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Overview of the MPEG-4 Standard

Executive Overview

MPEG-4 is an ISO/IEC standard developed by MPEG (Moving Picture Experts Group), the committee that also developed the Emmy Award winning standards known as MPEG-1 and MPEG-2. These standards made interactive video on CD-ROM, DVD and Digital Television possible. MPEG-4 is the result of another international effort involving hundreds of researchers and engineers from all over the world. MPEG-4, with formal as its ISO/IEC designation 'ISO/IEC 14496', was finalized in October 1998 and became an International Standard in the first months of 1999. The fully backward compatible extensions under the title of MPEG-4 Version 2 were frozen at the end of 1999, to acquire the formal International Standard Status early in 2000. Several extensions were added since and work on some specific work-items work is still in progress.

MPEG-4 builds on the proven success of three fields:

- Digital television;
- Interactive graphics applications (synthetic content);
- Interactive multimedia (World Wide Web, distribution of and access to content)

MPEG-4 provides the standardized technological elements enabling the integration of the production, distribution and content access paradigms of the three fields.

More information about MPEG-4 can be found at MPEG's home page (case sensitive): http://mpeg.telecomitalialab.com This web page contains links to a wealth of information about MPEG, including much about MPEG-4, many publicly available documents, several lists of 'Frequently Asked Questions' and links to other MPEG-4 web pages. The standard can be bought from ISO, send mail to sales@iso.ch. Notably, the complete software for MPEG-4 version 1 can be bought on a CD ROM, for 56 Swiss Francs. It can also be downloaded for free from ISO's website: www.iso.ch/ittf - look under publicly available standards and then for "14496-5". This software is free of copyright restrictions when used for implementing MPEG-4 compliant technology. (This does not mean that the software is fee of patents). As well, much information is available from the MPEG-4 Industry Forum, M4IF, http://www.m4if.org. See section 7, The MPEG-4 Industry Forum.

This document gives an overview of the MPEG-4 standard, explaining which pieces of technology it includes and what sort of applications are supported by this technology.

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1 Scope and features of the MPEG-4 standard

The MPEG-4 standard provides a set of technologies to satisfy the needs of authors, service providers and end users alike.

- For *authors*, MPEG-4 enables the production of content that has far greater reusability, has greater flexibility than is possible today with individual technologies such as digital television, animated graphics, World Wide Web (WWW) pages and their extensions. Also, it is now possible to better manage and protect content owner rights.
- For *network service providers* MPEG-4 offers transparent information, which can be interpreted and translated into the appropriate native signaling messages of each network with the help of relevant standards bodies. The foregoing, however, excludes Quality of Service considerations, for which MPEG-4 provides a generic QoS descriptor for different MPEG-4 media. The exact translations from the QoS parameters set for each media to the network QoS are beyond the scope of MPEG-4 and are left to network providers. Signaling of the MPEG-4 media QoS descriptors end-to-end enables transport optimization in heterogeneous networks.
- For *end users*, MPEG-4 brings higher levels of interaction with content, within the limits set by the author. It also brings multimedia to new networks, including those employing relatively low bitrate, and mobile ones. An MPEG-4 applications document exists on the MPEG Home page (www.cselt.it/mpeg), which describes many end user applications, including interactive multimedia broadcast and mobile communications.

For all parties involved, MPEG seeks to avoid a multitude of proprietary, non-interworking formats and players.

MPEG-4 achieves these goals by providing standardized ways to:

1. represent units of aural, visual or audiovisual content, called “media objects”. These media objects can be of natural or synthetic origin; this means they could be recorded with a camera or microphone, or generated with a computer;
2. describe the composition of these objects to create compound media objects that form audiovisual scenes;
3. multiplex and synchronize the data associated with media objects, so that they can be transported over network channels providing a QoS appropriate for the nature of the specific media objects; and
4. interact with the audiovisual scene generated at the receiver’s end.

The following sections illustrate the MPEG-4 functionalities described above, using the audiovisual scene depicted in Figure 1.

1.1 Coded representation of media objects

MPEG-4 audiovisual scenes are composed of several media objects, organized in a hierarchical fashion. At the leaves of the hierarchy, we find primitive media objects, such as:

- Still images (e.g. as a fixed background);
- Video objects (e.g. a talking person - without the background;
- Audio objects (e.g. the voice associated with that person, background music);

MPEG-4 standardizes a number of such primitive media objects, capable of representing both natural and synthetic content types, which can be either 2- or 3-dimensional. In addition to the

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