# Semantic, Constraint & Preference Based Authoring of Multi-topic Multimedia Presentations

Chrisa Tsinaraki[1], Andrea Perego[2], Panagiotis Polydoros[1], Athina Syntzanaki[1], Alessandro Martin[2], Stavros Christodoulakis[1]
[1] Technical University of Crete, Laboratory of Distributed Multimedia Information Systems and Applications (TUC/MUSIC), University Campus, 73100 Kounoupidiana, Crete, Greece, {chrisa, panpolyd, athina, stavros}@ced.tuc.gr
[2] University of Milan, Department of Computer Science and Communication (UNIMI/DICo), Via Comelico 39/41, 20135 Milano, Italy, {perego, martin}@dico.unimi.it

**Abstract.** We present in this paper an integrated system that allows the management and annotation of multimedia objects stored in MPEG-7/21 repositories, and the specification and semi-automatic generation of multimedia presentations based on the content relationships existing among multimedia objects. This system is the outcome of the collaboration between the Technical University of Crete (TUC-MUSIC) and the University of Milan (UNIMI) in Task 3.10 – CoCoMA (Content and Context Aware Multimedia Content Retrieval, Delivery and Presentation) of the DELOS II European Network of Excellence on Digital Libraries. The resulting system is one of the main components of the CoCoMA infrastructure, aiming to provide content- and context-aware rich interactive multimedia presentations by controlling data fusion and metadata reuse. The integrated system utilizes the SyMPA management and presentation authoring system developed by UNIMI and the DS-MIRF framework developed by TUC-MUSIC.

## 1. Introduction

The high penetration of the digital multimedia in several domains of the everyday life (e.g. education, entertainment etc.) has resulted in the increasing production of multimedia objects and the specification of multimedia presentations containing them. A **multimedia presentation** may be considered as a graph, where each node corresponds to a set of heterogeneous multimedia objects (e.g., text, images, audio and video files), grouped depending on their content relationships and organized according to a given spatial and temporal disposition. The edges connecting the graph nodes denote the execution flow of the presentation – i.e., the sequence according to which the objects in each node are displayed to the user.

Multimedia presentation authoring is quite a complex task, involving a set of different issues. Authors must collect the objects to be used, specify their spatial and temporal disposition inside each presentation node, and, finally, build the presentation graph (the 'structure' of the presentation). The available authoring models and systems provide different strategies for carrying out such tasks, but they require authors to specify explicitly the set of objects to be used, their disposition, and the presentation structure. This may be acceptable when we have a limited number of objects; nonetheless, such an approach cannot be applied when multimedia presentations are a means to access the contents of multimedia repositories such as Digital Libraries (DLs). In this case, mechanisms should be provided in order to automate as much as possible the composition of a multimedia presentation. This can be achieved if the authoring procedure focuses on the 'content' of the presentation itself. In fact, a multimedia presentation can be seen as a discourse on a given topic, where each node corresponds to a sub-topic, and the presentation structure represents the order according to which the sub-topics are addressed. Thus, the content relationships existing among objects, which may be either extracted from the objects themselves or derived from the metadata associated with them, can be used in order to generate both the nodes and the structure of the multimedia presentations. Author intervention cannot be avoided, but it mainly concerns the revision of the presentations automatically generated by the system.

In this paper, we present an integrated system that allows the management and annotation of multimedia objects stored in MPEG-7/21 repositories, and the specification and semi-automatic generation of multimedia presentations based on the content relationships existing among multimedia objects. This system is the outcome of the collaboration between the Technical University of Crete (TUC-MUSIC) and the University of Milan (UNIMI) in Task 3.10 – CoCoMA (Content and Context Aware Multimedia Content Retrieval, Delivery and Presentation) of the DELOS II European Network of Excellence on Digital Libraries. The resulting system is one of the main components of the CoCoMA infrastructure (Christodoulakis & al., 2005), aiming to provide content- and context-aware rich interactive multimedia presentations by controlling data fusion and metadata reuse. The integrated system utilizes the **SyMPA (System for Multimedia Presentation Authoring)** management and presentation authoring system developed by UNIMI and the **DS-MIRF (Domain-Specific Multimedia Indexing, Retrieval and Filtering) framework** developed by TUC-MUSIC.

The DS-MIRF framework (Tsinaraki & al., 2004a) aims to facilitate the development of knowledge-based multimedia applications utilizing and extending the MPEG-7 (Chang & al., 2001) and MPEG-21 (Pereira, 2001) standards. In the DS-MIRF framework, the **multimedia content annotator** is a special type of user that is responsible for the semantic annotation of multimedia documents. He uses an **annotation interface** integrated with the GraphOnto semantic multimedia annotation component (Polydoros & al., 2006), which allows ontology-based semantic annotation and utilizes the ontological infrastructure of the DS-MIRF framework. Since all the ontologies in the DS-MIRF framework are expressed in OWL, the result of the annotation process is an OWL description of the multimedia content. The OWL metadata are then transformed, using the **DS-MIRF transformation rules**, to **MPEG-7/21 metadata descriptions**. The MPEG-7/21 metadata are stored in the **DS-MIRF Metadata Repository**, which is accessed by the end-users through appropriate **application interfaces**. Semantic user preference descriptions are also stored in the DS-MIRF Metadata Repository (Tsinaraki & Christodoulakis, 2006).

**SyMPA** is a management and presentation authoring Web-based system, consisting of three main components: a database, a set of modules for object management, annotation, and presentation specification, and two modules in charge, respectively, of presentation generation and objects' / presentations' retrieval. SyMPA allows users to acquire and annotate objects, using multiple metadata vocabularies (which may be plain sets of descriptors, conceptual hierarchies, and ontologies), concerning both high- and low-level features. These annotations are then used to assist authors in building multimedia presentations. SyMPA allows the specification of multimedia presentations having a dynamic structure, unlike the existing approaches, which are designed for building fixed-structure presentations (usually modelled as a tree with one or more branches), comprised of a fixed set of objects. Thanks to this, when alternative versions of the same presentation are required, varying in duration or using different sets of multimedia objects, the author does not have to specify them explicitly. This not only reduces the complexity of the presentation specification task, but it also allows personalizing a presentation taking into account end users' interests and skill levels. In order to address this issue, SyMPA utilizes the multimedia presentation authoring model described in Bertino & al. (2005), where content relationships among objects are used to identify the objects associated with each node of the presentation and to build automatically different execution flows of the same presentation.
The MPEG-7/21 content-based and semantic metadata stored in the DS-MIRF Metadata Repository, which are associated with multimedia objects, can be used to automatically carry out the presentation specification task in SyMPA. In particular, such metadata can be used in the authoring model to infer the content relationships existing among objects, which will then determine the set of multimedia objects associated with each node of the presentation and the presentation structure itself. Thus, although the utilization of metadata cannot make completely automatic the presentation specification procedure, they can be used for improving its efficiency, especially when dealing with large collections of multimedia objects, where locating objects may be a difficult and time-consuming task. For this reason, we are working on the integration of the DS-MIRF MPEG-7/21 Metadata Repository with SyMPA, in order to store in the former the multimedia presentations and multimedia object annotations defined using the later and for locating multimedia objects that will be utilized in the presentations. In addition, the ontological infrastructure of the DS-MIRF framework is being extended, with a "topics" ontology, in order to be utilized in SyMPA as a set of metadata vocabularies for multimedia object annotation. Moreover, the GraphOnto component will be integrated in the SyMPA user interface for the management of the OWL ontologies that will be used as metadata vocabularies and for supporting ontology-based multimedia object annotation. Finally, the semantic user preference descriptions stored the DS-MIRF MPEG-7/21 Metadata Repository will be systematically utilized in order to allow presentation personalization.
The remainder of this paper is organized as follows: Section 2 discusses related work issues; Section 3 provides an overview of the integrated architecture of the proposed system, whereas section 4 illustrates the proposed semantic, constraint and preference based authoring approach; finally, section 5 concludes the paper and outlines future research directions.

## 2. Related Work

We present in this section research efforts relevant to our integrated multimedia authoring system. First, we present in subsection 2.1 research efforts in multimedia presentation authoring and then, we describe in subsection 2.2 research efforts in knowledge-based multimedia application support.

### 2.1. Multimedia Presentation Authoring

We present in this subsection research efforts in multimedia presentation authoring. The existing systems for multimedia presentation authoring and generation can be grouped into two main approaches: The **operational approach** and the **constraint-based approach**. The former asks authors to specify explicitly the **absolute** spatial and temporal disposition of the objects in each node of the presentation by using, for example, (x, y) coordinates and/or timelines, whereas the latter provides a set of spatio-temporal constraints expressing the **relative** position of each object with respect to another one (for instance, the temporal T_Before(**a**, **b**) constraint states that object **a** must be played before object **b**). The operational approach, due to the fact that it is easy to implement and that it allows authors to completely control the final presentation, is the most often adopted by the existing systems, such as Macromedia Director, ZyX (Boll & Klas, 2001), MET++ (Ackermann, 1994), and CMIF (Hardman & al., 1993). On the other hand, the constraint-based approach has the advantage of requiring just a high level specification of the spatio-temporal disposition of the objects, which is then used by the system to generate the final presentation. Among the systems that adopt this approach are CHIMP (Candan & al., 1996), CUYPERS (Geurts & al., 2001; van Ossenbruggen & al., 2003), and MADEUS (Jourdan & al., 1998; Tardif & al., 2000). Despite their differences, both the operational and the constraint-based approaches force authors to focus on how objects are presented to the end users, and not on the content of the presentation. For this purpose, in Bertino & al. (2005) a multimedia presentation authoring model has been proposed, which makes use of content-based constraints for the authoring and the semi-automatic generation of a multimedia presentation. In particular, three content-based constraints have been defined, which are binary relations expressing, respectively, that two objects belong to the same topic (C_Same), that two objects belong to different topics (C_Different), and that one object belongs to a topic which 'conceptually' follows the topic of the other one (C_Link). Such constraints are then used in order to generate the final presentation, where the C_Same and the C_Different relations identify the objects belonging to each presentation node, whereas the C_Link relations determine the structure of the presentation graph. Moreover, thanks to the C_Link constraint, it is possible to automatically determine different execution flows of the same presentation, which can be chosen by end-users depending on their preferences and/or

skill levels, whereas in the 'traditional' approaches each possible execution flow of the same presentation must be specified explicitly.

### 2.2. Knowledge-based Multimedia Application Support

We present in this subsection research efforts in knowledge-based multimedia application support. As MPEG-7 and MPEG-21 are the dominant standards for multimedia application support, the research in this area is mainly based on them. Although the well-accepted MPEG-7 standard allows, in the MPEG-7 MDS (ISO/IEC; 2003a), the semantic description of the audiovisual content using both keywords and structured semantic metadata, several systems follow the keyword-based approach (Rogers & al., 2003; Tseng & al., 2004; Wang & al., 2004; Graves & Lalmas, 2002). The keyword-based approach is limiting, as it results in reduced precision of the audiovisual content retrieval. As an example, consider a fan of the Formula-1 driver Fernando Alonso, who wishes to retrieve the audiovisual segments containing the overtakes that Alonso has performed against Kimi Raikkonen. If the user relies on the keyword "overtake" and the names "Alonso" and "Raikkonen", he will retrieve, in addition to the segments containing the overtakes that Alonso has performed against Raikkonen, the segments containing the overtakes that Raikkonen has performed against Alonso.

The above problem may be solved (at least at some extent) using the structured semantic description capabilities provided by MPEG-7. The major shortcoming of most of the systems adopting this approach is that the general-purpose constructs provided by MPEG-7 are used without a systematic effort for domain knowledge integration in MPEG-7 (Agius & Angelides, 2004; Hammiche & al., 2004; Lux & Granitzer, 2005), so that standard MPEG-7 software may utilize it. An approach allowing to integrate, in semantic MPEG-7 descriptions, domain knowledge expressed in domain ontologies formed using MPEG-7 constructs, is discussed in (Tsinaraki & al., 2003; Tsinaraki & al., 2005a). As the utilization of existing OWL domain ontologies makes interoperability support within user communities easier, a methodology for the integration of OWL domain ontologies in MPEG-7 has also been developed (Tsinaraki & al., 2004a; Tsinaraki & al., 2004b).

A structured semantic content description model cannot be fully exploited by keyword-based user preferences; As this is the case in MPEG-7/21 (the user preferences allow only keyword-based descriptions of the desired content), the MPEG-7/21 based systems either utilize keyword-only metadata thus ignoring the structured MPEG-7 semantic metadata (Rogers & al., 2003; Tseng & al., 2004; Wang & al., 2004) or ignore the MPEG-7/21 user preference model and follow proprietary filtering approaches on top of the structured MPEG-7 semantic metadata (Agius & Angelides, 2004). In order to allow the full exploitation of structured semantic audiovisual content descriptions, a semantic user preference model for MPEG-7/21 has been proposed in (Tsinaraki & Christodoulakis, 2006).

## 3. System Architecture

We provide in this section an overview of the major components of our integrated system, namely the DS-MIRF framework (presented in subsection 3.1) and the SyMPA multimedia presentation authoring system (presented in subsection 3.2), as well as an overview of the architecture of our integrated system (presented in subsection 3.3).

### 3.1. The DS-MIRF Framework

We present in this subsection the DS-MIRF framework (Tsinaraki & al., 2003; Tsinaraki & al., 2004a; Tsinaraki & al., 2004b; Tsinaraki & al., 2005), a software engineering framework that aims to facilitate the development of knowledge-based multimedia applications utilizing and extending the MPEG-7/21 standards. The **multimedia content annotator** is a special type of user in DS-MIRF that performs the semantic annotation of multimedia documents, uses an **annotation interface** integrated with the **GraphOnto** semantic multimedia annotation component (Polydoros & al., 2006). GraphOnto is a Java application that allows OWL (McGuinness & van Harmelen, 2004) ontology management, ontology-based semantic annotation and utilizes the ontological infrastructure of the DS-MIRF framework. The DS-MIRF ontological infrastructure includes:

(a) An OWL **Upper Ontology** that fully captures the MPEG-7 MDS (Multimedia Description Schemes) and the MPEG-21 DIA (Digital Item Adaptation) Architecture (ISO/IEC 2003b);
(b) A set of OWL **Application Ontologies** that provide additional to the upper ontology functionality in OWL. The functionality provided by the application ontologies either makes easier for the user the use of the MPEG-7/21 (like, for example, a typed relationship ontology that captures the typed relationship semantics implied in the MPEG-7 MDS text) or supports advanced multimedia content services (like, for example, a semantic user preference ontology); and
(c) OWL **Domain Ontologies**, which extend the Upper Ontology and the Application Ontologies with domain knowledge (like, for example, sports ontologies for soccer, formula 1 etc.).

Since all the ontologies in the DS-MIRF framework are expressed in OWL, the result of the annotation is an OWL description of the multimedia content. The OWL metadata are then transformed, using the **DS-MIRF transformation rules** that are implemented in the GraphOnto component, to **MPEG-7/21 metadata descriptions**. The MPEG-7/21 metadata are stored in the **DS-MIRF Metadata Repository**. The DS-MIRF Metadata Repository has been developed on top of the Berkley DB XML, contains MPEG-7/21 metadata descriptions associated with multimedia objects and provides semantic retrieval capabilities and is accessed by the end-users through appropriate **application interfaces**. The application interfaces may provide the end-users with multimedia content services like multimedia content retrieval, filtering and delivery. Applications based on OWL ontologies are developed using the **GraphOnto API**, a Java API that provides Java classes having the appropriate attributes and methods for fully editing all the OWL constructs. In addition to the multimedia object annotations, MPEG-7/21 user preference descriptions and semantic user preference descriptions, structured according to the model speci-

fied in (Tsinaraki & Christodoulakis; 2006), are stored in the DS-MIRF Metadata Repository, in order to allow for the personalization of the services offered to the users.

### 3.2. The SyMPA Authoring System

We present in this subsection SyMPA, a management and presentation authoring system for multimedia objects stored in distributed repositories. SyMPA allows users to acquire and annotate objects, using multiple metadata vocabularies (which may be plain sets of descriptors, conceptual hierarchies, and ontologies), concerning both high- and low-level features. Such annotations are then used to assist authors in building multimedia presentations, according to a content-based approach, formally defined in Bertino & al. (2005), where content relationships among objects are used to identify the objects associated with each node of the presentation and to build automatically different execution flows of the same presentation. This is obtained by supporting **content** constraints, allowing the author to specify a) the objects associated with the same "topic", b) the objects associated with different topics, and c) the objects associated with two consecutive topics. Such constraints can be specified explicitly or inferred from the content metadata possibly associated with multimedia objects. Thanks to these features, presentation specification becomes a task similar to object annotation, which results in making our approach suitable also for specifying presentations based on large multimedia object repositories, such as DLs. In particular the authors, using the available metadata vocabularies, build a presentation by specifying firstly the "topic" to be addressed. After having evaluated the existing annotations, the system returns both the set of objects which may be related to the specified topic and a possible structure of the presentation. This is obtained by grouping objects sharing similar characteristics (i.e., metadata) into subsets, whose nested structure is used to build the proposed presentation graph, where the nodes correspond to possible "sub-topics" of the presentation. It is important to note that the resulting presentation graph corresponds to the set of all the possible execution flows of the presentation, which can be used to provide different versions of the same presentation, addressing the different preferences (in terms of content, duration, etc.) of end-users. Finally, the author is asked to revise the proposed presentation by possibly modifying its structure and/or adding/removing objects in the presentation nodes.

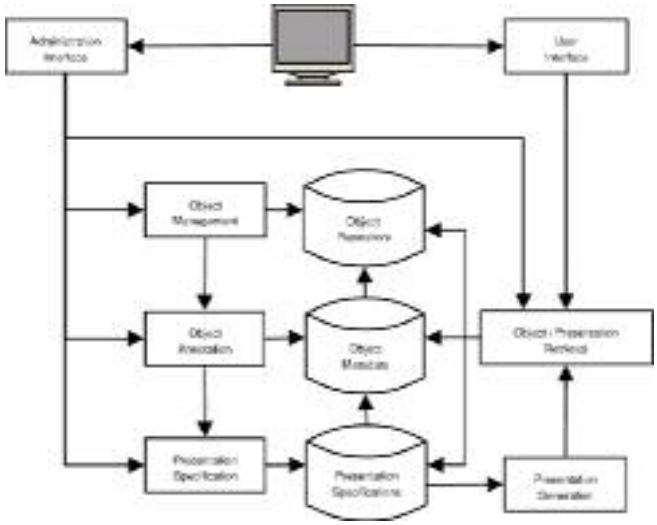

Figure 1: The SyMPA architecture

This approach has the advantage of supporting a **declarative** specification of a multimedia presentation, based on its "content", whereas the existing systems enforce **procedural** strategies, where a multimedia presentation is specified in terms of the spatial-temporal disposition of the objects in each node, and on how presentation nodes are organized. Moreover, content relationships can be used to automatically obtain multiple execution flows of the same presentation, which can be chosen by the end-users depending on their interests or skill levels. By contrast, in the available systems the presentation graph is fixed, and possible alternative paths must be specified explicitly by building different presentations.

SyMPA is a Web-based system, consisting of three main components: a database, a set of modules for multimedia object management, annotation, and presentation specification, and two modules charge, respectively, of presentation generation and objects' / presentations' retrieval. According to the SyMPA architecture, depicted in Figure 1, multimedia objects are stored in distributed repositories, whereas their metadata are stored and managed by a centralized database. Multimedia objects and the associated metadata are managed through a Web-based administration interface, which is supported by a set of software modules that collaborate in order to perform the supported tasks. The administration interface allows authors to specify multimedia presentations, according to the approach described above.

### 3.3. Architectural Overview

We present in this subsection our integrated system architecture, which is shown in Figure 2. As shown in Figure 2, the users and the system administrators interact with the system using ontology-based interfaces, which are based on the GraphOnto API and utilize the DS-MIRF ontological infrastructure. The system administrators may perform multimedia object management operations on the multimedia object repository, annotate multimedia

objects – thus producing multimedia object metadata – and specify multimedia presentations, which are stored in the DS-MIRF metadata repository. During multimedia presentation specification, multimedia objects and presentations may be retrieved in order to be used in the newly-created presentations. The users may retrieve, based on topic-based queries and according to their preferences, multimedia objects and/or multimedia presentations.

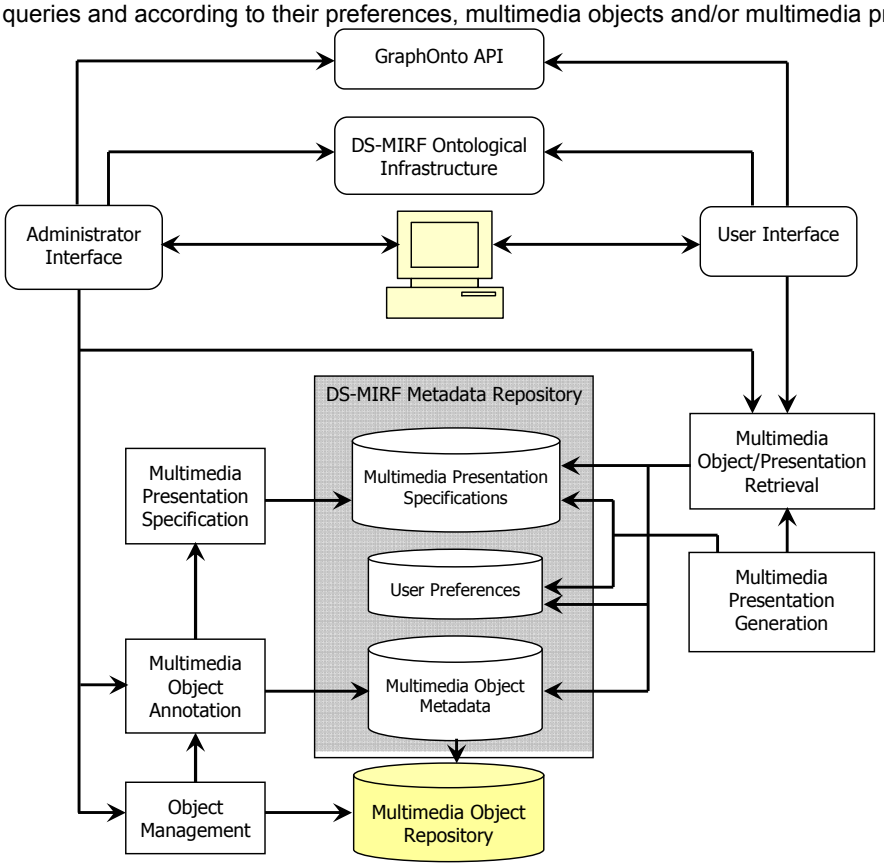


Figure 2: Overview of the System Architecture

The integrated architecture of Figure 2 shows the interplay of DS-MIRF with SyMPA, in order to support semantic, constraint and preference based multimedia authoring. In order to achieve this, the DS-MIRF framework and the SyMPA multimedia presentation authoring system are being integrated in the following points:

- The DS-MIRF MPEG-7/21 Metadata Repository is used: (a) for storing multimedia presentations and object annotations defined using SyMPA; and (b) for locating, using the semantic retrieval capabilities of the DS-MIRF framework, multimedia objects that will be utilized in the presentations. In addition, the metadata associated with the multimedia objects are used in the authoring model to infer the content relationships that exist among objects. These relationships determine which multimedia objects should be associated with each node of the presentation and the presentation structure itself.
- The semantic user preference descriptions stored in the DS-MIRF MPEG-7/21 Metadata Repository are systematically utilized in order to allow presentation personalization.
- The DS-MIRF ontological infrastructure is utilized as a set of metadata vocabularies and is being extended with a topics ontology,
- The SyMPA user interface is being integrated with GraphOnto, which is used as OWL Ontology editor/viewer and object annotation interface.

## 4. Semantic, Constraint and Preference based Authoring Support

We present in this section the multimedia presentation authoring approach supported by our integrated system. As already mentioned, the MPEG-7/21 content-based and semantic metadata stored in the DS-MIRF Metadata Repository, which are associated with multimedia objects, can be used to automatically carry out the presentation specification task in SyMPA. In particular, such metadata can be used in the authoring model to infer the content relationships existing among objects, which will then determine the set of multimedia objects associated with each node of the presentation and the presentation structure itself. This way, the multimedia presentation authoring approach of Bertino & al. (2005) is enhanced by inferring content constraints from the metadata associated with multimedia objects. Nonetheless, this feature does not allow avoiding author intervention for two main reasons. First, content constraints can be used only for grouping objects and building the presentation structure, but the spatial and temporal disposition of objects in each node cannot be determined automatically. Second, we cannot have a control over the number of objects which will be automatically associated with a presentation node. For instance, let us assume that in our repository we have 20 objects, associated with metadata describing them as images reproducing Impressionist paintings: in such a case, the node of the presentation corresponding to the Impressionism should contain 20 images, independently from the size of the display area. This issue may

be addressed by associating with each object a relevance level, which can be used to discard the less relevant objects, thus reducing the number of objects in each node of the presentation.
Nonetheless, in most cases, the relevance of an object cannot be determined a priori, but it depends on the context—i.e., the topic and/or the presentation. A possible solution may be to decide the relevance level of an object by taking into account the existing presentations, according to the principle that the more the object is used in a given context, the more it is relevant to it. For instance, if we have several presentations concerning the Impressionism where a given object is always used, this object may be considered relevant for such topic. Note, however, that, although this strategy allows us to possibly reduce the number of objects, we still may have a too large number of equally relevant objects. For instance, if among the set of objects concerning Impressionism, 10 of them are equally relevant, they may be still too many for a single node of a presentation. Moreover, this procedure can be applied only when we already have a sufficiently large and heterogeneous set of presentations in the system, so that it will be possible to evaluate statistically the relevance of the objects for any available topic.
Thus, although the utilization of metadata cannot make completely automatic the presentation specification procedure, they can be used for improving its efficiency, especially when dealing with large collections of multimedia objects, where locating objects may be a difficult and time-consuming task. The presentation authors may specify a presentation by defining a set of topics in terms of the semantic metadata available in the system utilizing the semantic retrieval capabilities of the DS-MIRF framework. Based on this, the system returns the set of objects belonging to each node; then the author decides which objects should be used and their spatial and temporal disposition. Finally, the possible execution flows of the presentation are obtained evaluating the semantic relationships existing among the selected objects. For this reason, we are working on the integration of the DS-MIRF MPEG-7/21 Metadata Repository with SyMPA, in order to store in the former the multimedia presentations and multimedia object annotations defined using the latter and for locating multimedia objects that will be utilized in the presentations. In addition, the ontological infrastructure of the DS-MIRF framework is being extended, with a "topics" ontology, in order to be utilized in SyMPA as a set of metadata vocabularies for multimedia object annotation. Moreover, the GraphOnto component will be integrated in the SyMPA user interface for the management of the OWL ontologies that will be used as metadata vocabularies and for supporting ontology-based multimedia object annotation. Finally, the semantic user preference descriptions stored the DS-MIRF MPEG-7/21 Metadata Repository will be systematically utilized in order to allow presentation personalization.

## 5. Conclusions – Future Work

We have presented in this paper an integrated system that allows the management and annotation of multimedia objects stored in MPEG-7/21 repositories, and the specification and semi-automatic generation of multimedia presentations based on the content relationships existing among multimedia objects. This system is the outcome of the collaboration between the TUC-MUSIC and UNIMI in Task 3.10 – CoCoMA of the DELOS II European Network of Excellence on Digital Libraries. The resulting system is one of the main components of the CoCoMA infrastructure, aiming to provide content- and context-aware rich interactive multimedia presentations by controlling data fusion and metadata reuse. The integrated system utilizes the SyMPA management and presentation authoring system developed by UNIMI and the DS-MIRF framework developed by TUC-MUSIC. In particular, the DS-MIRF framework and the SyMPA multimedia presentation authoring system are being integrated in the following points:

- The DS-MIRF MPEG-7/21 Metadata Repository is used: (a) for storing multimedia presentations and object annotations defined using SyMPA; and (b) for locating multimedia objects that will be utilized in the presentations. In addition, the metadata associated with the multimedia objects are used in the authoring model to infer the content relationships that exist among objects. These relationships determine which multimedia objects should be associated with each node of the presentation and the presentation structure itself.
- The semantic user preference descriptions stored in the DS-MIRF MPEG-7/21 Metadata Repository are systematically utilized in order to allow presentation personalization.
- The utilization of the DS-MIRF ontological infrastructure as metadata vocabularies and its extension with a topics ontology,
- The SyMPA user interface is being integrated with GraphOnto which is used as OWL Ontology editor/viewer and object annotation interface.

A first demonstrator of the integrated system is available, and the finer integration of the components is undergoing. Our future plans include the integration of our multimedia authoring system with the other components of the CoCoMA architecture (Christodoulakis & al., 2005).

## 6. Acknowledgements

The work presented in this paper was partially funded in the scope of the DELOS II Network of Excellence in Digital Libraries (IST – Project Record Number 507618).

## 7. References

1. P. Ackermann (1994). Direct manipulation of temporal structures in a multimedia application framework. In Proc. of the 2nd ACM Int. Conf. on Multimedia, pages 15–58, 1994.
2. H. Agius, M. Angelides (2004). Modelling and Filtering of MPEG-7-Compliant Meta-Data for Digital Video. ACM SAC, 2004, pp. 1248-1252.
3. E. Bertino, E. Ferrari, A. Perego, D. Santi (2005). A constraint-based approach for the authoring of multi-topic multimedia presentations. In Proc. of the IEEE International Conference on Multimedia & Expo (ICME 2005), Amsterdam (The Netherlands), July 6-8, 2005, IEEE CS Press, 2005.

4. S. Boll and W. Klas (2001). ZyX – A multimedia document model for reuse and adaptation. IEEE Transactions on Knowledge and Data Engineering, 13(3):361–382, 2001.
5. K. S. Candan, B. Prabhakaran, and V. S. Subrahmanian (1996). CHIMP: A framework for supporting distributed multimedia document authoring and presentation. In Proc. of the 4th ACM Int. Conf. on Multimedia, pages 329–340, 1996.
6. S.F. Chang, T. Sikora, A. Puri (2001). Overview of the MPEG-7 standard. IEEE Transactions on Circuits and Systems for Video Technology 11(2001), pp. 688–695.
7. S. Christodoulakis, C. Tsinaraki, C. Breiteneder, H. Eidenberger, D. Divotkey, S. Boll, A. Scherp, E. Bertino, and A. Perego (2005). CoCoMA: Content and Context Aware Multimedia Content Retrieval, Delivery and Presentation. European Conference on Research and Advanced Technology for Digital Libraries (ECDL) 2005, Vienna, Austria.
8. A. Graves, M. Lalmas (2002). Video Retrieval using an MPEG-7 based Inference Network. SIGIR 2002, Tampere, Finland.
9. J. Geurts, J. van Ossenbruggen, and L. Hardman (2001). Application-specific constraints for multimedia presentation generation. In Proc. of the Int. Conf. on Multimedia Modeling (MMM01), pages 247–266, 2001.
10. D. L. McGuinness and F. van Harmelen (eds.) (2004). OWL Web Ontology Language: Overview. W3C Recommendation, 10 Feb. 2004. (http://www.w3.org/TR/owl-features).
11. S. Hammiche, S. Benbernou, M.-S. Hacid, A. Vakali (2004). Semantic Retrieval of Multimedia Data (2004). 2nd ACM International Workshop on Multimedia Databases (MMDB), Arlington, VA, USA, November 2004.
12. L. Hardman, G. van Rossum, and D. C. A. Bulterman (1993). Structured multimedia authoring. In Proc. of the 1st ACM Int. Conf. on Multimedia, pages 283–289, 1993.
13. ISO/IEC: 15938-5:2003 (2003a). Information Technology – Multimedia content description interface – Part 5: Multimedia description schemes. 2003, First Edition.
14. ISO/IEC: JTC 1/SC 29/WG 11/N5845 (2003b). MPEG-21 Multimedia Framework, Part 7: Digital Item Adaptation (Final Committee Draft). ISO/MPEG N5845, July 2003.
15. M. Jourdan, N. Layaïda, C. Roisin, L. Sabry-Ismaïl, and L. Tardif (1998). MADEUS, An authoring environment for interactive multimedia documents. In Proc. of the 6th ACM Int. Conf. on Multimedia, pages 267–272, 1998.
16. M. Lux, M. Granitzer (2005). Retrieval of MPEG-7 based Semantic Descriptions. BTW-Workshop "WebDB Meets IR" in context of the "11. GI-Fachtagung für Datenbanksysteme in Business, Technologie und Web", University of Karlsruhe, Germany, March 2005.
17. J. van Ossenbruggen, J. Geurts, L. Hardman, and L. Rutledge (2003). Towards a formatting vocabulary for time-based hypermedia. In Proc. of the 12th Int. World Wide Web Conf., pages 384–393, 2003.
18. F. Pereira (2001). The MPEG-21 standard: Why an open multimedia framework?. 8th International Workshop on Interactive Distributed Multimedia Systems (IDMS 2001), LNCS 2158, Lancaster, September 2001, Springer-Verlag, Heidelberg, pp. 219–220.
19. P. Polydoros, C. Tsinaraki, S. Christodoulakis (2006). GraphOnto: OWL-Based Ontology Management and Multimedia Annotation in the DS-MIRF Framework. Workshop on Multimedia Semantics (WMS), Chania, Crete, June 2006.
20. D. Rogers, J. Hunter, D. Kosovic (2003). The TV-Trawler Project. In Special Issue of the International Journal of Imaging Systems and Technology on Multimedia Content Description and Video Compression, March 2003.
21. L. Tardif, F. Bes, and C. Roisin (2000). Constraints for multimedia documents. In Proc. of the Int. Conf. on Practical Applications of Constraint Techniques and Logic Programming, 2000.
22. B. Tseng, C.-Y. Lin, J. Smith (2004). Using MPEG-7 and MPEG-21 for personalizing video. IEEE Multimedia, 11(1):42-52, Jan.-Feb. 2004.
23. C. Tsinaraki, S. Christodoulakis (2006). A Multimedia User Preference Model that Supports Semantics and its Application to MPEG 7/21. Multimedia Modeling 2006 Conference (MMM 2006), pp. 35-42, January 2006, Beijing, China.
24. C. Tsinaraki, E. Fatourou, S. Christodoulakis (2003). An Ontology-Driven Framework for the Management of Semantic Metadata Describing Audiovisual Information. 15th International Conference on Advanced Information Systems Engineering (CAISE), pp. 340-356, June 2003, Klagenfurt/Velden, Austria.
25. C. Tsinaraki, P. Polydoros, S. Christodoulakis (2004a). Interoperability support for Ontology-based Video Retrieval Applications. Conference on Image and Video Retrieval (CIVR) 2004, pp. 582-591, July 2004, Dublin, Ireland.
26. C. Tsinaraki, P. Polydoros, S. Christodoulakis (2004b). Integration of OWL ontologies in MPEG-7 and TV-Anytime compliant Semantic Indexing. 16th International Conference on Advanced Information Systems Engineering (CAISE), pp. 398-413, June 2004, Riga, Latvia.
27. C. Tsinaraki, P. Polydoros, F. Kazasis, Christodoulakis S. (2005a). Ontology-based Semantic Indexing for MPEG-7 and TV-Anytime Audiovisual Content. In Multimedia Tools and Application Journal (MTAP), Special Issue of on Video Segmentation for Semantic Annotation and Transcoding, 26, 299-325, August 2005.
28. Q. Wang, W.-T. Balke, W. Kiessling, A. Huhn (2005). P-News: Deeply Personalized News Dissemination for MPEG-7 based Digital Libraries. European Conference on Research and Advanced Technology for Digital Libraries (ECDL) 2005, Bath, UK.