Multimedia Synchronization
- Position Statement -

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Interactive distributed multimedia-documents enable a forward-looking combination and presentation of various information forms such as video, audio, text, graphics and are applicable in many areas. To guarantee a high-quality presentation over the network, synchronization mechanisms are necessary to render such a document as intended by the author. In this context, there can be distinguished between two levels of synchronization: The scheduling and the stream synchronization level. On the stream level, fine-grained synchronization mechanisms are necessary to guarantee the synchronization of the data streams, e.g. on the level of lip synchronization. Synchronization on the scheduling level has to assure that the media items are started, stopped and manipulated on time. Therefore, it applies coarse-grained synchronization mechanisms. Consolidated synchronization mechanisms at stream-level already exist, but there is a need for synchronization mechanisms on the scheduling level, especially for interactive presentations. In this context, we are interested in representation of time and synchronization aspects on authoring level and on synchronization techniques needed to render interactive distributed documents.

When composing a multimedia-document, authors have to specify scheduling and stream synchronization constraints. We developed an interval-based temporal model a temporal specification can be based on. This model allows to represent all relevant temporal relations that occur in multimedia documents. Temporal extents which are necessary to perform a presentation can be indefinite at authoring level. Thus, the model allows to define temporal durations in an indeterministic manner. There might be presentation parts whose interrelations are not definite at authoring time. Therefore, the temporal model integrates indeterminism to ensure the flexibility of created documents. It is possible to specify partial restrictions of the relations and leave the selection of the best relation to the system. Interaction is a crucial topic in enhanced multimedia presentations. Therefore, the temporal model is not only representing temporal relations but also integrates temporal interaction. It is possible to model synchronous and asynchronous interaction. With synchronous interaction, the system waits for user input. Asynchronous interaction occurs when the user intervenes in the running presentation. A specification must be unambiguous. For any specified relation, the system has to known whether it is mandatory or optional. Usually, mandatory relations have to be specified explicitly. Optional relations give the presentation system the choice to meet the relation or realize a different relation. Therefore, the presentation system is more adaptable to other constraints, e.g. resource limitations. With our temporal model only mandatory temporal relations have to be specified.

Especially, adding interaction to multimedia titles makes their temporal layout quite complex because the user might interfere with the presentation at any time and the temporal layout of a multimedia title varies for different executions of the title depending on the instants and forms of user interaction. Therefore, flexible synchronization techniques are needed to guarantee the specified synchronization constraints when interaction occurs. In contrast to synchronization of non-distributed multimedia documents, synchronization mechanisms for distributed multimedia-titles have to cope with the problem of highly indeterministic delays during the start-phase of the presentation of media items because of the variations in the start-up times of the software components in a distributed system. Thus, the crucial problem is to determine the preparation time of a media stream such that the correlated synchronization constraints are met. Existing synchronization schemes and architectures mostly deal with modeling of the multimedia synchronization problem without taking into account resource limitations. But with limited storage facilities or tight playout deadlines (e.g. in case of user interaction) the performance of the subsidiary supporting system must also be considered. Thus, methods to adjust the preparation to the dynamically changing resources (e.g. buffers for prefetching media data) have to be applied. Currently, we develop such synchronization techniques.