```

4.1.4.8 SDP_VideoMetadata

Purpose

Container class for SDP (Session Definition Protocol) [R-14] formatted video metadata.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&external;SDP_VideoMetadata"
    rdfs:label="external:SDP_VideoMetadata">
  <rdfs:subClassOf rdf:resource="&external;VideoContentMetadata"/>
</rdfs:Class>
```

4.1.4.9 TV-Anytime_VideoMetadata

Purpose

Container class for TV-Anytime [R-15] formatted video metadata.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&external;TV-Anytime_VideoMetadata"
    rdfs:label="external:TV-Anytime_VideoMetadata">
  <rdfs:subClassOf rdf:resource="&external;VideoContentMetadata"/>
</rdfs:Class>
```

4.1.4.10 VOD_VideoMetadata

Purpose

Container class for VOD (Video on Demand) [R-6] formatted video metadata.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&external;VOD_VideoMetadata"
    rdfs:label="external:VOD_VideoMetadata">
  <rdfs:subClassOf rdf:resource="&external;VideoMetadata"/>
</rdfs:Class>
```

4.1.5 Aggregative-related External Metadata classes

4.1.5.1 RelationshipMetadata

Purpose

Upper class and category for external metadata formats that can be used to describe relationships between content.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&external;RelationshipMetadata"
    rdfs:label="external:RelationshipMetadata">
  <rdfs:subClassOf
    rdf:resource="&abstract;ExternalContentAggregativeMetadata"/>
</rdfs:Class>
```

4.1.5.2 SMIL_PresentationMetadata

Purpose

Container class for SMIL (Syncronized Multimedia Integration Language) [R-1] metadata format representing the spatial layout of CAM Objects.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&external;SMIL_PresentationMetadata"
    rdfs:label="external:SMIL_PresentationMetadata">
  <rdfs:subClassOf rdf:resource="&external;RelationshipMetadata"/>
</rdfs:Class>
```

4.1.6 Generic Service-related External Metadata classes

4.1.6.1 ServiceContentMetadata

Purpose

Upper category for external metadata format that can be used to provide information about service content.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&external;ServiceContentMetadata"
    rdfs:label="external:ServiceContentMetadata">
  <rdfs:subClassOf
    rdf:resource="&abstract;ExternalContentFeatureMetadata"/>
</rdfs:Class>
```

4.1.6.2 DownloadableApplicationContentMetadata

Purpose

Category for external metadata format that can be used to provide information about downloadable applications.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&external;DownloadableApplicationContentMetadata"
    rdfs:label="external:DownloadableApplicationContentMetadata">
  <rdfs:subClassOf rdf:resource="&external;ServiceContentMetadata"/>
</rdfs:Class>
```

4.1.6.3 SoftwareServiceContentMetadata

Purpose

Category for external metadata format that can be used to provide information about software service type of content.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&external;SoftwareServiceContentMetadata"
    rdfs:label="external:SoftwareServiceContentMetadata">
  <rdfs:subClassOf rdf:resource="&external;ServiceContentMetadata"/>
</rdfs:Class>
```

4.1.6.4 SoftwareServiceContentDescription

Purpose

Category for external metadata format that can be used to create service descriptions of software service content.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&external;SoftwareServiceContentDescription"
    rdfs:label="external;SoftwareServiceContentDescription">
  <rdfs:subClassOf
rdf:resource="&external;SoftwareServiceContentMetadata"/>
</rdfs:Class>
```

4.1.6.5 UserServiceContentMetadata

Purpose

Category for external metadata format that can be used to provide information about user service type of content.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&external;UserServiceContentMetadata"
    rdfs:label="external:UserServiceContentMetadata">
  <rdfs:subClassOf rdf:resource="&external;ServiceContentMetadata"/>
```

```
</rdfs:Class>
```

4.1.7 Service-related External Metadata classes

4.1.7.1 WSDL_SoftwareServiceDescription

Purpose

Container class for service descriptions written in WSDL (Web Services Definition Language) [R-16].

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&external;WSDL_SoftwareServiceDescription"
    rdfs:label="external:WSDL_SoftwareServiceDescription">
  <rdfs:subClassOf
    rdf:resource="&external;SoftwareServiceContentDescriptionFormat"/>
  <rdfs:subClassOf rdf:resource="&external;ServiceDescriptionMetadata"/>
</rdfs:Class>
```

4.2 Supplementary-related External Metadata classes

4.2.1 Community-related External Metadata classes

4.2.1.1 CommunityProfileMetadata

Purpose

Category for all external metadata that can be used to create profiles of communities.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&external;CommunityProfileMetadata"
    rdfs:label="external:CommunityProfileMetadata">
  <rdfs:subClassOf rdf:resource="&abstract;ExternalCommunityMetadata"/>
</rdfs:Class>
```

4.2.1.2 FOAF_CommunityMetadata

Purpose

Container class for community metadata described in user relationships that is modelled with FOAF (Friend Of A Friend) [R-17] vocabulary.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&external;FOAF_CommunityMetadata"
    rdfs:label="external:FOAF_CommunityMetadata">
  <rdfs:subClassOf rdf:resource="&external;CommunityProfileMetadata"/>
</rdfs:Class>
```

4.2.2 Device-related External Metadata classes

4.2.2.1 DeviceProfileMetadata

Purpose

Category for all external metadata that can be used to create profiles of devices.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&external;DeviceProfileMetadata"
    rdfs:label="external:DeviceProfileMetadata">
  <rdfs:subClassOf rdf:resource="&abstract;ExternalDeviceMetadata"/>
</rdfs:Class>
```

4.2.2.2 CC-PP_DeviceProfileMetadata

Purpose

Container class for CC-PP (Composite Capabilities/Preference Profiles) [R-18] formatted metadata that is used to describe device profiles.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&external;CC-PP_DeviceProfileMetadata"
    rdfs:label="external:CC-PP_DeviceProfileMetadata">
  <rdfs:subClassOf rdf:resource="&external;DeviceProfileMetadata"/>
</rdfs:Class>
```

4.2.2.3 MPEG-21-DIA_DeviceProfileMetadata

Purpose

Container class for MPEG-21 DIA (Digital Item Adaptation) [R-21] formatted metadata that is used to describe device profiles (codec capabilities, input/output capabilities, device properties).

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&external;MPEG-21-DIA_DeviceProfileMetadata"
    rdfs:label="external:MPEG-21-DIA_DeviceProfileMetadata">
  <rdfs:subClassOf rdf:resource="&external;DeviceProfileMetadata"/>
</rdfs:Class>
```

4.2.2.4 UAProf-DeviceProfileMetadata

Purpose

Container class for UAProf (User Agent Profile) [R-19] formatted metadata that is used to describe device profiles.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&external;UAProf_DeviceProfileMetadata"
    rdfs:label="external:UAProf_DeviceProfileMetadata">
  <rdfs:subClassOf rdf:resource="&external;DeviceProfileMetadata"/>
</rdfs:Class>
```

4.2.3 Network-related External Metadata class

4.2.3.1 NetworkProfileMetadata

Purpose

Category for all external metadata that can be used to create profiles of networks.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&external;NetworkProfileMetadata"
    rdfs:label="external:NetworkProfileMetadata">
  <rdfs:subClassOf rdf:resource="&abstract;ExternalDeviceMetadata"/>
</rdfs:Class>
```

4.2.3.2 MPEG-21-DIA_NetworkMetadata

Purpose

Category for MPEG-21 DIA [R-21] metadata format for expressing network characteristics metadata.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&external;MPEG-21-DIA_NetworkMetadata"
    rdfs:label="external:MPEG-21-DIA_NetworkMetadata">
  <rdfs:subClassOf rdf:resource="&external;NetworkProfileMetadata"/>
</rdfs:Class>
```

4.2.4 Service-related External Metadata classes

4.2.4.1 ServiceDescriptionMetadata

Purpose

Generic category for all external metadata formats that can be used to create profiles about the system services. The WSDL_ServiceDescription previously defined in section 4.1.7.1 is one of its subclasses.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&external;ServiceDescriptionMetadata"
    rdfs:label="external:ServiceDescriptionMetadata">
  <rdfs:subClassOf rdf:resource="&abstract;ExternalServiceMetadata"/>
</rdfs:Class>
```

4.2.5 User-related External Metadata classes

4.2.5.1 UserProfileMetadata

Purpose

Generic category for all external metadata formats that can be used to create profiles about the system users.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&external;UserProfileMetadata"
    rdfs:label="external:UserProfileMetadata">
  <rdfs:subClassOf rdf:resource="&abstract;ExternalUserMetadata"/>
</rdfs:Class>
```

4.2.5.2 UserEnvironmentProfileMetadata

Purpose

Category for all external metadata formats that can be used to create environment profiles of system users.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&external;UserEnvironmentProfileMetadata"
    rdfs:label="external:UserEnvironmentProfileMetadata">
  <rdfs:subClassOf rdf:resource="&external;UserProfileMetadata"/>
</rdfs:Class>
```

4.2.5.3 UserPreferenceProfileMetadata

Purpose

Category for all external metadata formats that can be used to create preference profiles of system users.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&external;UserPreferenceProfileMetadata"
    rdfs:label="external:UserPreferenceProfileMetadata">
  <rdfs:subClassOf rdf:resource="&external;UserProfileMetadata"/>
</rdfs:Class>
```

4.2.5.4 UserPersonalProfileMetadata

Purpose

Category for all external metadata formats that can be used to create personal profiles of system users.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&external;UserPersonalProfileMetadata"
    rdfs:label="external:UserPersonalProfileMetadata">
  <rdfs:subClassOf rdf:resource="&external;UserProfileMetadata"/>
</rdfs:Class>
```

4.2.5.5 MPEG-7_UserPersonalMetadata

Purpose

Container class for MPEG-7 (Moving Pictures Experts Group standard) [R-3] formatted user personal information metadata (mpeg7:AgentType).

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&external;MPEG-7_UserPersonalMetadata"
    rdfs:label="external:MPEG-7_UserPersonalMetadata">
  <rdfs:subClassOf rdf:resource="&external;UserPersonalProfileMetadata"/>
</rdfs:Class>
```

4.2.5.6 MPEG-21-DIA_ContentPreferencesMetadata

Purpose

Category for MPEG-21 DIA [R-21] metadata format for expressing user preferences in terms of content.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&external;MPEG-21-DIA_ContentPreferencesMetadata"
    rdfs:label="external:MPEG-21-DIA_ContentPreferencesMetadata">
  <rdfs:subClassOf rdf:resource="&external;UserPreferenceProfileMetadata"/>
</rdfs:Class>
```

4.2.5.7 MPEG-21-DIA_PresentationPreferencesMetadata

Purpose

Category for MPEG-21 DIA [R-21] metadata format for expressing user preferences in terms of presentation.

Metadata format and RDF Schema definition

```
<rdfs:Class                                    rdf:about="&external;MPEG-21-
DIA_PresentationPreferencesMetadata"
    rdfs:label="external:MPEG-21-DIA_ContentPreferencesMetadata">
  <rdfs:subClassOf rdf:resource="&external;UserPreferenceProfileMetadata"/>
```

```
</rdfs:Class>
```

4.2.5.8 MPEG-21-DIA_NaturalEnvironmentMetadata

Purpose

Category for MPEG-21 DIA [R-21] metadata format for expressing the user natural environment.

Metadata format and RDF Schema definition

```
<rdfs:Class rdf:about="&external;MPEG-21-DIA_NaturalEnvironmentMetadata"
    rdfs:label="external:MPEG-21-DIA_NaturalEnvironmentMetadata">
  <rdfs:subClassOf
rdf:resource="&external;UserEnvironmentProfileMetadata"/>
</rdfs:Class>
```

4.3 Property specifications

The concrete part of the External Metamodel does not define any properties. The placeholder properties for external metadata is defined in the abstract part of the External Metamodel.

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6 Appendices

6.1 Community created metadata

Motivation

Dynamic, community created metadata is an important concept in the Core part of the CAM4Home metadata specification. The purpose of this metadata is to make content-related community contributions independent or semi-independent from the typical client-server structure that exist in contemporary multimedia web services. User comments, user ratings and social tags are some examples of community created metadata.

Goals

For this purpose, community created metadata has been designed with following goals:

- Community created metadata is delivered using the same technological means than the other content-related metadata (title and creator of the content for example).
    - This means that community created metadata is part of CAM bundle and object metadata. This allows metadata to be consumed in hybrid network configurations and becomes part of the content flow in the platform. For example, when CAM client makes a transition in network environment from internet-connected broadband to a personal area network, community created metadata is still available for consumption inside the bundles and objects.
- Since community is dispersed around various communication networks and accumulate metadata sporadically, there needs to be a mechanism to guarantee that the metadata is as up-to-date as possible in each client that is consuming bundles or objects.
    - This means that any updates to the metadata in any location of the CAM4Home platform need to be reflected in every instance of the same bundle/object assuming that the CAM clients are online and connected to the platform services. Otherwise, latest cached contents are used.

Stuctural description

To reach the goals, following structure is defined for the community created metadata:

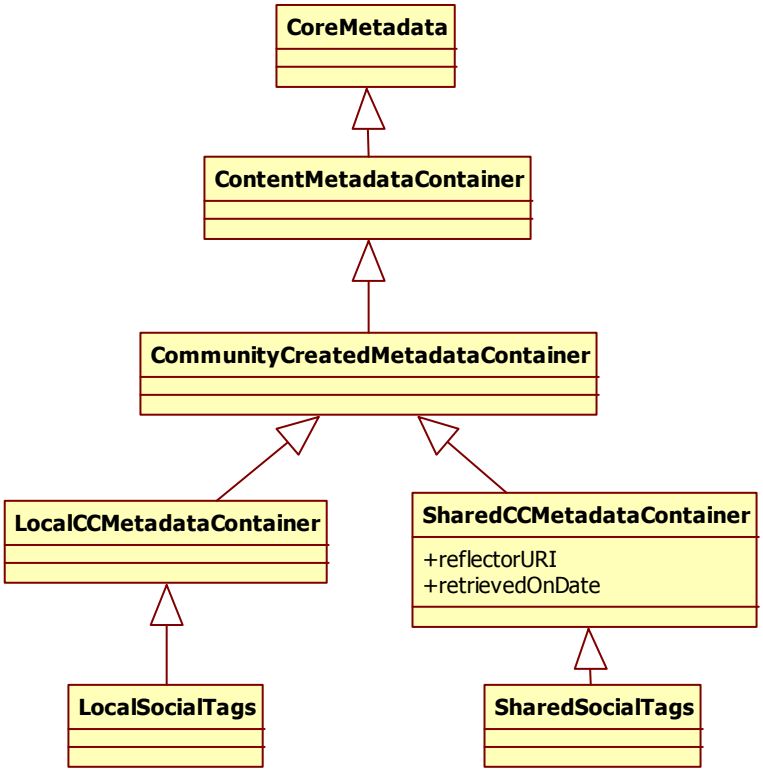

Figure: Illustration of the community created metadata

Figure above shows how community created metadata is part of the Core metadata container group. The actual metadata is separated into two parallel metadata structures, local and shared.

Shared container holds the metadata that has been accumulated by the community members. It has two mandatory properties that are used by every consuming client to obtain up-to-date content for the specific metadata using platform's reflector services that distribute the latest additions and modifications to the clients: ReflectorURI contains the server address where the latest version of metadata content can be downloaded and RetrievedOnDate contains the date for the latest download. Downloaded metadata is stored inside the SharedCCMetadataContainer so that it can be consumed when CAM clients are not connected to the platform.

Local container separates offline metadata modifications from the shared metadata cache. In a case where CAM client has become disconnected from the platform reflector services, all modifications to the community created metadata inside bundles/objects are local and not shared by other clients that consume the same objects or bundles separately in different locations. However, local modifications will be sent to other CAM clients that receive the bundles or objects via short-range personal area networks, such as bluetooth transfers. Whenever any of the clients with local metadata (i.e. offline generated metadata) establishes a connection to the CAM4Home platform's reflector services, local modifications will be flushed to the service and shared cache will be updated. After delivery, each connected CAM Client will retrieve the new modifications to their shared metadata container when they access the bundle/object in the client application.

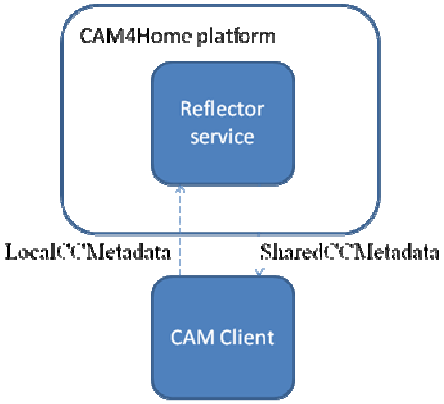

Figure: The principal idea for local and shared community created metadata.

Rules for CAM Client operations

Following operational rules are necessary for CAM clients that access and manipulate the community created metadata:

1. Accessing community created metadata when CAM client is online
    a. Each time this metadata is accessed in the bundle/object, connected client should first upload any local metadata to the reflector service, remove local and shared metadata and automatically redownload newest shared metadata from the service.
    b. If no local metadata is available, it should check the availability of newer versions from the reflector service by comparing the latest online version to the local cache's RetrievedOnDate. If newer versions exist, client should remove the old shared metadata and redownload the latest version.
2. Accessing community created metadata when client is offline
    a. CAM client combines the shared and local metadata in the bundle/object and the result is shown to the user as a single view to the metadata.
3. Modifying community created metadata
    a. If CAM client is offline, all modifications are stored in local metadata and are to be uploaded to the reflector service next time the client has a connection to the platform services.
    b. If CAM client is online, local modifications to the metadata trigger a sequence as described in (1.a).
4. Receiving bundle/object via personal area network
    a. If CAM client receives a new bundle/object via personal area network and has a connection to the platform services, it follows the sequence described in (1)
    b. If CAM client receives a new bundle/object via personal area network and doesn't have a connection to the platform services, it follows the sequence described in (2)
    c. Synchronizing: If CAM client receives a bundle/object via personal area network but has earlier received an instance with the same ID and version number, it synchronizes the local and shared metadata so that (I) no local changes are lost, (II) shared metadata is replaced with the content that has the latest RetrievedOnDate. Synchronization should be done in sender and receiver clients.

An illustrative example scenario

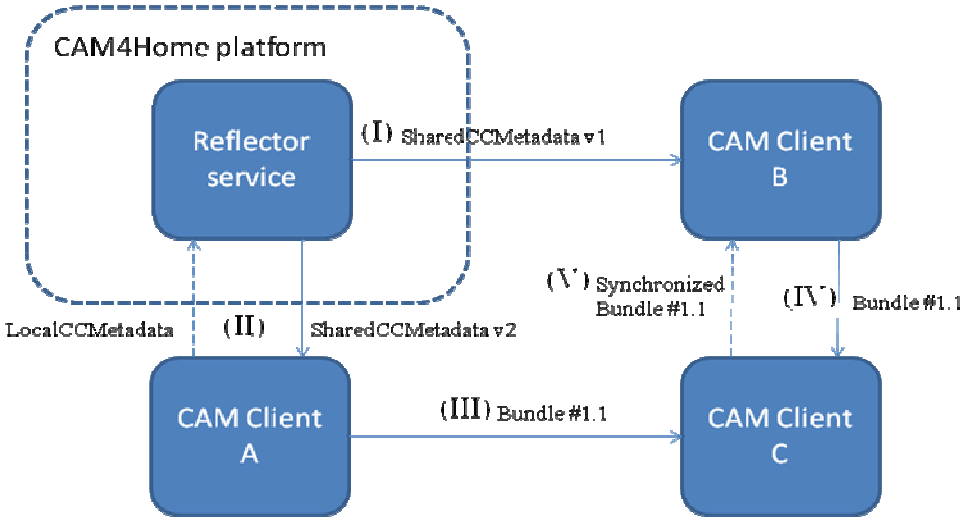

Figure: a scenario showing different ways to distribute shared metadata

The figure illustrates a scenario that depicts different ways to distribute shared metadata for platform-connected (CAM Clients A and B) and non-connected clients (CAM Client C).

I) Client B receives shared metadata from the reflector service for the Bundle with a UID of #1.1.

II) Client A uploads its local modifications to the shared metadata to the reflector service, which updates its main SharedCCMetadata repository and allows Client A to download the updated version of the shared metadata into its instance of Bundle #1.1.

III) Bundle #1.1 is transmitted to Client C from A using a personal area network connection.

IV) At this point, Clients B and C have the same Bundle #1.1 but different shared metadata caches. Client B disconnects from the platform services, makes local changes to the shared metadata and then sends its bundle to Client C using a personal area network connection. Client C finds out that its Bundle has newer shared metadata cache than the Client B but does not have the local changes that are available in Client B's bundle.

V) Client C first synchronizes Bundle's shared and local metadata contents and then sends the synchronized Bundle to Client B. After this operation, both Clients have the latest available shared and local metadata in their Bundle instances. Client A does not have the local changes made by Client B in its Bundle until it receives that either via Reflector service (requires that either B or C becomes connected to the platform) or synchronizes the Bundle using direct personal area network connection with B or C.

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