MADEUS: an Authoring Environment for Interactive Multimedia Documents

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Abstract:

We present Madeus, an authoring environment for interactive multimedia documents. Madeus' aim can be summed up in the following statement: high temporal expressivity must not be reached to the detriment of a user-friendly interface editing approach. We provide the author with a declarative and hierarchic specification language based on an extension of Allen’s algebra. Static temporal checking and dynamic scheduling are based on an extension of temporal constraint networks.

Multimedia documents compose in time and space different types of elements like video, audio, still-picture, text, synthesized image, etc. Interactive multimedia documents aim at transforming the reader from passive (he cannot interact with the document presentation) to an active one.

Our goals is to design an authoring environment for interactive multimedia documents [4, 5]. We set the following ambitious targets for our projects:

- a large set of possible temporal scenarios with local interactions and hyperlinks;
- a user-friendly interface allowing highly interactive and fast design process by direct manipulation of the document components;
- a static analysis of the document specification to prevent temporal inconsistencies;
- a portable document format which eases multimedia documents interchange;
- an efficient presentation layer which handles the different presentation services as well as the distribution of media objects all over the network;
- a link with a multimedia database server to help the author to find the basic components of his documents and to allow a document to be dynamically update.

We have currently made two important choices: firstly, to provide the author with a declarative and hierarchic specification language of multimedia documents based on an extension of Allen’s interval operators [11]. It is important to note that in our proposition, the temporal structure of the document is not strongly related to its hierarchic decomposition. In other words, we do not use a tree structure in which nodes are labelled by temporal operators, since it is known that this solution restricts the set of possible temporal scenario; secondly, to use an extension of temporal constraint networks to manage the temporal scenario of a document. Moreover, we define a general architecture of a prototype called Madeus [4] to demonstrate the validity of the two above-mentioned choices.

The reasons why we based our approach on the Allen’s algebra are numerous. The three major ones are: first, this is an intuitive way to specify the temporal scenario of the document since the author declares what he wants but not the way to compute the solution. Moreover it is not the author who computes the exact duration of each object but this is the job of what we call a temporal formatter by analogy with a spatial formatter; second, it is well suited to the incremental nature of the editing process: a declarative specification is easier to modify than an imperative one. Moreover, associated algorithms to detect inconsistencies and to find consistent solutions have been studied for a long time by the Artificial Intelligence community [3, 9] and have quite good time performances; finally, it is possible to define a textual declarative format which is platform independent.

At a first glance using Allen’s algebra for editing multimedia documents can be considered as a simple application of well known theoretical results. Unfortunately, this is not the case. Allen’s algebra has been defined to manipulate intervals with statically known durations, whereas multimedia documents requires the manipulation of intervals with statically unknown durations. For instance, the time elapsed between the moment when an interaction button is activated and the one at which it is really pressed is only known at the presentation time. The presence of this kind of intervals modifies the classical definitions and algorithms used in the domain. Moreover, Allen’s algebra does not provide the author with “interruption” like operators. This is why we have to extend the set of operators and the way this two kind of operators (Allen’s operators and interruptions) are mixed is not so trivial as far as the semantic of the language is concerned.
Our work about multimedia documents began three years ago. Its current state is the following: we know exactly where are the difficulties of the approach we take. We make a global proposition in terms of language, static analysis and dynamic scheduling. For each of these aspects, we know the advantages and the drawbacks of our solution. We are currently working on defining the formal semantics of the language. The difficulty of the static analysis whose aim is to prevent temporal inconsistencies in the specification appears with the introduction of unpredictable objects as user-interactions. We propose a first solution based on an extension of constraint propagation algorithms. This solution is not complete, but we suspect the whole problem to be NP complete. However, we already have some ideas in order to improve our solution. Our prototype provides us with the skeleton of a real running application that can be developed incrementally. It is already possible to build and present non trivial interactive document. We plan to collaborate with a data base research team in order to study how our environment can be connected to a multimedia objects server. We also work on the graphical visualisation of the global behavior of a temporal scenario in order to help the author in his editing phase. It would be the first step to reach in order to have a user-friendly interface providing the author with direct manipulation facilities.

Our work could be compared to the following ones: Firefly[2] Cmifed[8], and Isis[7]. The last one is the closest one since it takes the problem of temporal formatting as a central issue but does not consider real-duration of objects and local interactions (only hyperlinks are provided).

We know that a lot of work has to be done in order to reach our ultimate goal, but our first theoretical and practical results give us some reasons to think that we are on the right direction. One proof is that the WWW Consortium takes an interest in our work as a solution to extend HTML to support temporal synchronization.


