

**Adaptable MULtimedia
for EDucational purposes
(AMULED)**
Ideas for a project proposal

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Summary

One of the main advantages of digital content is that it is extremely flexible. Tailoring and reuse of digital content are relatively cheap in comparison with paper media, since the publisher or content provider is no longer restricted by a costly printing and physical distribution process. Hence, when a publisher owns a set of multimedia objects these objects can, in principle, be reused infinitely at a relatively low cost. However, the availability of appropriate metadata and/or quick search algorithms is of course an important precondition to facilitate and stimulate the reuse of multimedia objects. Thus, in the digital era the activities of publishers concerning the traditional printing and physical distribution activities are exchanged for activities directed at the disclosure of digital content. Nevertheless, these disclosure activities will add extra functionality to the content, as will be shown in the rest of this document.

The focus of AMULED is the development of an advanced content disclosure service: a system for semi-automatic authoring. The authoring environment that is developed will enable teachers and/or publishers to easily create customised presentations for a variety of pupils and contexts by reusing existing material. Parties that will be involved in AMULED are publishers, schools, SLO, CWI and Telematica Instituut.

In the course of the project a prototype of a semi-automatic authoring environment for multimedia documents for educational purposes will be developed. The first version of the prototype will allow the user to search a set of multimedia objects and to use the retrieved objects in a presentation. In the searching process, customisation information such as user preferences is taken into account in order to generate precise and appropriate search results. The presentation is prepared by the teacher in a user-friendly editor which provides templates for different presentation styles and structures. In the second version of the prototype, teachers are in addition able to let the system automatically generate a presentation. Also here customisation information plays an essential role in order to let the system generate a presentation that is appropriate for the type of pupil or the type of context the teacher has in mind. The teacher is able to manually edit the automatically generated presentation.

For both versions of the prototype, metadata play an essential role. Since hand coding of metadata is costly it is important that a metadata model is developed that only contains the most indispensable metadata for the authoring environment in question. The development of such a model entails a thorough study of the application domain, including user studies and studies of the type of (multimedia) documents that are appropriate for the domain in question.

1. Introduction

1.1 AMULED in a nutshell

The aim of AMULED is enabling teachers and/or publishers to easily create customised presentations for a variety of students by reusing existing material. Customisation may, for instance, be based on the knowledge level of the student, the terminal the student is working on, the language the student speaks and/or a disability. CWI and Telematica Instituut are responsible for the technical realisation of the project. SLO (specialisten in leerprocessen) and various publishers and schools will be involved in the project in order to create an authoring environment that is really valuable for educational purposes.

1.2 Context

“Kennisset” is a project of the Dutch “Ministerie van OCenW”. It connects several groups within the educational sector: schools, students, teachers, parents, (cultural) organisations and institutions (e.g. libraries and museums), and people that are interested in education. At the moment about 400 schools are connected to “Kennisset”. Finally, all Dutch schools except for colleges of higher education and universities will be connected. This makes a total of about 10.000 schools. “Kennisset” users have several services at their disposal: information services, discussion services and technical services (e.g. the use of a central server). The availability of sound digital content for education is of major importance for the success of “Kennisset”. However, currently the development of markets for digital content for education lags behind the development of network and cable infrastructure.

More information on “Kennisset” can be found at: <http://www.kennisset.nl/>

1.3 Goal

The goal of AMULED is the development of a prototype of a semi-automatic authoring environment for multimedia documents for educational purposes. The environment is semi-automatic since the user of the system is given the possibility to edit the resulting presentation. As a basis for the prototype, a model for customised multimedia documents for educational purposes will be developed.

1.4 Main objectives

- Explorative research: state-of-the-art research (metadata, user modelling, authoring tools etc.) and interviews with schools and publishers.
- Development of a model for customised multimedia documents for educational purposes.

- Creation of multimedia objects including metadata. This is a task performed by participating publishers.
- Development of a prototype of a semi-automatic authoring environment for multimedia documents for educational purposes, where customisation and accounting, billing and payment play a central role. The prototype is based on a pilot with publishers and schools.
- Explore the possibilities for portability/scalability of results beyond educational domain.

2. Research description

2.1 Scenario

Ellen van Bommel is a teacher at the primary school “De Telgenkamp” in Utrecht. Yesterday one of her pupils in Group 4, Joris, was ill. Today Joris is back again and Ellen would like to give Joris a summary of what the other children learned when Joris was absent. The main topic that Ellen covered yesterday was the “Waddenzee”. Ellen opens the Web-browser at one of the PCs she has in her classroom. She types in the URL of the site where a consortium of publishers offers a service to create customised multimedia presentations on the basis of a variety of texts, video fragments, audio fragments and images owned by the different members of the consortium. She answers some questions in order to enable the system to generate the desired presentation. She indicates, for example, that the presentation may take at most one hour, that at least the topics landscape, flora, fauna, fishing and islands must be covered and that important terms must be highlighted. Joris prefers images over text, and when he reads texts, concrete examples are a great help to him. Furthermore, Ellen knows that it is problematic for Joris to separate main issues from side issues. Therefore she indicates that the presentation should contain relatively many images, examples and summaries. Finally, Ellen indicates that Joris is 7 years old and that he is a moderate reader for his age. Then she clicks on the “generate”-button. After two minutes an icon appears. In the meantime she calls Joris and gives him some instructions. Then Ellen leaves Joris alone. Joris clicks on the icon to start the presentation. After the presentation, “De Telgenkamp” digitally pays 95 cents (50 cents to one publisher (for the text objects), 40 cents to another (for the images) and 5 cents to the consortium for using the service).

2.2 Adaptable multimedia

Current technology enables authors to create multimedia presentations by specifying which media objects should be included, when they should appear during playback and their position on the screen. While this enables the creation of presentations, the author has no support for any but the most low-level of details.

The long-term goal of the proposed research is to allow the scenario, as sketched above, to be carried out in a fully automated environment. Annotated items in a database are selected on the basis of semantic relevance and co-ordinated together to form an informative and aesthetically pleasing presentation. A shorter term aim is to gain experience with the generation process and automate those parts which can already be automated and explore those parts which, as yet, cannot. The work in this project is specifically oriented towards taking a practical scenario and putting together parts of the complete presentation generation chain, based on various simplifying assumptions and to show that the approach is feasible.

Firstly, we have to assume that multimedia objects and the accompanying metadata are made available by the publisher(s) that participate in the project (See Content-box in Figure 2-1). The specific semantics and form of the metadata falls within the research remit of the project. For example, exploration of the use of appropriate international standards, such as XML, RDF, IEEE/LOM or MPEG-7, will be carried out. Within this project we want to ensure that some minimal level of annotation is carried out so that a choice of media items is available for a particular information need.

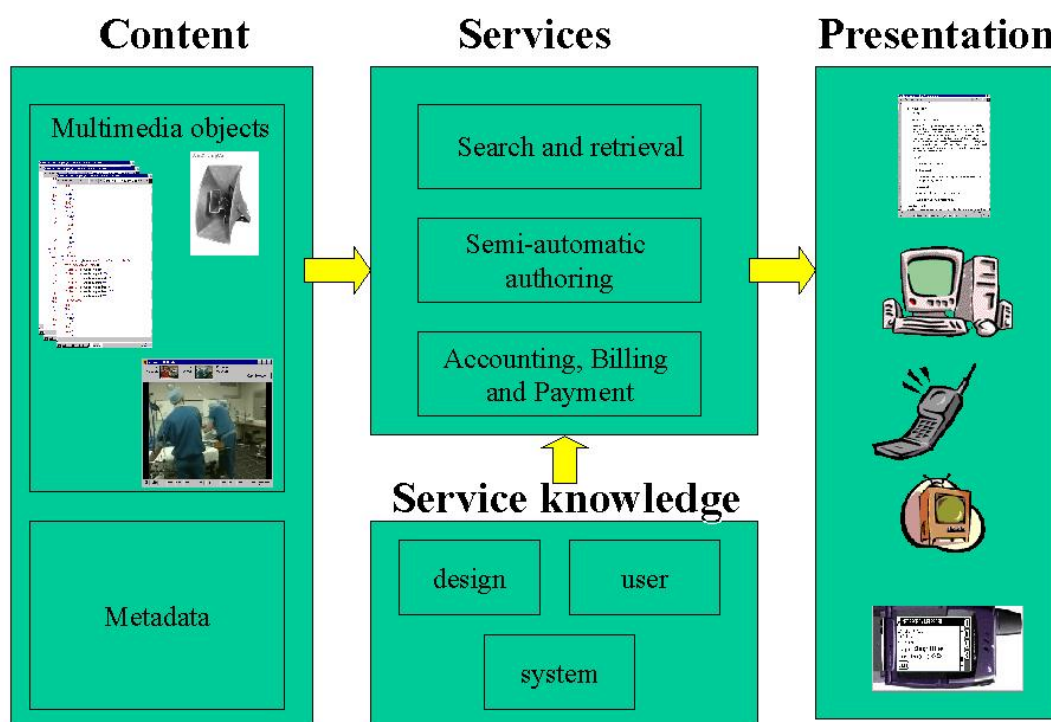


Figure 2-1: Important aspects for AMULED

While metadata are necessary for selecting relevant items, these are insufficient input for generating a coherent presentation. Extra information on the rhetorical structure of the piece is required, and rhetorical annotations may be required in the database (See Service-knowledge-box (design) in Figure 2-1). For example, a particular piece of film may be more appropriate as an ending to a presentation than as an introductory scene.

The presentation generated needs to be appropriate for the end-user, e.g. for media preferences, for the type of display device they have (from telephone to small-screen display to high-end PC), and their level of knowledge. To take these variances into account a model of the user (i.e. user profile) has to be created and used within the presentation generation process database (See Service-knowledge-box (user) in Figure 2-1). For the scope of this project we intend to keep the user profile simple to emphasise selecting among profiles, rather than exploring the expressibility of the user profiles

themselves. An implication of this is that media items relevant to a single information need should be available for at least two different user profiles.

In addition, the presentation should be able to adapt to the end-user platform and media preferences of the user, using, e.g., W3C specification such as XSL database (See Service-knowledge-box (system) in Figure 2-1). The tools and processes are based on a declarative document model, separating issues such as structure, content and style.

The presentation that is generated as output of the system should make use of currently available international specifications such as those produced by W3C (e.g. XML, SMIL) and ISO (e.g. MPEG-4).

The services in the Services-box in Figure 2-1 are discussed in some more detail in Chapter 3.

3. Project approach

The target group of AMULED is primary school pupils. The reason for this focus is the fact that students of this age (four through twelve) differ considerably with respect to text or image orientedness, reading speed, preferred learning approaches etc. The project is performed in co-operation with SLO, teachers and publishers. In consultation with these parties one or two subjects are selected for which a set of information objects (i.e. texts, audio, video, images) is built.¹ Subsequently, it needs to be determined in what respect presentations on the chosen subjects may need customisation, in order to optimise the added value for the pupils. Also this needs to be done in close consultation with SLO, teachers and publishers. Furthermore, interviews with teachers and publishers will make explicit wishes with respect to user interaction.

In an early stage of the project, state-of-the-art research with respect to (metadata) standards, authoring languages and tools, multimedia players, user modelling and accounting, billing and payment needs to be performed in order to determine which approach is most suitable for the educational setting. The next step is the development of a model for the generation of customised multimedia documents for educational purposes, including a metadata model. In the document model, aspects such as structure, content and style play a central role. In the metadata model, aspects such as user profiles, system profiles, and billing and accounting information may be covered.

Subsequently, a prototype of a semi-automatic authoring environment for customised multimedia documents is developed. Initially a demo is built. The demo will be used for user experiments that test the appropriateness of the document model and the interaction design. The results of this experiment will be taken into account in the development of the prototype. The first version of the prototype will allow the user to search a set of multimedia objects and to use the retrieved objects in a presentation. In the searching process, customisation information such as user preferences is taken into account in order to generate precise and appropriate search results database (See Services-box (Search and retrieval) in Figure 2-1). The presentation is prepared by the teacher in a user-friendly editor which provides templates for different presentation styles and structures. In the second version of the prototype, teachers are in addition able to let the system automatically generate a presentation database (See Services-box (Semi-automatic authoring) in Figure 2-1). Also here customisation information plays an essential role in order to let the system generate a presentation that is appropriate for the type of pupil or the type of context the teacher has in mind. The teacher is able to manually edit the automatically generated presentation. Accounting, billing and payment aspects will play a central role in the final prototype (see scenario).

¹ For instance, depending on which topics are suitable for transfer by video or animation and depending on earlier activities with digital content of the publishers.

In the last phase of the project a generalisation of the model is made, in order to make it applicable in a wider variety of contexts.

AMULED has a runtime of two years. The needed resources are 4 fte per year. The planning is as follows:

Year 1

Cycle 1: Orientation and development of a model for customised multimedia documents for educational purposes (concept version). (Moreover, in this cycle the publisher(s) will have to prepare a minimal set of multimedia objects, which can be extended during the following cycles.)

Cycle 2: Further development of the model (final version) and preparation of a demo version of the final environment that can be used in user experiments. (Moreover, in this cycle the publishers will have to provide their multimedia objects with metadata according to the model.)

Year 2

Cycle 3: User experiments and development of a prototype of a semi-automatic authoring environment for multimedia documents (first version: searching and authoring environment).

Cycle 4: Further development of the prototype (second version: semi-automatic authoring environment) and making a generalisation of the model for applicability in a wider variety of contexts.

The fte's and the tasks mentioned above will be divided equally between CWI and the Telematica Instituut.

Division of tasks:

- SLO will act as educational advisor during the development of a model for customised multimedia documents for educational purposes.
- The publisher(s) will have to prepare a set of multimedia objects including metadata. Furthermore, the publisher(s) will contribute to the development of a model for customised multimedia documents for educational purposes.
- The schools will contribute to the document model and the prototype by means of interviews and user experiments.
- CWI will contribute to the document model and the prototype. Furthermore, CWI will make available to this project a software framework for (semi-) automated hypermedia presentation generation. This allows different types of information to influence the presentation generation process in specific and controlled ways. This is enabled through the use of modules which can be instantiated to specify, e.g., user characteristics, end-user platform characteristics, presentation design rules, meta-data about the content, access to the content for the particular application (see also appendix).
- The Telematica Instituut will contribute to the document model, the experiments and the prototype (including accounting, billing and payment aspects). Furthermore,

the Telematica Instituut will make available to this project knowledge and implementations concerning distributed services for content production and content deployment including a client's web-browser application with functionalities such as searching, browsing, viewing and editing video.

4. Relations with other projects

4.1 Links within CWI

Ongoing research projects at CWI are already investigating the production of hypermedia presentation by (semi-)automatic means. Current emphasis is on the use of constraints for generating presentations for different platforms (ToKeN2000), and the investigation of adaptation to network traffic (RTIPA) and the use of meta-data in the generation process (Dynamo).

More information on these projects can be found via:

http://dbs.cwi.nl:8080/cwwwi/owa/cwwwi.print_themes?ID=4

CWI is also involved with the XHTML and SYMM working groups of the W3C.

4.2 Links within the Telematica Instituut

Several projects at the Telematica Instituut cover topics that overlap with the topics covered in AMULED. Within GigaCE (GigaPort Content Engineering) tasks about authoring, metadata (indexing), user interaction, search and retrieval and architecture & platform may be of interest for AMULED. Furthermore within VIP (Video over IP) a distributed service for the use of video material for history education is being developed. Accounting, billing and payment are covered in GigaABP (GigaPort Accounting, Billing and Payment). In GigaMobile customisation plays an essential role. And finally, in MIKE (Migratie Kennisnet II) the (future) possibilities of Kennisnet are explored.

More information on these projects can be found via:

<http://www.telin.nl/Projecten/index.htm>

Telematica Instituut is also actively involved in the MPEG-7 metadata standardisation initiative.

Appendix: Status of the research at CWI

CWI has developed a software framework for (semi-)automated hypermedia presentation generation. This framework allows different types of information to influence the presentation generation process in specific and controlled ways. This is enabled through the use of modules which can be instantiated to specify, e.g., user characteristics, end-user platform characteristics, presentation design rules, meta-data about the content, access to the content for the particular application.

The architecture of the generation process is split into 5 processes (See Figure 0-1). CWI as been investigating these processes "bottom-up", that is we are already able to generate final-form presentations, have investigated the use of quantitative constraint solving systems and are currently investigating the qualitative constraint processing layer. In addition to the current implementation work on these layers, we are also involved in conceptual work at the upper two layers. Namely, the translation of hypermedia communicative devices to (multi-dimensional) constraints and the use of rhetorical structure theory for deriving potential communicative devices.

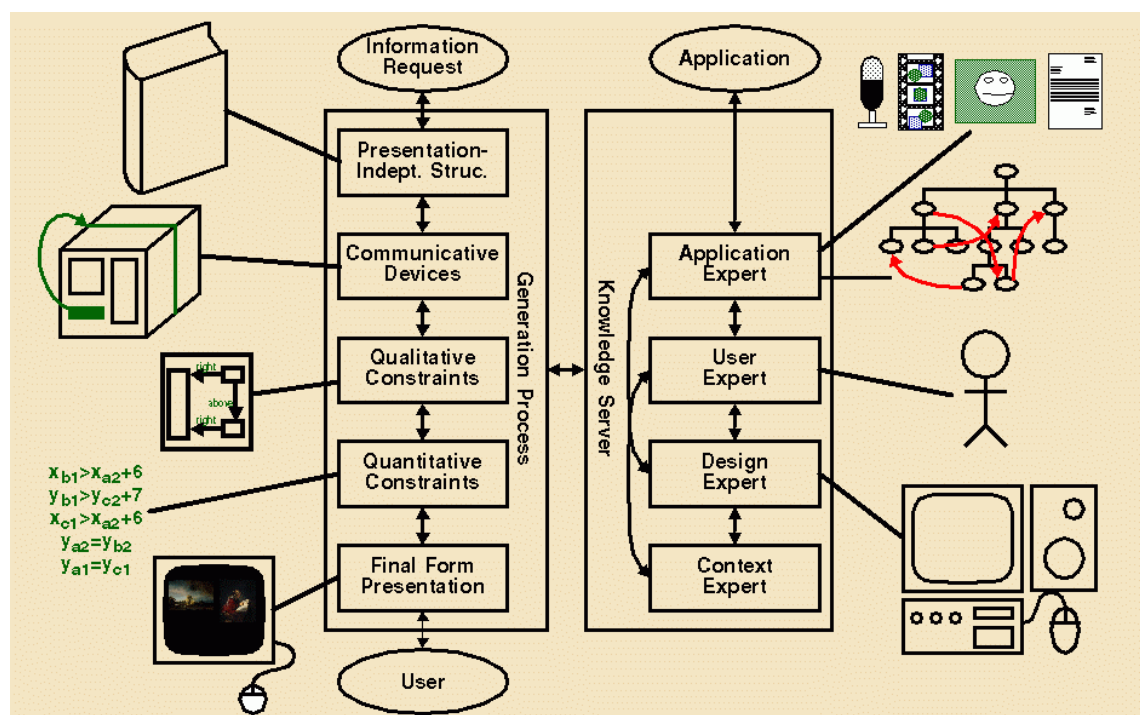


Figure 0-1: Architecture for the semi-automated presentation generation process

Through the work planned in the AMULED project, we also intend to "fill in" a number of the knowledge bases shown on the right-hand side of the figure, whose contents will influence the generation process.

At the time of writing we have not yet experimented with ways of influencing the generation process.