

<p>Project acronym: LADIO</p> <p>Project number: 731970</p> <p>Work package:</p> <p>Deliverable number and name:</p> <p>D2.4: Release implementations as open source</p>	<p>Title: Release implementations as open source</p> <p>Work Package: WP2</p> <p>Version: 1</p> <p>Date: August 31, 2017</p> <p>Author:</p> <p>Carsten Griwodz</p>
<p>Type:</p> <p><input type="checkbox"/> Report</p> <p><input type="checkbox"/> Demonstrator, pilot, prototype</p> <p><input type="checkbox"/> Website, patent filings, videos, etc.</p> <p><input checked="" type="checkbox"/> Other</p>	<p>Co-Author(s):</p> <p>Thomas Eskenazi</p> <p>To:</p> <p>Albert Gauthier, Project Officer</p>
<p>Status:</p> <p><input type="checkbox"/> Draft</p> <p><input type="checkbox"/> To be reviewed</p> <p><input type="checkbox"/> Proposal</p> <p><input checked="" type="checkbox"/> Final / Released to EC</p>	<p>Confidentiality:</p> <p><input checked="" type="checkbox"/> PU – Public</p> <p><input type="checkbox"/> CO – Confidential</p> <p><input type="checkbox"/> CL – Classified</p>
<p>Revision:</p> <p>Final</p>	
<p>Contents:</p> <p>Deliverable 2.4. Release implementations as open source</p>	

Table of contents

Table of contents	2
Introduction	3
Development of the LADIO model	4
Schema for the LADIO model	5
Schema information for spatial dependencies	12

Introduction

Deliverable 2.4 is a software deliverable that provides the metadata formats that are maintained by LADIO in an extension of EBU work, for collection by CamBox/MiniBox devices, collection by the SetBox, and access through a REST API.

Concerning the metadata that is collected, it is able to maintain and store, among other things, time, camera movement track, recording device information, lens metadata, shot identification, quality, and accuracy. The idea of versioning, which is mentioned in the Technical Annex, has been revised in discussions to allow only write-once semantics on metadata between transfers between machines (meaning that versioning mechanisms can be used for a specific purpose, but interchanged data is implemented as a new instance that is related by a ReconstructionJob (see D2.1) with a previous version.

The internal metadata encoding that is transferred between instances of LADIO MiniBox and CamBox (collectively called Box) and the SetBox is a JSON-encoded representation for the metadata described by the LADIO-extended EBUCore format. This choice of internal representation is due to the current state-of-the-market in document stores, and documented in more detail in Deliverable 1.2. By understanding the EBUCore, we have learned that metadata concerning orientation and movement of recording devices should conceptually be integrated with the general metadata format. Consequently, this information is also encoded in JSON.

The LADIO Model schema is in the repository <https://github.com/griwodz/ladioproject.git> in the branch quinedataset and included below in this document.

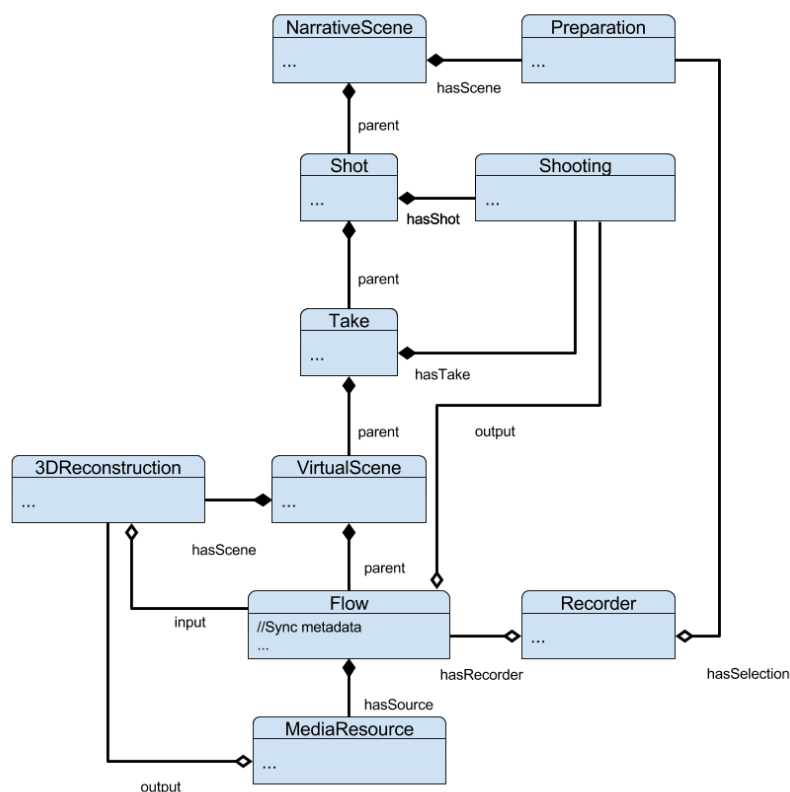


Figure 1 : LADIO Data Model

Development of the LADIO model

The current version of the schema implements the LADIO model from Deliverable 2.1 as well as the classes relation to the timelines that must be recorded on set in order to synchronize them in subsequent production steps.

This schema builds strictly on the latest versions of EBUCore and the EBU CCDM and does not add any further basic classes. All objects and properties of the LADIO data model inherit from the EBU schemas wherever feasible. The schema has been validated by the W3C RDF Validation Service¹.

LADIO has presented the model at the EBU meeting (MDN WORKSHOP 2017) in Zürich in June 2017 and we were invited to develop it further in collaboration with the EBU task forces.

¹ <https://www.w3.org/RDF/Validator/>

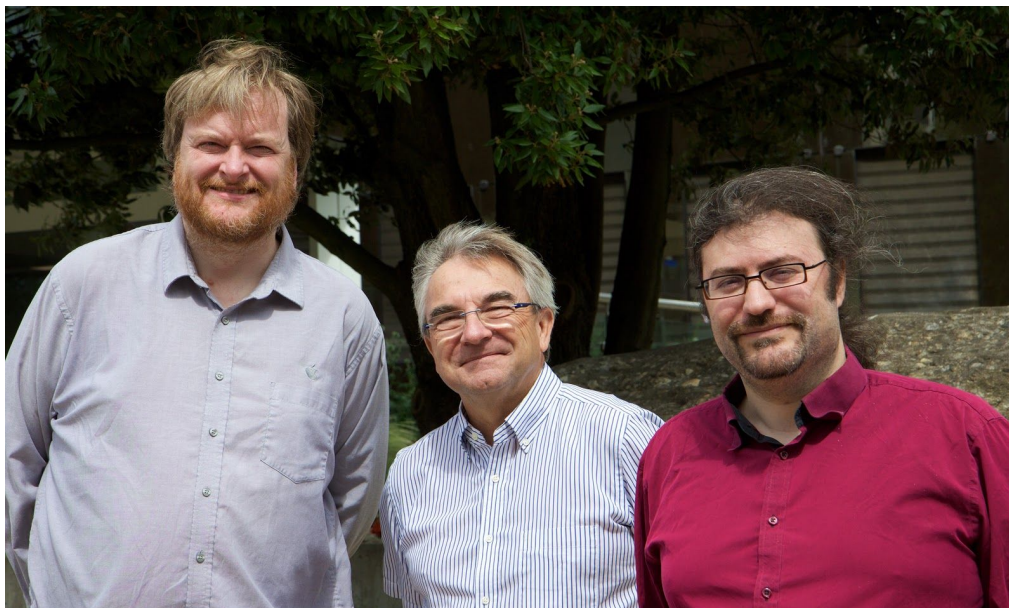


Figure 2: Tormod Værvågen (NRK), Jean-Pierre Evain (EBU) and Thomas Eskénazi (MIK) at the EBU meeting in June 2017

Schema for the LADIO model

```
<?xml version="1.0"?>
<rdf:RDF
  xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#"
  xmlns:skos="http://www.w3.org/2004/02/skos/core#"
  xmlns:cc="http://creativecommons.org/ns#"
  xmlns:vs="http://www.w3.org/2003/06/sw-vocab-status/ns#"
  xmlns:owl="http://www.w3.org/2002/07/owl#"
  xmlns:dc="http://purl.org/dc/elements/1.1/"
  xmlns:dct="http://purl.org/dc/terms/"
  xmlns:ebucore="http://www.ebu.ch/metadata/ontologies/ebucore/ebucore#"
  xmlns:ebucdm="http://www.ebu.ch/metadata/ontologies/ebucdm#"
  xmlns:xsd="http://www.w3.org/2001/XMLSchema#"
  xmlns:vann="http://purl.org/vocab/vann/"
  xmlns:rdfs="http://www.w3.org/2000/01/rdf-schema#"
  xmlns:tim="http://baseTime.fims.tv#"
  xmlns:ladio="http://ladioprojects.eu/ontologies/ladio#"
  xml:base="http://ladioprojects.eu/ontologies/ladio">
  <owl:Ontology rdf:about="">
    <dc:publisher xml:lang="ch">LADIO Project</dc:publisher>
    <dc:description xml:lang="en">The LADIO data model has been developed to extend the EBUCore CCDM for a better maintenance and transfer of information between information recorded on a film set to post-production services. It is based on the EBUCore.</dc:description>
    <owl:versionInfo xml:lang="en">Initial version.</owl:versionInfo>
```

```

<dc:title xml:lang="en">LADIO Data Model</dc:title>
<dc:modified rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>2017-08-29</dc:modified>
<owl:versionInfo xml:lang="en">This is the initial version.</owl:versionInfo>
<owl:imports rdf:resource="http://www.w3.org/2004/02/skos/core"/>
<dc:rights xml:lang="en">Copyright 2017 Simula and MikrosImage</dc:rights>
<dc:creator xml:lang="no">Carsten Griwodz, Simula</dc:creator>
<dc:contributor xml:lang="fr">Thomas Eskenazi, MikrosImage</dc:contributor>
<cc:licence rdf:datatype="http://www.w3.org/2001/XMLSchema#string"
>http://creativecommons.org/licenses/by-sa/3.0/</cc:licence>
<vs:term_status xml:lang="en">draft</vs:term_status>
</owl:Ontology>

<rdfs:Class rdf:ID="NarrativeScene">
  <rdfs:subClassOf>
    <rdfs:Class rdf:about="http://www.ebu.ch/metadata/ontologies/ebucore/ebucore#EditorialObject"/>
  </rdfs:subClassOf>
  <rdfs:label xml:lang="en">NarrativeScene</rdfs:label>
  <rdfs:comment xml:lang="en">The place where a film shot takes place.</rdfs:comment>
</rdfs:Class>

<rdfs:Class rdf:ID="Shot">
  <rdfs:subClassOf>
    <rdfs:Class rdf:about="http://www.ebu.ch/metadata/ontologies/ebucore/ebucore#EditorialObject"/>
  </rdfs:subClassOf>
  <rdfs:label xml:lang="en">Shot</rdfs:label>
  <rdfs:comment xml:lang="en">
    A temporal segment of a narrative that is filmed at once (Live Action).
  </rdfs:comment>
</rdfs:Class>

<rdfs:Class rdf:ID="Take">
  <rdfs:subClassOf>
    <rdfs:Class rdf:about="http://www.ebu.ch/metadata/ontologies/ebucore/ebucore#EditorialObject"/>
  </rdfs:subClassOf>
  <rdfs:label xml:lang="en">Take</rdfs:label>
  <rdfs:comment xml:lang="en">
    A Take is an instance of a Shot, where each Take is one recording of the Shot's narrative
    segment.
  </rdfs:comment>
</rdfs:Class>

<rdfs:Class rdf:ID="VirtualScene">
  <rdfs:subClassOf>
    <rdfs:Class rdf:about="http://www.ebu.ch/metadata/ontologies/ebucore/ebucore#EditorialObject"/>
  </rdfs:subClassOf>
  <rdfs:label xml:lang="en">VirtualScene</rdfs:label>

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<rdfs:comment xml:lang="en">
  The set of all audiovisual elements that are combined to create a Take that represents a narrative
  segment.
</rdfs:comment>
</rdfs:Class>

<rdfs:Class rdf:ID="Flow">
  <rdfs:subClassOf>
    <rdfs:Class rdf:about="http://www.ebu.ch/metadata/ontologies/ebucore/ebucore#MediaResource"/>
  </rdfs:subClassOf>
  <rdfs:label xml:lang="en">Flow</rdfs:label>
  <rdfs:comment xml:lang="en">
    The Flow is a special MediaResource without own media content that deals with clock translation
    between wallclock time and drifting recorder clocks as well as temporal sub-sequences.
  </rdfs:comment>
</rdfs:Class>

<rdfs:Class rdf:ID="Recorder">
  <rdfs:subClassOf>
    <rdfs:Class rdf:about="http://www.ebu.ch/metadata/ontologies/ebuccdm#ProductionDevice"/>
  </rdfs:subClassOf>
  <rdfs:label xml:lang="en">Recorder</rdfs:label>
  <rdfs:comment xml:lang="en">
    A Recorder maintains all the static properties of a recording device that was used to create a Flow.
  </rdfs:comment>
</rdfs:Class>

<rdfs:Class rdf:ID="ReconstructionJob">
  <rdfs:subClassOf>
    <rdfs:Class rdf:about="http://www.ebu.ch/metadata/ontologies/ebuccdm#ProductionJob"/>
  </rdfs:subClassOf>
  <rdfs:label xml:lang="en">ReconstructionJob</rdfs:label>
  <rdfs:comment xml:lang="en">
    A ReconstructionJob is a generic class that describes how a new VirtualScene including its Flows is
    generated from one or more MediaResources.
  </rdfs:comment>
</rdfs:Class>

<rdfs:Class rdf:ID="Shooting">
  <rdfs:subClassOf>
    <rdfs:Class rdf:about="http://www.ebu.ch/metadata/ontologies/ebuccdm#ProductionJob"/>
  </rdfs:subClassOf>
  <rdfs:label xml:lang="en">Shooting</rdfs:label>
  <rdfs:comment xml:lang="en">
    Shooting is a ProductionJob that specifies how the Flows of a Take are produced.
  </rdfs:comment>
</rdfs:Class>

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<rdfs:Class rdf:ID="Preparation">
  <rdfs:subClassOf>
    <rdfs:Class rdf:about="http://www.ebu.ch/metadata/ontologies/ebuccdm#ProductionJob"/>
  </rdfs:subClassOf>
  <rdfs:label xml:lang="en">Preparation</rdfs:label>
  <rdfs:comment xml:lang="en">
    Preparation is a ProductionJob that ties the requirements for recording elements to a
    NarrativeScene, including the required recording and transcoding devices.
  </rdfs:comment>
</rdfs:Class>

<rdfs:Property rdf:ID="hasParent">
  <rdfs:subPropertyOf
rdf:resource="http://www.ebu.ch/metadata/ontologies/ebucore/ebucore#isMemberOf"/>
    <rdfs:domain rdf:resource="#Shot"/>
    <rdfs:domain rdf:resource="#Take"/>
    <rdfs:domain rdf:resource="#VirtualScene"/>
    <rdfs:range rdf:resource="#Group"/>
    <rdfs:label xml:lang="en">parent</rdfs:label>
    <rdfs:comment xml:lang="en">
      VirtualScene, Take, Shot and NarrativeScene have a hierarchical
      relation that is implemented through inheritance of EditorialObject,
      which inherits Group. The hierarchy is not enforced by the schema.
    </rdfs:comment>
  </rdfs:subPropertyOf>
</rdfs:Property>

<rdfs:Property rdf:ID="isInput">
  <rdfs:subPropertyOf
rdf:resource="http://www.ebu.ch/metadata/ontologies/ebucore/ebucore#instantiates"/>
    <rdfs:domain rdf:resource="#Flow"/>
    <rdfs:range rdf:resource="#BusinessObject"/>

    <rdfs:label xml:lang="en">parent</rdfs:label>
    <rdfs:comment xml:lang="en">
      Express the membership of Flows in a VirtualScene.
    </rdfs:comment>
  </rdfs:subPropertyOf>
</rdfs:Property>

<rdfs:Property rdf:ID="hasScene">
  <rdfs:subPropertyOf rdf:resource="http://www.ebu.ch/metadata/ontologies/ebuccdm#basedOn"/>
  <rdfs:domain rdf:resource="#ReconstructionJob"/>
  <rdfs:range rdf:resource="#VirtualScene"/>
  <rdfs:label xml:lang="en">hasScene</rdfs:label>
  <rdfs:comment xml:lang="en">
    Several ReconstructionJobs can generate the media content that makes up the MediaResources in
    a scene. This ranges from static 3D reconstruction to color correction.
  </rdfs:comment>
</rdfs:Property>

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</rdfs:comment>
</rdfs:Property>

<rdfs:Property rdf:ID="input">
  <rdfs:subPropertyOf
rdf:resource="http://www.ebu.ch/metadata/ontologies/ebucdm#hasInputMediaResource"/>
  <rdfs:domain rdf:resource="#ReconstructionJob"/>
  <rdfs:range rdf:resource="#Flow"/>
  <rdfs:label xml:lang="en">input</rdfs:label>
  <rdfs:comment xml:lang="en">
    A ReconstructionJob refers to all Flows that it requires as input for
    generating the media content in a VirtualScene.
  </rdfs:comment>
</rdfs:Property>

<rdfs:Property rdf:ID="output">
  <rdfs:domain rdf:resource="#ReconstructionJob"/>
  <rdfs:range rdf:resource="#MediaResource"/>
  <rdfs:label xml:lang="en">output</rdfs:label>
  <rdfs:comment xml:lang="en">
    A ReconstructionJob refers to all Flows that it requires as input for
    generating the media content in a VirtualScene.
  </rdfs:comment>
</rdfs:Property>

<rdfs:Property rdf:ID="hasRecorder">
  <rdfs:subPropertyOf
rdf:resource="http://www.ebu.ch/metadata/ontologies/ebucdm#hasProductionDevice"/>
  <rdfs:domain rdf:resource="#Flow"/>
  <rdfs:range rdf:resource="#Recorder"/>
  <rdfs:label xml:lang="en">has Recorder</rdfs:label>
  <rdfs:comment xml:lang="en">
    A Flow refers to a set of Recorders that have been used in its generation.
    This may be cameras, but also editing software.
  </rdfs:comment>
</rdfs:Property>

<rdfs:Property rdf:ID="hasSelection">
  <rdfs:domain rdf:resource="#Preparation"/>
  <rdfs:range rdf:resource="#Recorder"/>
  <rdfs:label xml:lang="en">has Selection</rdfs:label>
  <rdfs:comment xml:lang="en">
    Devices that are used in a production process must be selected during Preparation. This allows to
    maintain the list of selected Recorders before they have actually been used to create Flows.
  </rdfs:comment>
</rdfs:Property>

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<rdfs:Property rdf:ID="hasShot">
  <rdfs:subPropertyOf
rdf:resource="http://www.ebu.ch/metadata/ontologies/ebuccdm#hasAssociatedProductionJob"/>
  <rdfs:domain rdf:resource="#Shooting"/>
  <rdfs:range rdf:resource="#Shot"/>
  <rdfs:label xml:lang="en">has Shot</rdfs:label>
  <rdfs:comment xml:lang="en">
    Maintain a list of Shots that make up the timeline of a Narrative Scene.
  </rdfs:comment>
</rdfs:Property>

<rdfs:Property rdf:ID="hasTake">
  <rdfs:subPropertyOf
rdf:resource="http://www.ebu.ch/metadata/ontologies/ebuccdm#hasAssociatedProductionJob"/>
  <rdfs:domain rdf:resource="#Shooting"/>
  <rdfs:range rdf:resource="#Take"/>
  <rdfs:label xml:lang="en">has Take</rdfs:label>
  <rdfs:comment xml:lang="en">
    Maintain a list of Takes that were created for a Shooting.
  </rdfs:comment>
</rdfs:Property>

<rdfs:Class rdf:ID="WallclockTime">
  <rdfs:subClassOf rdf:resource="http://www.w3.org/2002/07/owl#Thing"/>
  <rdfs:label xml:lang="en">Wallclock Time</rdfs:label>
  <rdfs:comment xml:lang="en">
    A time source that is considered global for a particular NarrativeScene of a set. When a
    FreeRunningTimeRecorder exists to create a stream of timecodes, it must use the WallclockTime that
    is associated with the correct NarrativeScene.
  </rdfs:comment>
</rdfs:Class>

<rdf:Property rdf:ID="isWallclockTimeOf">
  <rdfs:label xml:lang="en">isWallclockTimeOf</rdfs:label>
  <rdfs:comment xml:lang="en">
    A WallclockTime can be the time source for several NarrativeScenes.
  </rdfs:comment>
  <rdfs:domain rdf:resource="#WallclockTime"/>
  <rdfs:range rdf:resource="#NarrativeScene"/>
</rdf:Property>

<rdf:Property rdf:ID="hasWallclockTime">
  <rdfs:label xml:lang="en">hasWallclockTime</rdfs:label>
  <rdfs:comment xml:lang="en">
    A NarrativeScene should have an associated WallclockTime unless stream synchronization is not
    relevant.
  </rdfs:comment>

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```

    <rdfs:domain rdf:resource="#NarrativeScene"/>
    <rdfs:range rdf:resource="#WallclockTime"/>
  </rdf:Property>

  <rdf:Property rdf:ID="generatesTimecodesFrom">
    <rdfs:label xml:lang="en">generatesTimecodesFrom</rdfs:label>
    <rdfs:comment xml:lang="en">
      A FreeRunningTimeRecorder creates a stream of timecodes from this source.
    </rdfs:comment>
    <rdfs:domain rdf:resource="#FreeRunningTimeRecorder"/>
    <rdfs:range rdf:resource="#WallclockTime"/>
  </rdf:Property>

  <rdf:Property rdf:ID="RecorderTime">
    <rdfs:label xml:lang="en">Recorder time (timecode)</rdfs:label>
    <rdfs:comment xml:lang="en">The start time of the MediaResource on the Recorder timeline. The
value is given as a SMPTE timecode.</rdfs:comment>
    <rdfs:domain rdf:resource="#MediaResource"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
  </rdf:Property>

  <rdf:Property rdf:ID="WallclockDrift">
    <rdfs:label xml:lang="en">Wallclock Drift</rdfs:label>
    <rdfs:domain rdf:resource="#Flow"/>
    <rdfs:range rdf:resource="http://www.w3.org/2000/01/rdf-schema#Literal"/>
    <rdfs:comment xml:lang="en">
      Clock drift refers to a clock that does not tick at exactly the same rate as a given reference clock.
      Recorders that implement a drift estimation can store their estimate in the Flow. Encoded as NTPTime
      (RFC5905).
    </rdfs:comment>
  </rdf:Property>

  <rdf:Property rdf:ID="WallclockSkew">
    <rdfs:label xml:lang="en">Wallclock Skew</rdfs:label>
    <rdfs:domain rdf:resource="#Flow"/>
    <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#double"/>
    <rdfs:comment xml:lang="en">
      Clock skew refers to a system in which the same clock signal reaches different components of a
      system at different times. This attribute must be derived by external means (GPS clock,
      post-processing) and added to the Flow. It is a multiplier defined as a double.
    </rdfs:comment>
  </rdf:Property>

  <rdfs:Class rdf:ID="FreeRunningTimeRecorder">
    <rdfs:subClassOf>
      <rdfs:Class rdf:about="#Recorder"/>
    </rdfs:subClassOf>

```

```

<rdfs:label xml:lang="en">Free Running Time Recorder</rdfs:label>
<rdfs:comment xml:lang="en">
  This is a specific type of recorder that does not generate any Flow, but only maintains a medium
  with a stream of timecodes.
</rdfs:comment>
</rdfs:Class>

<rdfs:Class rdf:ID="NarrativeTime">
  <rdfs:label xml:lang="en">Narrative Time</rdfs:label>
  <rdfs:domain rdf:resource="#Shot"/>
  <rdfs:range rdf:resource="http://www.w3.org/2001/XMLSchema#string"/>
  <rdfs:comment xml:lang="en">
    A Shot has a well-known temporal location on the timeline of a NarrativeScene. The Narrative Time
    encodes this as a timecode.
  </rdfs:comment>
</rdfs:Class>

</rdf:RDF>

```

Schema information for spatial dependencies

We need to create a valid schema for spatial dependencies in addition to the temporal dependencies that are already handled above. Our approach to encoding spatial dependencies and their change over time is strongly inspired by the proposals for the MediaInfo² proposals to the EBU, which we discussed in Deliverable 2.1. Two of the encoding styles for intrinsic camera parameter changes according to the MediaInfo model were adopted by the EBU.

Consequently, the only sensible encoding of our spatial dependency information should follow the same pattern and inherit from the properties that MediaInfo used in their model. Unfortunately, we have so far received only examples but no schema from MediaInfo to build on. This will be part of our forthcoming joint effort with EBU and MediaInfo in the following months.

² <https://mediaarea.net/fr/MediaInfo>