Implementation of RAMO-based Multimedia Applications on MPEG-4 Platform

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Abstract - This paper reports the implementation of the concepts of the Reactive and Adaptive Multimedia Object model (RAMO) via a guided review of its development process on a MPEG-4 rendering platform. The implementation of a simple iTV application is presented as well as a content animation engine. These activities have been achieved in the context of the ITEA Jules Verne project.

RAMO Model

Models for designing and developing enhanced adaptive multimedia applications are required to set up a creation and rendering framework. The Reactive and Adaptive Multimedia Object (RAMO) model [1] specifies a general approach to design and develop object-oriented multimedia applications. By benefiting from the OO paradigm, this Multi-Agent System-oriented design of multimedia scenes proposes an organization and execution model. It aims at offering new content creation opportunities to support enhanced digital services for Web & iTV consumers, with high interactivity and content adaptation capabilities. This paper presents first what the RAMO model consists in by reviewing its leading principles and concepts. Main features of the Systems part of the MPEG-4 standard [2] are then presented in conjunction with the implementation of our RAMO-based multimedia content adaptation and presentation engine. To illustrate our guided development process, the creation of a demonstrative MPEG-4 iTV application is finally reviewed.

The RAMO model promotes the build of dynamic multimedia presentations with new levels of interactivity and immersion of end-users. It specifies the design and development of applications based on autonomous and living objects, from their authoring up to their rendering. The complete framework addresses the Edit Once Publish Many (EOPM) paradigm. Focus is made on applications’ design and implementation.

The model proposes the setting up of applications as a composition of multiple multimedia scenes. Scenes are populated by RAMO objects, derived into two kinds: the Contextual and Embedded ones. The former are dedicated to enact multimedia contents and manage them, i.e., alteration of description data, multimedia contents, metadata, and of its own methods to be fully dynamic. They emulate self-animated entities via sensorial representations and life-like behaviors. Contextual objects are backstage managers of scenes. They articulate and support scene animations, e.g., supervision of objects interactions, retrieving of object properties’ correspondences for dynamic matching, user object management, lead of collective tasks, etc. Figure 1 shows how a multimedia application can be structured, i.e., as a composition of RAMO objects. Granularity, flexibility and reusability of RAMO components are inherent to this generic and modular organizational architecture.

Whatever their kind, RAMO objects rely on a common architecture, described in Figure 2. The audio-visual contents are media of any types and constitute the sensorial representation of objects in the scene. Metadata on contents enable enriching information and specifying parameters of object’s properties. Processors handle low and high-level behaviors animating objects evolution over time and through event-based scenarios. The cognitive layer achieves the AI perception-decision-action cycle from its available knowledge and methods. It handles object’s autonomous and enhanced behaviors as well as interactions with its surrounding environment composed of Contextual and Embedded RAMO objects.

Autonomous and cognitive RAMO objects could potentially make the choice to not respect some constraints and not have an expected behavior. [7] proposes a Multi-Agent model to specify and control behavior of RAMO objects.

To implement RAMO-based applications on iTV set-top boxes, the Multimedia Home Platform (MHP) and MPEG-4 platforms have been chosen. After a brief overview of the MPEG-4 standard, mostly the Systems part, we show how it is suitable for the implementation of multimedia applications using the RAMO model, and provide an illustrative example.
**RAMO-based MPEG-4 Application**

The MPEG-4 standard is a promising emerging standard for implementing object-oriented multimedia application. It is above all known for its high performance in audio-visual media compression. These parts correspond however to a limited set of specifications the standard covers to create advanced applications. Figure 3 shows parts we exploit to implement our RAMO-based applications. The Binary Format for Scene description (BiFS, [2,3,4]) is used for textually specifying scenes and objects audio-visual media, layout and animation properties. The MPEG-Java Application Programming Interface (MPEG-J API, [2,5]) allows to code components’ structure and executable routines. Media are encoded using the Advanced Audio Visual (AVC, [6]) format. The Thomson MPEG-4 content production and rendering toolkit has been exploited to achieve our developments. This toolkit is fully standard-compliant, handles all stream types, implements most of the standard features and moreover their MPEG-4 player renders latest Java MPEGlets functionalities.

![Core elements’ class diagram of the Hunting animation scene](image)

**CONCLUSION AND PERSPECTIVES**

The implementation of a RAMO rendering engine and applications with the MPEG-4 standard outlines their high-adequacy and relevancy to achieve enhanced interactive services. Ongoing research activities consist in integrating semantics’ description technologies, in addition to user profiles, contents and application-oriented metadata. It aims at self-describing object properties, roles, capabilities that could be dynamically interpreted, adapted to user and thus, enabling autonomous animation possibilities.

**REFERENCES**


