ONTOGRAPHY-BASED MULTIMEDIA AUTHORING AND INTERFACING TOOLS

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Abstract.

This demonstration session intends to present the tools developed by the CULTOS (Cultural Units of Learning – Tools and Services) project (IST-2000-28134), for the implementation of hypertext based intertextual studies’ knowledge cases about the European culture. For the needs of the demonstration an ontology will be implemented, consisting of concepts (entities, objects, events, processes, goals, and results), instances (occurrences of concepts) and relations between them, as well as multimedia threads, that reference the ontology on the one hand, and designated segments of multimedia objects on the other. The tools built can serve non-technical users in other scientific domains to implement ontologies and knowledge-aware multimedia threads. CULTOS tools that will be demonstrated are: (a) designer tools (ontology builder and authoring tool for multimedia threads) (b) interfacing technologies, in order to assist third parties to take advantage of CULTOS technology (EMMOs – Enhanced Multimedia Meta Objects to map relationships between multimedia objects into navigable hypermedia structures and Transformers - meta-translation systems for generation of translators from declarative specifications) and (c) end-user tools for viewing EMMOs.

1. Introduction

1.1. From hyperlinks to third generation multimedia authoring tools

Hypertext (Nelson, 1987) refers to a nonlinear system of information browsing and retrieval that contains associative links (hyperlinks) to other related documents. When in addition to text, other forms of content communication media, such as sound, images, video etc., are introduced, the term hypertext is transformed to the term hypermedia. Authoring tools are used in order to materialize those hypermedia links.

First generation Web-content encodes information in handwritten (HTML) Web pages. Second generation Web content generates HTML pages on demand, e.g. by filling in templates with content retrieved dynamically from a database or transformation of structured documents using style sheets (e.g. XSLT - Extensible Stylesheet Language Transformation). Third generation Web pages make use of rich markup (e.g. XML) (Bray et al., 1998) along with metadata (e.g. RDF – Resource Description Framework) schemes (Lassila and Swick,
to make the content not only machine-readable but also machine processable, a necessary pre-requisite to the Semantic Web (Berners-Lee et al., 2001).

Third generation authoring tools for knowledge workers are therefore needed in order to introduce hypermedia links to the Semantic Web and since this hyper-linking process usually involves only parts of the hypermedia involved (a portion of a video, sound, image, text, etc.), this is also a basic requirement from third generation authoring tools, in order to avoid data redundancy.

1.2. Multimedia threads

A Multimedia thread is a collection of third generation web pages serving a specific need. A thread could be a specific web site serving the needs of one organization or individual or purpose. So a thread consists of a knowledge repository, a content repository and the structures of the various web pages.

1.3. Ontologies

Multimedia threads serving the same or similar purposes, although they usually use different content repositories, they tend to use very similar knowledge based structures, since they are all dealing with similar entities. This collection “of categories of things that exist or may exist in some domain” is termed, according to Sowa (Sowa, 2000) an ontology. An ontology (Gruber, 1995) serving the general needs of a community is an upper ontology, whereas the ontology serving the specific needs of one thread is a lower ontology.

2. The CULTOS project (IST-2000-28134) tools

CULTOS is an acronym from the words Cultural Units of Learning – Tools and Services. The overall objective of CULTOS is to develop new knowledge-aware multimedia authoring and presentation tools for non-technical experts, for cross-media integration of cultural multimedia artefacts. This objective includes amongst other:

- Adaptation and development of designer tools for building knowledge models from ontologies (ontology builder) to multimedia threads (authoring tool) that support autonomous, portable meta-data objects.
- Specification and implementation of the properties of autonomous portable meta-data objects (Enhanced Multimedia Meta Objects - EMMOs).
- Generation of transformers for advanced information objects in order to communicate EMMOs to different application environments.
2.1. Knowledge-Based Multimedia Authoring

In order to arrive at a “semantic web” (http://www.semanticWeb.org), information technology needs to provide mechanisms that allow domain experts to express their knowledge, and combine that knowledge with medial presentations and illustrations. In a collaborative modeling phase, the experts (Seely-Brown and Duguid, 1991) define an ontology of concepts and relations. That ontology is made accessible to users (who may be the experts themselves) who then associate instances of the concepts and relationships with digital multimedia resources.

Knowledge-Based Multimedia Authoring is then, the filling up of a database with instances that reference the ontology on the one hand, and designated segments of multimedia objects on the other.

2.2. Ontology builder

K-Infinity is the tool Intelligent Views have developed for the creation, maintenance and use of a knowledge network (Carpenter, 1992). It offers the editor broad support for object-oriented knowledge modeling. The user benefits from a large array of opportunities to access and utilize the information network. K-Infinity features the following editorial components:

The Knowledge Builder is K-Infinity's main component. This tool allows the user to create, delete, rename and edit objects, as well as to set up relations between objects. This can be done in two different workspaces: (a) The Graph Editor and (b) The Concept Editor.

Along with the tools for editing the knowledge network, the editor needs organizational aids in order to structure daily tasks. The K-Organizer is designed to fill this need. The editor can use the K-Organizer to classify and group objects, either manually or through the use of given object properties.

2.3. The thread builder – Authoring tool

CULTOS Authoring Tool allows the authors of threads to carry out two tasks:

- Designing a thread in a top-down fashion
- Authoring a thread bottom-up, by associating segments of multimedia files to ontological concepts.
When a thread has been authored, it can be saved and re-edited, or it can be viewed, using the CULTOS Viewing Tool. EMMO Authoring happens when multimedia sources are associated with other multimedia sources using reference to the media files on the one hand, and references to the ontology on the other. EMMO authoring requires domain knowledge, but not much computer-specific knowledge. EMMO Viewing is the browsing of existing, pre-authored EMMOs.

The EMMO authoring tool is composed of four subcomponents:
1. Ontology Visualization Component
2. Several Media Editors (for text, images, audio, and video)
3. Command Palette (for housekeeping functions, search tools etc)
4. Tool “container” for the above subcomponents

**2.4. Enhanced Multimedia Meta Objects (EMMOs)**

The input and output of the value-chain supported by CULTOS tools are Enhanced Multimedia Meta Objects (EMMOs). As the main “unit of value”, EMMOs “encapsulate” meaningful relationships between multimedia objects and map them into navigable hypermedia structures. The content of an EMMO (CULTOS, 2000) is the set of explicit semantic relationships defined between the multimedia objects, and conforming to relevant interchange standards. This will enable users along the value chain to freely choose component tools, leading to a flexible authoring and publishing environment.
2.5. Semi-automatic generation of Transformers in CULTOS

It is foreseeable that formats for advanced information objects will continue to differ from each other. “Intelligent” applications will increasingly be required to be resilient to differences in syntactic format, when there is sufficient semantic overlap between the objects that are manipulated by the applications. In the case of threads, EMMOs carrying these threads will have to communicate with different application environments.

Rather than treating interoperation as a traditional “integration exercise” by writing ad-hoc wrappers, CULTOS uses recently developed meta-translation systems (a special class of attribute grammars) for semi-automatic generation of translators from declarative specifications.

The diagram illustrates how the multimedia repository, the knowledge database (the “home” of Thread-knowledge), the ontology database, the EMMOs and the transformers relate to each other. EMMOs are saved in the Knowledge Database (KDB) and refer to ontology (OntoDB) and media repository (MDB)
References