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An XML-Based Approach to Multimedia Software Engineering for Distance Learning

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ABSTRACT

Multimedia Software Engineering (MSE) is a new frontier for both Software Engineering (SE) and Visual Languages (VL). In fact multimedia software engineering can be considered as the discipline for systematic specification, design, substitution and verification of visual patterns. In this paper we concentrate on the first of these possibilities, distance learning. One aim of this paper is to demonstrate how it is possible to design and implement conplex multimedia software systems for distance learning using a Teleaction Object transformer based on XML technology applying a Component-Based Multimedia Software Engineering approach. The paper shows a complete process of dataflow transformation that represents TAO in different ways (text, TAOML, etc.) and at different levels of abstraction. The transformation process is a reversible one. A component-based tool architecture is also discussed.

Keywords:multimedia software engineering; distance learning; XML technology

INTRODUCTION

For many years the need to represent data in a portable format has grown in the industrial and in the academic community. In the past, data was kept in a format that couldn't be read by a different computer and the applications couldn't be run under different operating systems or on other hardware platforms. Today, with the spread of computer networks, it is necessary to support portability and interoperability so that data can flow through many networks in a way transparent to the user.

Once data is represented in a portable way, it is easy to transform it for specific uses. For example, during its route from sender to receiver, data may be represented several times at different levels of abstraction so that it can be easily handled by the software or hardware devices and transmitted across the network (Maresca, 2000a). Often information or

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data are used as representations of other information in order to support reuse. This concept of information that describes some other information is known as *metadata*. Using metadata, it is possible to take a structured document, parse it, and store the contents in a database or an application, local or remote. In this way, the document assumes an exchangeable structured form in which all parts of it may be reused. Metadata also supports resource discovery. This concept can be extended to all textual and multimedia applications. In this context it's easy to understand why XML (Bray) has become widely accepted as a new generation of languages that has promoted data and application portability with the possibility to use them on most browsers, offering moreover the possibility to handle information exchange in a better way for the Internet. It's natural to think that the advantages offered by Software Engineering and XML could be immediately tested in Multimedia Software Engineering. It's worth remembering that Multimedia Software Engineering is really a new frontier for Software Engineering as well as Visual Languages. In fact Multimedia Software Engineering can be regarded as the discipline for systematic specification, design, substitution and verification of patterns that are often visual (Chang, 2000). Visual languages give contribution to Multimedia Software Engineering such as: visual notation for software specification, design and verification flow charts, E-R diagrams, Petri Nets, UML visualization, visual programming languages, etc. The good news is that we can apply software engineering principles to the design of multimedia systems (Chang, 2000). At this point we can start experimenting with multimedia methodologies, techniques and languages. But first we must ask ourselves: "What is multimedia?"

Multimedia Software Engineering

In Chang (2000) *multimedia* was defined as composition of two components: *multiple media* and *hypermedia.*

*Multimedia = Multiple Media + Hypermedi*a.

Multiple media means different media (audio, video, text, etc.) while *Hypermedia* means objects + links.

The definition contains the conceptual model for multimedia software engineering applications: the *multimedia language*.

A multimedia language is a language where the primitive objects can include media types and where the operators include spatial and temporal operators. We think that four fundamental aspects describe a multimedia language:

- **Syntactic**. A multimedia application is constructed from a collection of multimedia objects. The primitive objects can include media. The complex multimedia objects are composed of these primitive objects and in general are of mixed media type. The syntax of a multimedia language describes how the complex multimedia objects are constructed from the other multimedia objects. Spatial and temporal composition rules must be taken into consideration.
- **Semantic**. Multimedia applications nowadays are seldom passive. A static