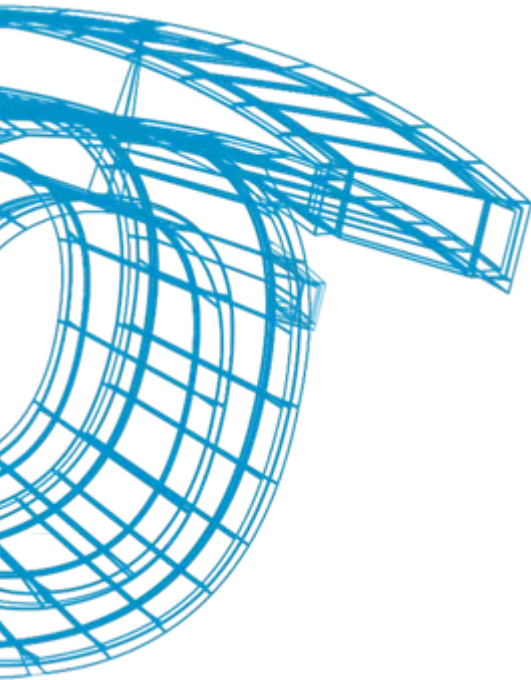




DMS-1 Driven Data Model to Enable a Semantic
Middleware for Multimedia Information Retrieval in a
Broadcaster



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visual interaction
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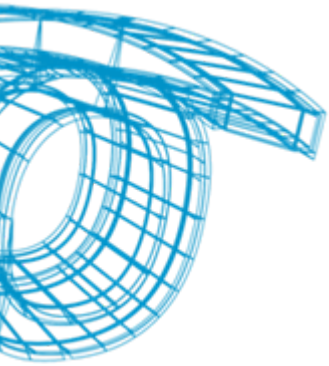
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DMS-1 Driven Data Model to Enable a Semantic Middleware for Multimedia Information Retrieval in a Broadcaster

INDEX

1. Motivation.
 - a) Content digitalization
 - b) Multimedia information retrieval
 - c) Rushes
2. Context.
 - a) Rushes system
 - b) Metadata model
3. Related Work.
 - a) Multimedia metadata management Standardization
4. Implementation.
 - a) Model Implementation.
 - b) Descriptive Metadata Scheme 1
 - c) DMS-1 Ontology
 - d) Other Ontologies
 - e) Benefits of the Model
5. Conclusions & Future Work.



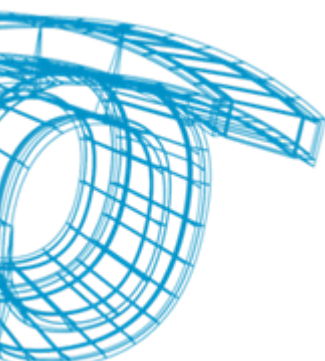
Content digitalization

Before

- Tapes
 - ❑ Whole information was stored in magnetic tapes.
- Archives
 - ❑ Deep storage.
 - ❑ The participation of an archivist was absolutely necessary to retrieve the stored data.

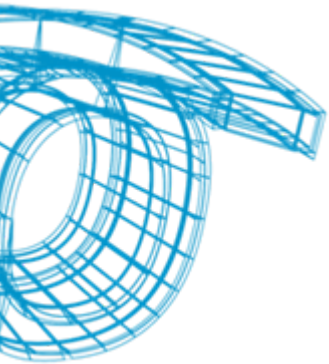
Now

- Digitalization
 - ❑ The information is stored in databases.
 - ❑ Allows immediate access to the content for all users
- Metadata
 - ❑ Standards development to store metadata of the multimedia assets.
- Semantic Web
 - ❑ New multimedia processing techniques and technologies that can improve search systems.



Multimedia Information Retrieval

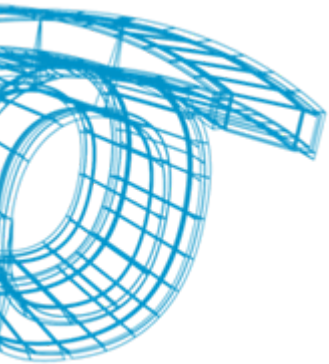
- Active research field which is focused on the improvement of some process related with the retrieval of the assets.
 - Query processing.
 - Natural language processing.
 - Query adaptation and federation.
 - Content analysis.
 - Information integration.
 - Results Ranking.
 - Information Visualization.
- Most of the processes listed above, rely on a semantic model of the domain. Ontologies and SW techniques have been employed to provide solutions to all of them.



Rushes

○ Rushes Project:

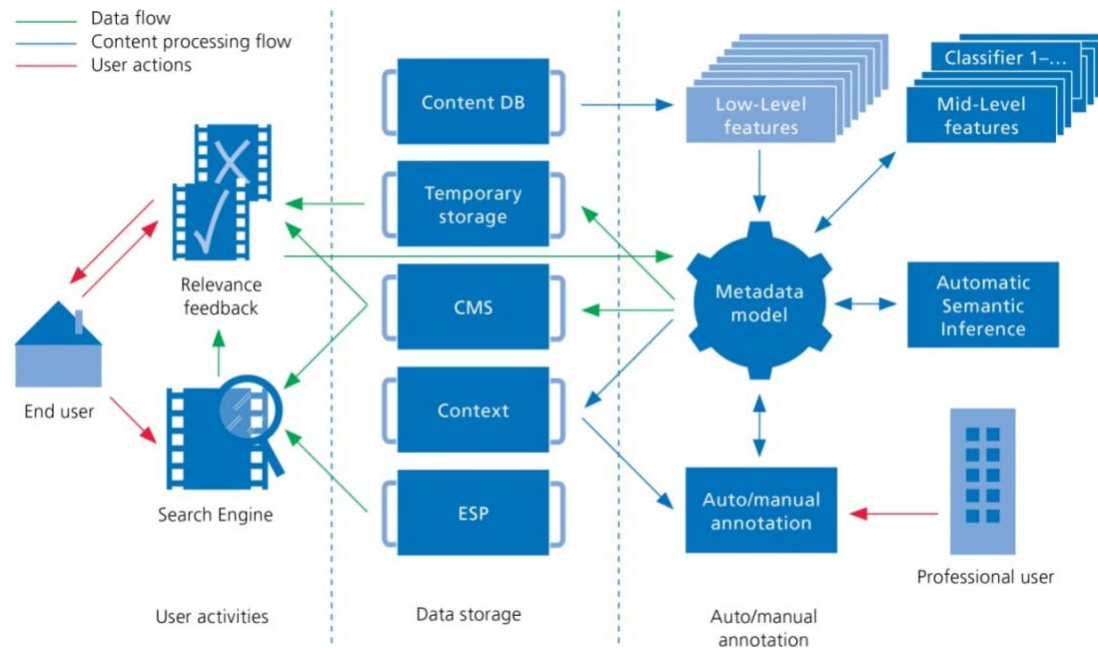
- **RUSHES** is a STREP funded by the European Commission of the 6th framework programme.
- The overall aim:
 - Design and implement a system for indexing, accessing and delivering raw, unedited audio-visual footage known in broadcasting industry as "rushes".
- The goal:
 - Promote the reuse of such material, and especially its content in the production of new multimedia assets by offering semantic media search capabilities.



Rushes System

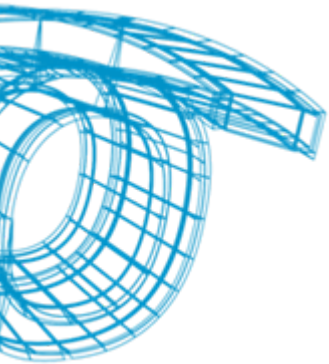
○ Components:

- ❑ Automatic features capture modules.
- ❑ Manual annotation tool.
- ❑ Metadata model component.
- ❑ User tools.
- ❑ Commercial search engine.



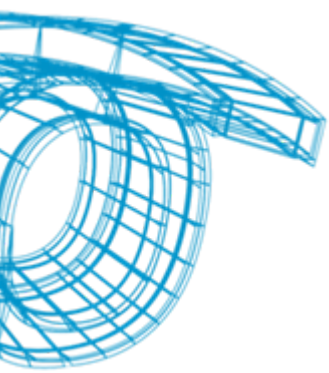
Metadata Model Component

- It is a passive element of the system.
- What metadata model component should do:
 - ❑ Help to automatic features detection modules providing required information.
 - ❑ Time decomposition of features of the multimedia content.
 - ❑ Semantic support for a recommendation wizard of the manual annotation tool.
 - ❑ Parse the knowledge to a file indexable by the search engine.
- And what it must model:
 - ❑ The domain: News elaboration process.
 - ❑ Technical characteristics of the multimedia contents.
 - ❑ Descriptive characteristics of the multimedia contents.



Multimedia Metadata Management Standardization

- Both industrial and academic efforts in order to standardize the definition and management of metadata in broadcast environment.
 - ❑ DescriptiveMetadataScheme-1 (MXF).
 - ❑ EBU P/Meta standard for annotation.
 - ❑ MPEG-7.
 - ❑ Dublin Core.
 - ❑ TVAnytime.
 - ❑ BMF (Broadcast Metadata exchange Format)



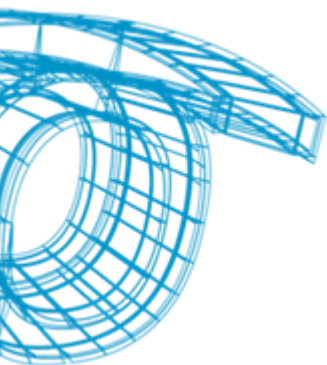
Multimedia Metadata Management Standardization

○ MPEG-7

- ❑ Represents the clearest linkage between standardization efforts and the approaches that apply semantic techniques for multimedia information retrieval.
- ❑ The extreme complexity of the standard doesn't help to the promotion of the solutions and products based on it.
- ❑ The emerging techniques to improve semantic driven multimedia analysis are based on simplified and customized MPEG-7 ontologies.

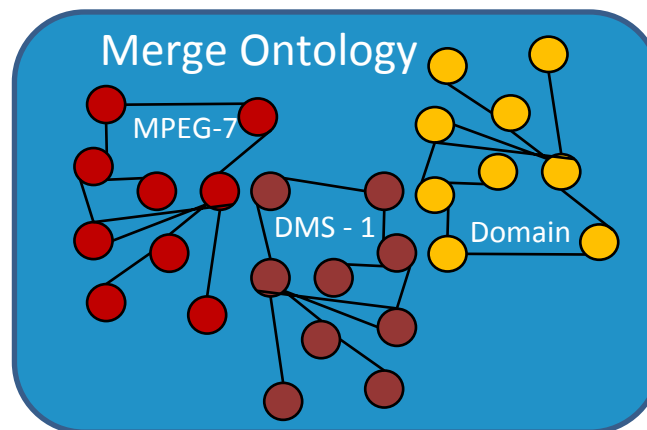
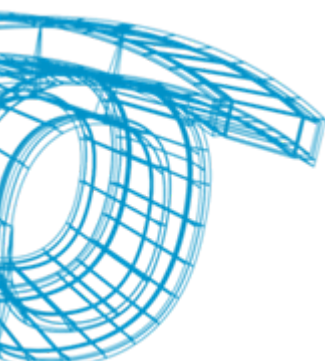
○ MXF/DMS-1

- ❑ MXF is a container format for professional digital video and audio media defined by a set of SMPTE standards.
- ❑ DMS-1 is the metadata schema used in MXF.
- ❑ Some cameras and ingesting devices are already implementing feature to handle metadata based in this schema.
 - Panasonic P2
 - Sony XDCAM



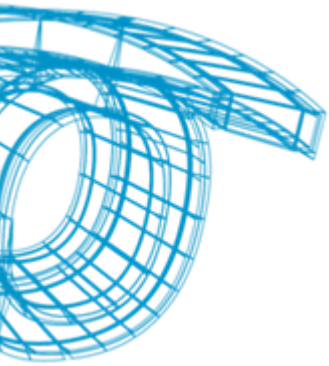
Model Implementation

- After the analysis of the state of the art and project requirements, our implementation was based on three different ontologies :
 - **Generic descriptive metadata ontology:** DMS-1 is used to implement metadata resources in order to allow the maximum compatibility with the broadcaster's workflow, which uses MXF.
 - **Low Level Ontology:** We based on MPEG-7 to extend the scope of technical issues that would be used in analysis processes.
 - **Domain Ontology:** A model that describes in detail the domain in which the system will work, based on LSCOM Lite.



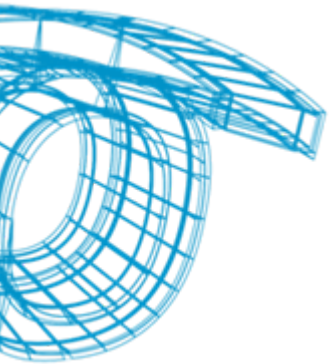
Descriptive Metadata Scheme 1

- DMS-1 defines a logical structure of metadata sets divided in frameworks that allows them to plug in the header metadata of a MXF file.
- The existing frameworks to represent the semantic levels:
 - Production Framework:
 - Compiles the set of metadata related to the identification and ownership details of the audio-visual content. MXF considers that during the Production, the metadata is always related to the complete MXF file.
 - Clip Framework:
 - Handles the sets of descriptive metadata and the properties related to the caption and creation of information of the independent audiovisual clips. A clip is an essence container that may comprise of a number of interleaved audio, video, or data essence elements.
 - Scene Framework:
 - Contains descriptive metadata sets and properties that describe actions and events within individual scenes of the audio-visual content. Scenes may overlap and they may relate to a point in time rather than having duration.

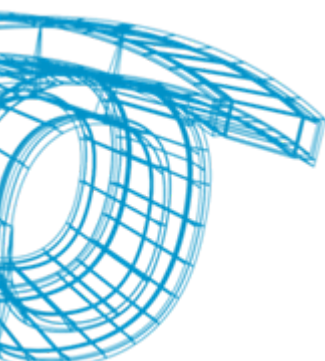
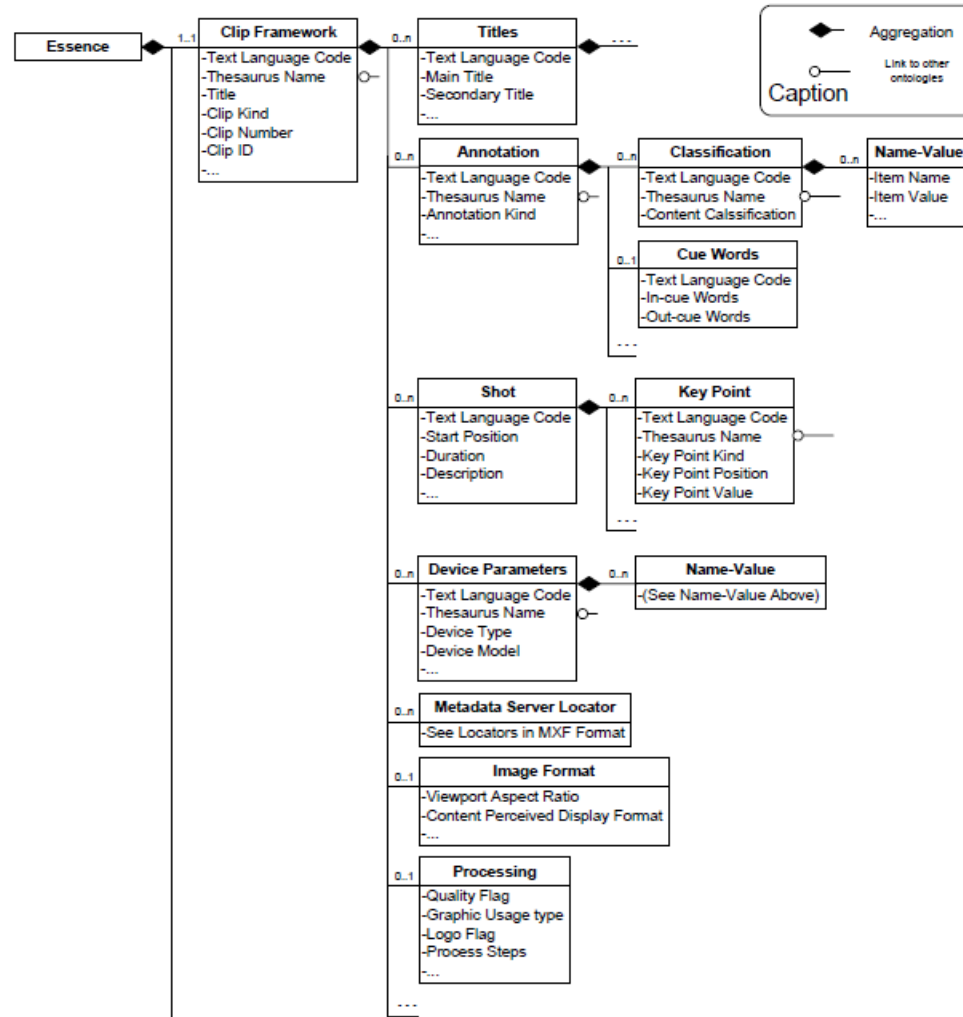


DMS-1 Ontology

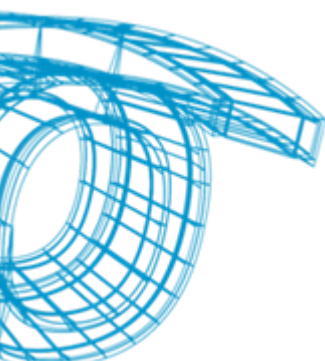
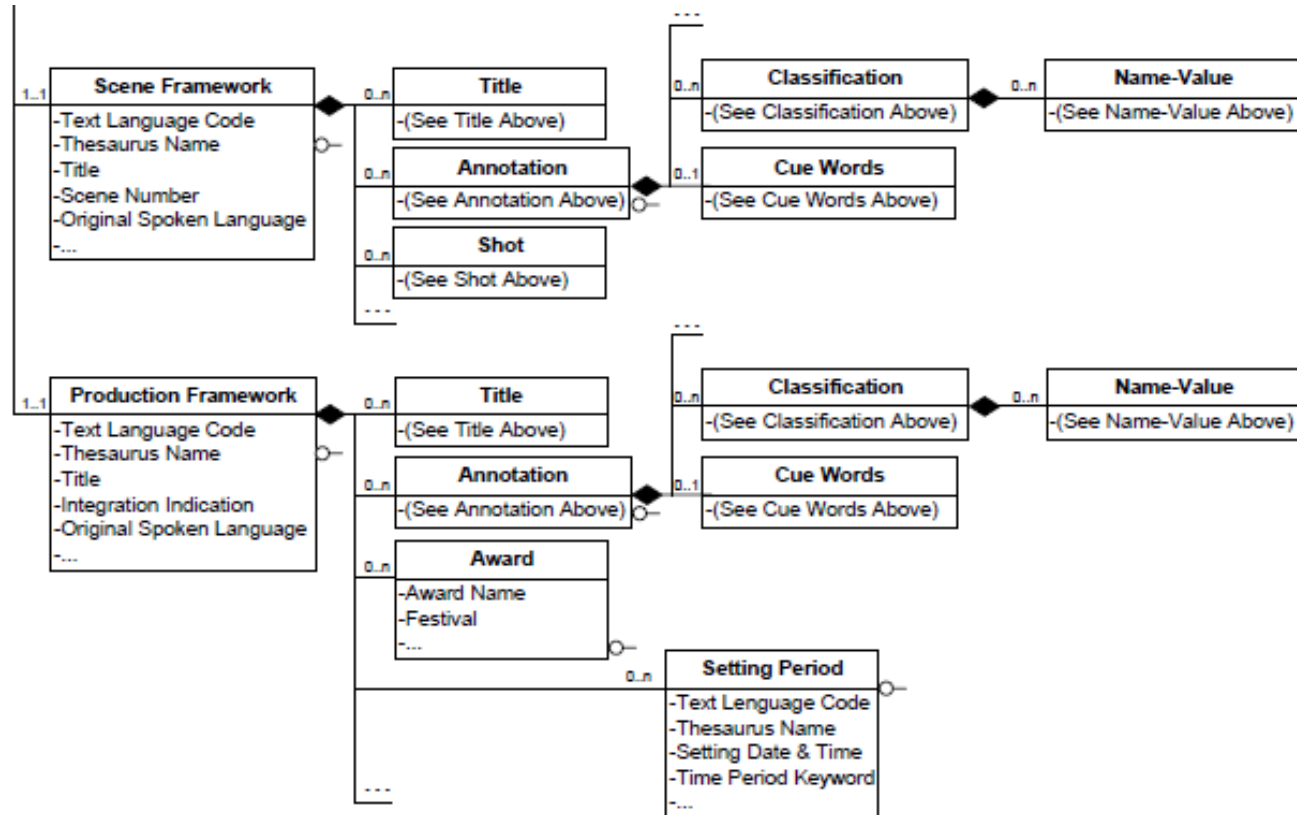
- According to the standard, the ontology groups annotations in three logical entities: Production, Clip, Scene.
 - The sets of metadata and properties can be applied to various frameworks and their nature is diverse.
 - Titles
 - Awards
 - Events
 - Device Parameters
 - File
 - Format
 - Right Management
 - Regarding the temporal decomposition, the ontology models concept Shot. A Shot allows to define concrete annotations.
 - Duration
 - Start/End Position
 - Description
 - Key Points
 - Extra Annotations
 - To add a concrete metadata the model defines a property named Annotation. This property is directly linked to different thesauri.



DMS-1 Ontology



DMS-1 Ontology



Other Ontologies

○ Domain Ontology:

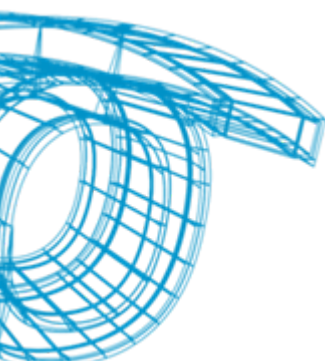
- ❑ It was defined by a broadcaster according to a concrete scenario.
 - Daily activity in the preparation of the news.
- ❑ LSCOM Lite is the base of the domain ontology which extends it with information obtained...
 - Via analysis modules.
 - Via thesauri provided to the journalist in the annotation tool.

○ Low Level Ontology:

- ❑ Allows the conduction of the information during the analysis process.
- ❑ It is a implementation of MPEG-7 Detailed A/V Profile (DAVP) with tackles only the visual description of the content.

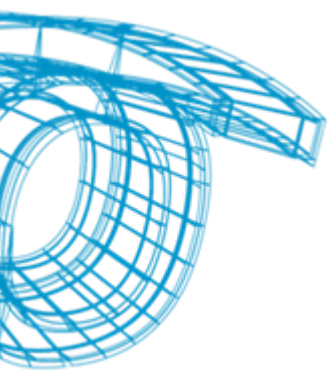
○ Define Mapping between ontologies:

- ❑ DAVP and DMS-1 through temporal decomposition of the pattern.
- ❑ DMS-1 dictionaries with concepts of the Domain ontology.



Benefits of the Model

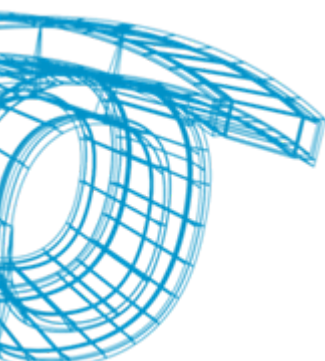
- DMS-1 driven information management.
 - The information exchange between the different modules is performed following an XML schema compliant with the DMS-1 standard. The metadata model is able to export the semantic information gathered in the ontology (including the individuals) in a coherent way with that XML.
- Information Conduction during the analysis process.
 - The model is able to play a key role during the process of the content analysis, since it is able to provide any module with any piece of information that could have been extracted by analysis module already performed
- Enabling the reasoning (the location of a shot with the presence of a helicopter is classified as outdoor).
- Supporting the manual enrichment.
 - DMS-1 model facilitates the manual annotation by providing lists of recommendations to the user based on the previous actions of other users.



Conclusions & Future Work

○ Conclusions:

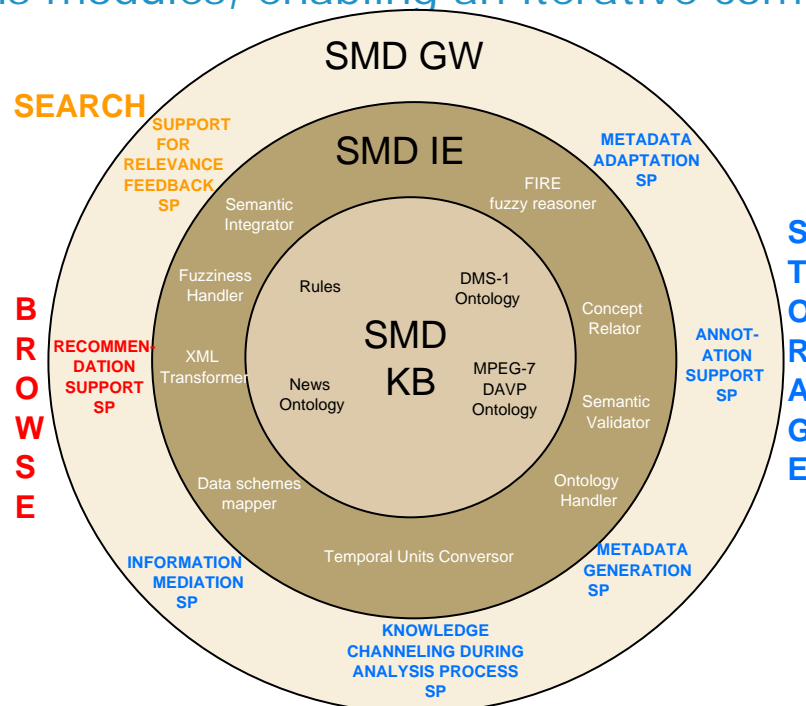
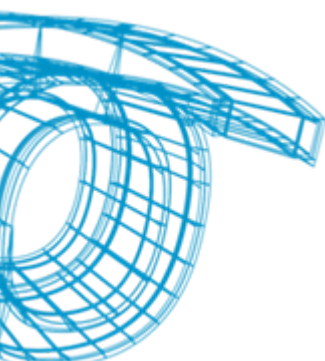
- ❑ The motivation and the implementation of a semantic model developed to support diverse semantic services in a Multimedia Asset Management system in a Broadcaster has been presented.
- ❑ The model is mainly driven by DMS-1 (Descriptive Metadata Scheme) standard, which is part of the Multimedia eXchange Format standard defined by the broadcast industrial community → seamless integration.
- ❑ The first implementation of DMS-1 using the OWL language.
- ❑ The model is complemented with other models coming from the academia in order to cover the diverse nature of the different semantic needs identified in the whole workflow.

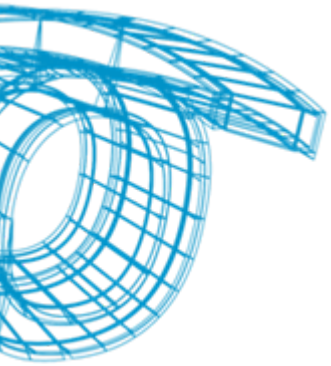


Conclusions & Future Work

○ Future Work.

- ❑ Complete the OWL DMS-1 ontology, introducing the rest of the parts of the standard that were out of the scope of Rushes(Right Management).
- ❑ Increase the cooperation between the middleware and the analysis modules, enabling an iterative communication.





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