Interoperability of eLearning Applications with Audiovisual Digital Libraries
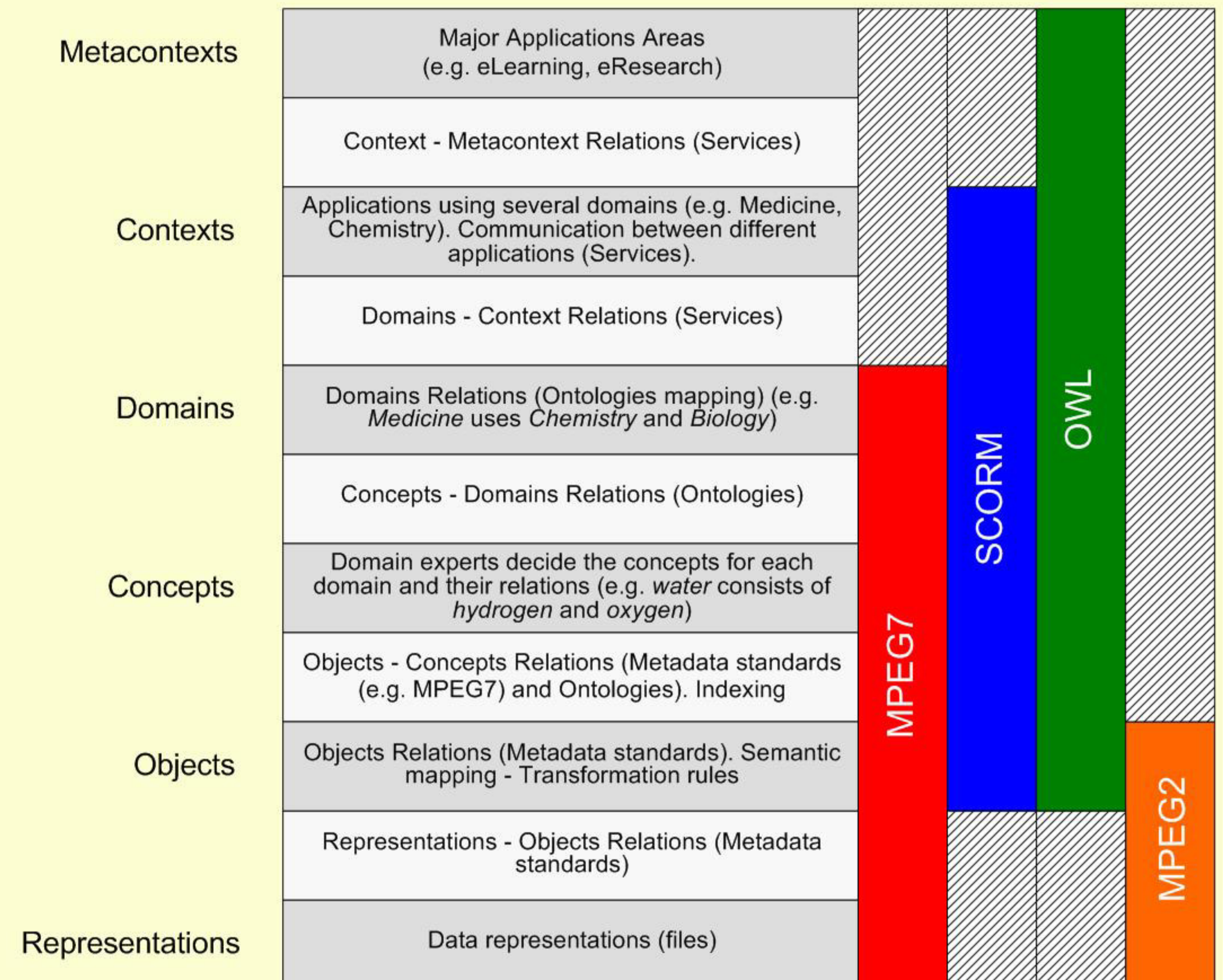
Research problem, Aim, Expected Results

Research problem

✓ Digital Libraries are an important source for the provision of eLearning resources.

✓ However, digital library metadata standards and eLearning metadata standards have been developing independently, presenting interoperability issues between digital libraries and eLearning applications (multi-facet problem).
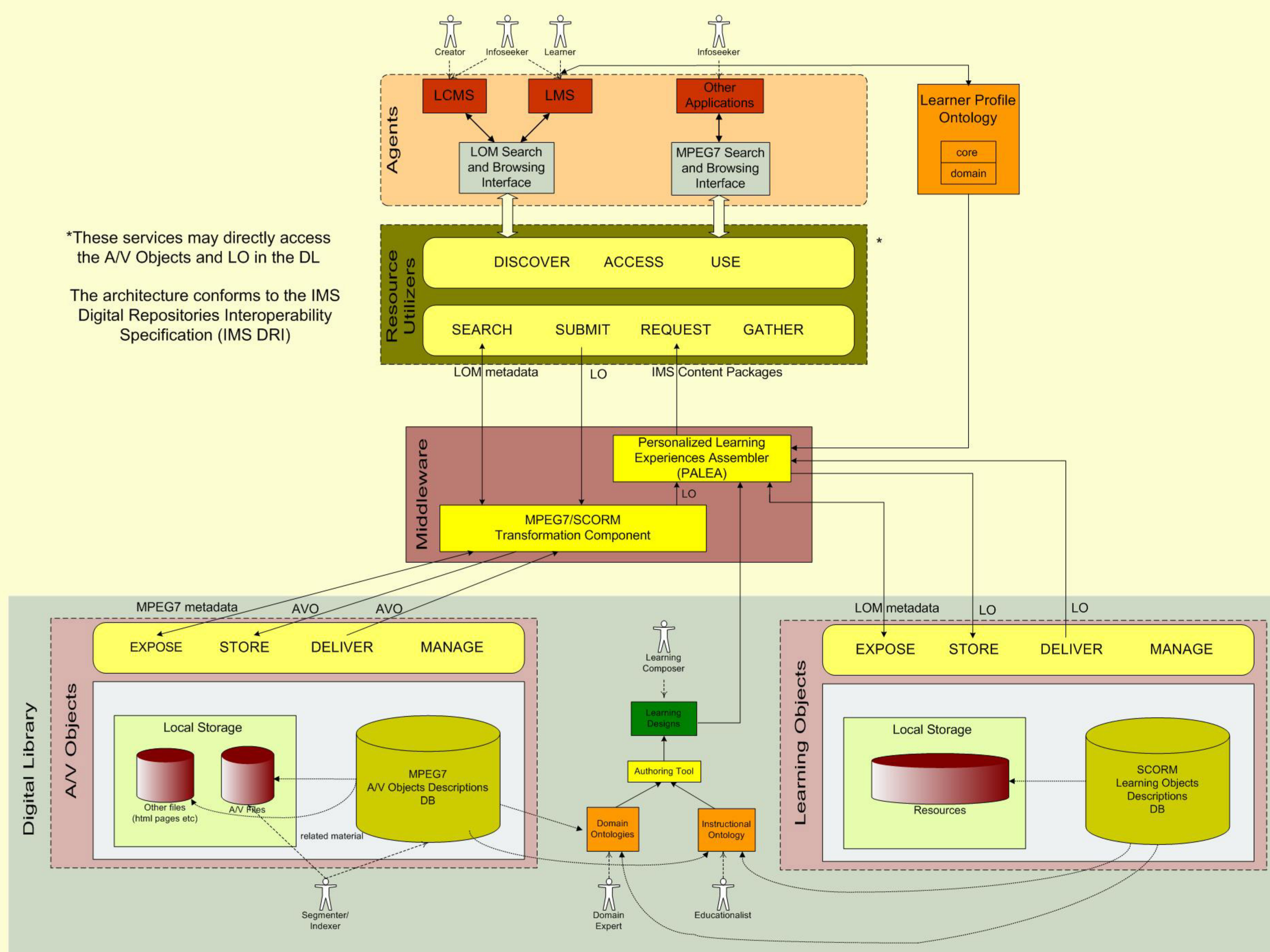
Aim and Expected Results

✓ Development of a robust model that will allow for the use of semantic descriptions of audiovisual content objects and/or segments that reside on a digital library in order to support the creation of reusable learning objects that may be used in the assembly of personalized learning experiences.

✓ Comparative study of the related standards for digital libraries (METS, Dublin Core etc.), eLearning (SCORM) and audiovisual content description (MPEG7) and development of an appropriate interoperability framework for their usage.

✓ Investigation of various options for packaging objects and the related metadata (e.g. METS, MPEG21 DIDL or IMS CP) to see which is best suited for the exchange of records within the above interoperability framework.

✓ Development of a Learner Model for generating learner profiles for use in creating personalized learning experiences.

✓ Development of a demonstrator supporting the above interoperability framework.

✓ Measurement of the reactions of different classes of users and their acceptance of the proposed model.

The multilevel problem of interoperability

Layer	Description	MPEG7	SCORM	OWL	MPEG2
Metacontexts	Major Applications Areas (e.g. eLearning, eResearch)			OWL	
	Context - Metacontext Relations (Services)			OWL	
Contexts	Applications using several domains (e.g. Medicine, Chemistry). Communication between different applications (Services).		SCORM	OWL	
	Domains - Context Relations (Services)		SCORM	OWL	
Domains	Domains Relations (Ontologies mapping) (e.g. *Medicine* uses *Chemistry* and *Biology*)	MPEG7	SCORM	OWL	
	Concepts - Domains Relations (Ontologies)	MPEG7	SCORM	OWL	
Concepts	Domain experts decide the concepts for each domain and their relations (e.g. *water* consists of *hydrogen* and *oxygen*)	MPEG7	SCORM	OWL	
	Objects - Concepts Relations (Metadata standards (e.g. MPEG7) and Ontologies). Indexing	MPEG7	SCORM	OWL	
Objects	Objects Relations (Metadata standards). Semantic mapping - Transformation rules	MPEG7			MPEG2
	Representations - Objects Relations (Metadata standards)	MPEG7			MPEG2
Representations	Data representations (files)	MPEG7			MPEG2

✓ Modern information systems can be seen as a stack of layers were each one is built on top of the previous one.

✓ This conceptual representation in layers is important to understand where the interoperability problem stands: Different data representations, objects, concepts, domains, contexts and metacontexts in the layer stack that should be efficiently managed in a standard way.

✓ If one puts different models besides this stack, he may identify gaps and intersection regions so that it is apparent where the interoperability issues among the models occur.

Demonstrator Architecture

*These services may directly access the A/V Objects and LO in the DL

The architecture conforms to the IMS Digital Repositories Interoperability Specification (IMS DRI)

Personalized Audiovisual Learning Experiences System (PALES)

Components

♦ **Digital Library**, logically separated in Audiovisual Objects part, and Learning Objects part.

♦ **Applications** (Software Agents in terms of IMS DRI, like LCMS, LMS etc.) discover, access and use the audiovisual content of the digital library through appropriate services (*resource utilizers*).

♦ **Middleware**, responsible for the assembly of personalized learning experiences.

  ▪ **MPEG7/SCORM transformation component**

  ▪ **Personalized A/V Learning Experiences Assembler (PALEA)** constructs the personalized learning experiences, taking into account the knowledge provided by the Learning Designs and the Learner Profiles and delivers them in the form of IMS Content Packages.

♦ **Ontologies** provide knowledge to the PALEA for the automatic construction of personalized learning experiences.

  ▪ **Domain Ontologies** provide vocabularies about concepts within a domain and their relationships.

  ▪ **Instructional Ontology** provides a vocabulary for the instructional function of a resource and a vocabulary for the construction of possible pedagogical approaches which can be applied to the construction of learning experiences.

  ▪ **Learner Profile Ontology** represents a learner model for the creation of learner profiles.

♦ **Learning Designs**: Abstract training scenarios in a certain domain combining information taken from the corresponding domain and the instructional ontology.