# The MAVA Approach

## Multimedia Authoring in Higher Education

Elisabeth Freydank
University Library of Stuttgart
*elisabeth.freydank@ub.uni-stuttgart.de*
Pfaffenwaldring 55, D-70569 Stuttgart
www.ub.uni-stuttgart.de/ub/mava/devs/mava.html
*Keywords:* multimedia authoring, MAVA, document SYSTEM, multimedia

### Abstract

*The broadening use of multimedia documents and the need to apply them to the field of higher education increase the demands a multimedia document SYSTEM has to be tailored to.*

*Simplifying the production and presentation of multimedia documents in a user-friendly way is a precondition for the advancement of multimedia in higher education. Further requirements to a multimedia SYSTEM should be reusability and retrievability of documents, platform independence and an extensibility which allows to adapt the SYSTEM to application specific needs. Particularly in the field of education multimedia documents should be more than view-only animations and allow an active appropriation of knowledge by offering interactive functionality. Another property useful for an application of multimedia documents in higher education is database connectivity.*

*The multimedial document SYSTEM MAVA ("***M***ultimedia* **D***ocument* **V***ersatile* **A***rchitecture") meets these demands by using an accordant meta-document model as well as highly compatible internet standards like Java and XML. A MAVA user does not need programming knowledge at all since the SYSTEM contains an editor which allows editing a document by means of a graphic user interface.*

*MAVA documents can be displayed with minimal requirements at any time. Required media items are loaded dynamically prior to the presentation. Due to open interfaces the MAVA SYSTEM can be extended by additionally required application specific components.*

*MAVA was implemented and tested in a project conducted by the Institute of Parallel and Distributed High-Performance Systems (IPVR) of the University of Stuttgart in co-operation with the Library of the University of Stuttgart. The project was funded by the German Research Foundation (DFG) and has a successor project which aims to design and implement new extensions and to integrate MAVA into the libraries fulltext SYSTEM OPUS (Online Publications of the University of Stuttgart).*

## Introduction

The usage of multimedia presentations to entertain internet users and to draw their attention to advertising messages is certainly widespread. But multimedia has potentialities, which are far beyond these fields of application.

The possibilities of providing and transporting information are more comprehensive than those of textual or static documents. Especially in the field of education and research the quality of knowledge transfer can be increased by the variety of media which can be integrated into a digital document. If we account for the existence of expert knowledge which either cannot be imparted by static documents at all or at least only by a rather imperfect representation - as it is, for instance, in the field of performing arts - we can assert that multimedia documents should be considered being more than illustrating addenda to textual publications. They could be serious publications themselves, used to impart highly specialised contents of heterogeneous fields of science, stored in digital libraries and accessible via internet.

Thus an application in the field of higher education produces some demands a multimedia document SYSTEM has to be tailored to.

## What is MAVA?

MAVA ("Multimedia Document Versatile Architecture") is a multimedia document SYSTEM, which was implemented and tested in a project conducted by the Institute of Parallel and Distributed High-Performance Systems (IPVR) of the University of Stuttgart in co-operation with the Library of the University of Stuttgart. It is based upon the Java Media Framework and entirely written in Java for a JRE version 1.4.0 or higher.

MAVA is made up of an editing and a presentation tool which can be used independently from each other. By means of an editor a user can define the media items he wants to integrate into the document, such as images, movies, sounds, textual elements, panoramic views etc. The user also has to define the location of the media items, their properties and the relations they have to each other. These relations are represented by operators - a temporal relation between two media items can for instance be described by a *while*- or a *before-end-of-operator,* a spatial relation by an *above-*, a *behind-*, an *in-front-*of-operator and so on.

Application specific needs require specialised concepts, which are represented by managers. A set of specific operators is allocated to each manager [Hauser 03]. An interactive travel guide for instance would consist of a set of elements like a touristic map and operators, which define interesting locations on it. The manager is the functional unit which encloses them and controls their co-operation.

By saving the document MAVA generates a file which contains the document description. Now the presentation tool has to read this file and to transform the information contained into a presentation which can be played back either locally or as an applet in a Java enabled browser.

But how does the meta-document model of this authoring SYSTEM look like? Any information concerning elements and structure of the multimedia document is described and stored in an XML file [Hauser 01b/c]. Since the meta-document model allows a nesting of information, a user can build complex presentations of widely user-defined depth. Another part of the meta-document model we should mention is the XML-representation of document specific metadata, which follows the Dublin Core Metadata Standard [Hauser 01a].

The meta-document model and the use of Java cause some specific properties of the MAVA approach meeting demands on a multimedia document SYSTEM. This paper will discuss them now in more detail.

## General demands on a multimedia document SYSTEM

### User friendliness

There are some general needs a multimedial document SYSTEM should meet - no matter which field of application is regarded. A main demand to any software is, of course, user friendliness. It would accommodate an average user if a software allows to build multimedia documents without any knowledge of programming languages. Thus MAVA contains an editor which allows editing a document by means of a plain and self-explanatory graphical user interface. As figure 1 shows, each element of the presentation is represented by an icon and connected with other elements by a line. Except for properties of media items and operators as well as meta-information about the document, which are both textual, the whole document can be built by the drag-and-drop method.

### Reusability

Another general demand is the reusability of documents. To reuse parts of a document later and in another context would make authoring more effective. The MAVA approach meets this demand by using XML as a basis for the document model. The possibility to nest information on the structure of the document allows an encapsulation of functions and, at last, the reusability of any information on the document. All the user has to do is to save the information he needs as template and to import it into a new document [Hauser 01c].

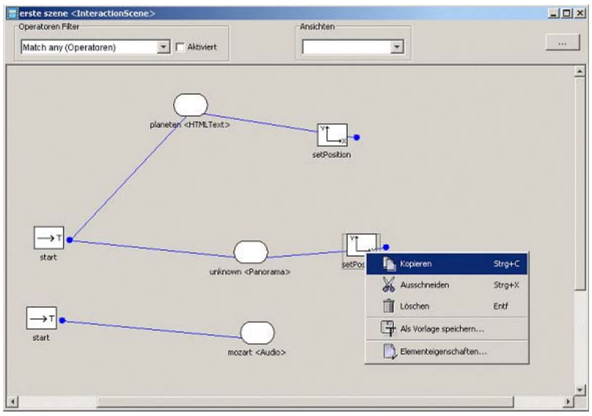


*Figure 1: Media items and operators - The user interface of the MAVA editor*

## Special demands on a multimedia document SYSTEM in the field of higher education

### Extensibility

Some qualities a multimedia document SYSTEM should have are particularly desirable for an application in the field of higher education.

Considering the lack of personal and financial resources educational institutions often encounter we can affirm that a multimedia document SYSTEM should enable users to build documents with minimal financial, personal and temporal commitment. Moreover the SYSTEM has to offer functions to integrate highly specialised contents of heterogeneous fields of science. Therefore a demand to both the authoring and the presentation SYSTEM is their extensibility. If a document requires application specific functions which the SYSTEM does not offer yet, it should be possible to add them subsequently and dynamically. [Hauser 03].

Thus MAVA has to integrate various application specific concepts. The document model of MAVA as well as the presentation SYSTEM support this extensibility. XML as document format does not have a fixed set of elements as, for example, HTML, and thus it can be extended by any element required. Moreover, the dynamic class loading mechanism of Java also supports the extensibility of the application and allows to load required functions easily and at runtime. All the user has to do is to select the functions he needs by means of a dialog.

After all, the extensibility of MAVA does not only concern new functions, but new media formats too; different viewers for one media item can easily be provided.

## Interactivity

The specifics of user interactions normally depend on the particular field of application, but there are some functions generally useful for didactical documents. One of them is the possibility to modify the presentation's runtime behaviour by user interactions. This is, of course, essential to navigate within a multimedia document, and it renders a multimedia document being more than a simple and straightforward animation. MAVA meets this demand by a concept which allows answering a mouse event by invoking any other scene of the presentation (cf. Fig. 2).

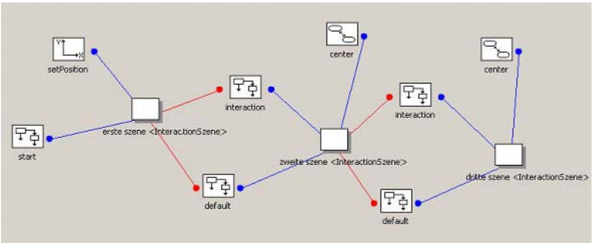


*Figure 2: Modifying the runtime behaviour - Visual representation of the interaction concept*

Computer based training is another field for which user interactions are fundamental. To appropriate knowledge in an active way increases the didactical benefit the user has. This purpose causes a set of features, which allow to impart knowledge, e.g. simulations, tests and didactical games, by the means of an interaction between user and document. This necessitates that the authoring SYSTEM provides the functionality to realise such concepts or that it can be extended by it. For this purpose MAVA offers for instance a concept which provides various types of questions. It depends on whether an answer is correct or false how the presentation continues.

In addition to interactions which influence the sequence of the presentation we also need user interactions to control the behaviour of single media items, to rotate a three-dimensional object by a mouse drag, to start and stop a movie etc. The character of these interactions basically depends on the field of application.

## Database connectivity

Another function useful for digital publications in the field of education and research is database connectivity. It is often required to integrate structured data into a document. This can be achieved by a database interface, which allows to store data and document description separately from each other.

The advantages a database interface has are obvious: If the data which various documents use are stored on a central location the consistency and up-to-dateness of the documents are guaranteed. It is possible to share a database with internet applications of completely different character, to protect data against unwarranted access, and to update the data displayed in a document without having to edit it anew.

One of the fields database access is useful to is e-learning. Thus an online tutorial can integrate data of a knowledge base, for instance a dictionary or a lexicon. It can offer the opportunity to access data by a search function (cf. Fig. 3) or to insert new records into a database table.

Considering this aspect MAVA also benefits from the platform independence of the programming language Java: It is possible to display data from any database, which can be accessed by JDBC (**J**ava **D**ata**b**ase **C**onnectivity).

Another benefit of a database interface is a control of the user's access to the data the presentation needs. This restriction is useful either if the presentation needs data the user should not access at all, for instance if the document contains certifications or tests, or if the presentation demands different access rights for different users.

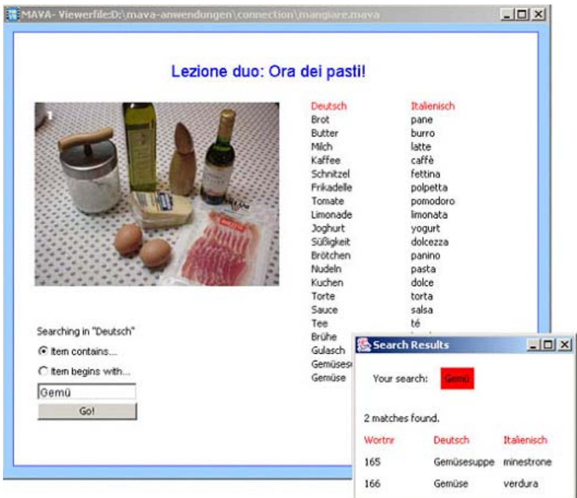


*Figure 3: Multimedial tutorial with integrated knowledge base and search function*

## Portability

The growing number of multimedia presentations and their longer-term use and value entails the necessity of storing these documents in digital libraries and accessing them via internet.

Unfortunately the author of an internet document has - in contrast to a document placed within a LAN - few information from which platform it will be accessed by potential users. At least since the rise of LINUX some years ago it makes few sense to rely on a monoculture of operating SYSTEMs. Both presentation and authoring SYSTEM should be portable. The document format should, of course, support this by using platform independent standards. Therefore MAVA bases on Java and XML, which are conceptualised especially for the use within the web. XML is a database-neutral and device-neutral format, and applications written in Java conform to a well-defined and widely accepted API. They are highly portable across operating SYSTEMs, and a Java runtime environment is available for nearly every platform.

**Retrievability**

An archival storage of a multimedia document requires the retrievability of its content. This can be realised by a suitable meta-document model. Another demand is that multimedia documents could be integrated into existing document SYSTEMs by a modicum of effort and by the use of interfaces the document SYSTEM provides.

The MAVA approach has a set of qualities which make it interesting for an application in the field of digital libraries. At first MAVA uses, as we already mentioned, highly compatible internet standards. To use them ensures a long-dated accessibility of the documents, and the portability and extensibility of the presentation SYSTEM renders it unnecessary to convert media items to other formats.

MAVA does not aim to support a retrieval of audio- and video data, but a textual retrievability of MAVA documents is provided by the use of standardised metadata [Hauser 01a]. The XML file does not only contain a description of elements and structure of the presentation but also metadata which render the document retrievable. Thus a user has the opportunity to search a SYSTEM using metadata properties - like "title", "author" etc. - as keywords. Since the meta-information model follows the Dublin Core Standard, a compatibility to other retrieval SYSTEMs like the fulltext SYSTEM OPUS (Online Publications of the University of Stuttgart) [Scholze 00] is guaranteed. A prototypic integration of MAVA into OPUS is aim of a current project which takes place at Stuttgart University Library.

## Conclusion

The MAVA approach meets the growing demands to multimedia document SYSTEMs in higher education by offering a plain and widely self-explanatory user interface, by basing on standards like Java and XML and by using a meta-document model which supports platform independence, reusability and retrievability of documents. It also supports an extensibility of the SYSTEM which allows to adapt it to application specific needs. Furthermore MAVA offers functions like interactivity and database connectivity which are not application specific but generally expedient for a use of multimedia in higher education.

We still do not know if multimedia will establish itself as a medium for scientific publications and if it will be secured by a binding copyright law. We also do not know how flexible graduation or diploma regulations will be in order to allow and advance multimedia theses and dissertations. But we certainly can assume that the spread of multimedia for e-learning purposes will increase. Due to the advantages of the MAVA approach we can anticipate an enrichment of digital documents in higher education by an application of this multimedia document SYSTEM.

**References**


[Bray 98] Tim Bray, Jean Paoli, C.M. Sperberg-McQueen (Eds.) : **Extensible Mark-up Language (XML) 1.0**, Working Recommendation, W3C, 1998

[Hauser 00] Jürgen Hauser, Frank Scholze, Uwe Albrecht "MAVA - Entwicklung und Integration eines erweiterbaren multimedialen DokumentenSYSTEMs" , **In:** Grenzenlos in die Zukunft 89. Deutscher Bibliothekartag in Freiburg im Breisgau 1999. Frankfurt 2000, pp. 57-69

[Hauser 01a] Jürgen Hauser und Frank Scholze "Integration und Verarbeitung multimedialer Dokumente in digitalen Bibliotheken - der MAVA-Ansatz" in BIT online, **Heft 1, 2001**, pp 35 - 41

[Hauser 01b] Jürgen Hauser "A Component-based Extensible Multimedia System " In: Proceedings of the International Conference on Parallel and Distributed Processing Techniques and Applications PDPTA'01, Las Vegas, 2001, pp. 1243 - 1249

[Hauser 01c] Jürgen Hauser and Jing Tian "Abstractions in Multimedia Authoring - The MAVA Approach " In: Proceedings of the 6. Eurographics Workshop on Multimedia, Manchester, UK, 2001 virtual.inesc.pt/egmm2001/proceedings/hauser.pdf

[Hauser 03] Jürgen Hauser : Erweiterbarkeit multimedialer DokumentenSYSTEMe zur dynamischen Anpassung an anwendungsspezifische Anforderungen, PhD, Stuttgart (to appear 2003)

[Scholze 00] Frank Scholze : "Einbindung elektronischer Hochschulschriften in den Verbundkontext am Beispiel OPUS " In: Beate Tröger (Hrsg.), Wissenschaft online: Elektronisches Publizieren in Bibliothek und Hochschule. Frankfurt, 2000, pp. 406 - 420

[Steinmetz 00] Ralf Steinmetz : Multimedia-Technologie, 3. Aufl . Berlin, 2000