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MPEG-A: A New Kind of MPEG Standard

Abstract:

This White Paper promotes the concept and the idea behind MPEG-A in general and Multimedia Application Formats (MAFs) in particular. To this end, the White Paper is published via the MPEG Web site. The document is targeted at people in MPEG who are not familiar with MPEG-A yet as well as at industry representatives who may not be involved with the MPEG standardization process.

1. The MPEG-A Standard

ISO/IEC 23000 (also known as "MPEG-A") is a recent addition to a sequence of standards that have been developed by the Moving Picture Experts Group. This new standard is developed by selecting existing technologies from all published MPEG standards and combining them into so-called "Multimedia Application Formats" or MAFs. MPEG-A aims to serve clearly identified market needs by facilitating the swift development of innovative and standards-based multimedia applications and services. This application driven process results in normative specifications of multimedia formats along with reference software implementation allowing interoperabilty on an application level.

2. The Rationale

Since 1992, MPEG has produced a sequence of standards for compressing multimedia data including audio and video compression (MPEG-1, MPEG-2 and MPEG-4). In contrast to media compression, MPEG-7 constitutes a suite of tools for meta-data representation describing the content of multimedia data. More recently, the group has developed MPEG-21, a framework to facilitate creation, distribution and consumption of Digital Items. Among other things, MPEG-21 includes standardized components which can be used by industry or industry consortia for the development of digital rights management systems facilitating interoperability.

In this suite of standards, MPEG-1 and MPEG-2 are two very successful examples; these technologies are used around the world in a number of large-scale consumer products (DTV, DVD, MP3, etc.). These two MPEG standards are somewhat vertically integrated standards serving the needs of clearly identified markets and industries. Therefore, most people – industry representatives as well as consumers –have a clear picture of how these standards can be used to create products.

During the work on MPEG-4, MPEG-7 and MPEG-21, experts have developed an incredible wealth of technologies, with technical quality and merit second to none. However, it has become increasingly difficult for the industry to master all the technical options and to evaluate their relative benefits.

In order for the industry to fully leverage the existing body of MPEG technologies, it is necessary for MPEG to deliver normative specifications to achieve interoperabilty on the application level and to offer guidance on how to use these MPEG standards in new and innovative ways. Multimedia

Application Formats provide this guidance by offering combinations of various MPEG technologies to address specific application scenarios.

In the past, MPEG has addressed the problem of providing solutions with scoped complexity by defining profiles. A profile in MPEG represents a subset of tools from a part of an MPEG standard (subset of the syntax) in order to carve out a part of the standard to arrive at an appropriate trade-off in terms of functionality and complexity for relevant classes of applications.

For example, in MPEG-2 Video there exists the "Main Profile", which represents a subset of the complete MPEG-2 Video specification and which is tailored to digital television services. Other examples for widely known profiles in MPEG are the "Simple Profile" or the "Advanced Simple Profile" in the MPEG-4 Visual standard or the widespread MP3 audio coding format, which is actually a subset of MPEG-1 audio coding. However, these profiles have always been defined within a specific standard, e.g. within MPEG-2 Audio or MPEG-4 Visual.

The concept of picking components from different standards and combining them with other technologies to arrive at industry specific specifications is not new at all. So far, industry consortia like the DVD-Forum, DVB, ISMA and ATSC have done this successfully. Consider the example of the ubiquitous DVD, which employs MPEG-2 Video while using non-MPEG technology for coding of multi-channel audio. The DVD is a commercially successful technology and has had a major impact on consumer electronics as well as on the content industry.

3. The Concept of MPEG-A

MPEG-A supports a fast track to standardization by selecting readily tested and verified tools taken form the MPEG body of standards and combining them to form a MAF. This approach builds on the toolbox approach of existing MPEG standards. This means there is no need for time-consuming research, development and testing of new technologies. If MPEG cannot provide a needed piece of technology, then additional technologies originating from other organizations can be included by reference in order to facilitate the envisioned MAF. Hence, a MAF is created by cutting horizontally through all MPEG standards, selecting existing parts and profiles as appropriate for the envisioned application.

Consider Figure 1, which provides an illustration of this concept. MPEG standards are represented by the vertical bars on the right, and profiles are represented by the bold boxes. Non-MPEG standards or technologies are represented as vertical bars on the left. A particular MAF uses profiles from each technology (the various colored boxes) and combines them in a single standard.

Ideally, a MAF specification consists of references to existing profiles within MPEG standards. However, if the appropriate profiles do not exist, then the experts can select and quantify the tools and profiles they believe are necessary to develop the MAF, which in turn provides feedback to the ongoing profiling activities within MPEG. It is also conceivable that the MAF process will help to identify gaps in the technology landscape of MPEG standards, gaps that may be mended subsequently by a new standardization campaign.

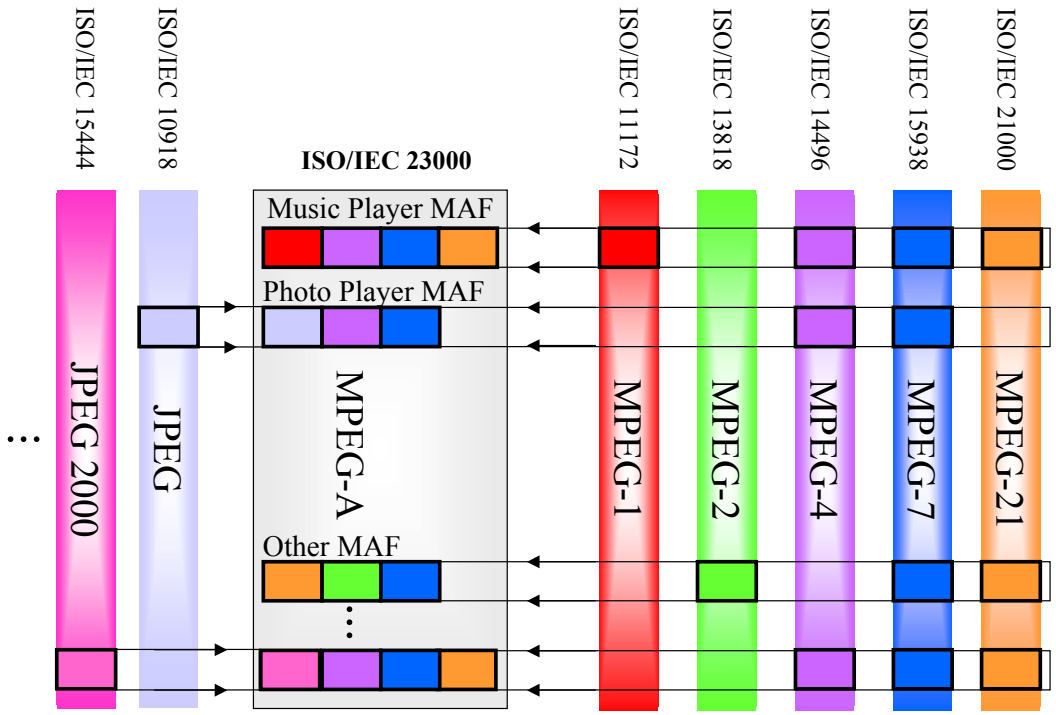

Figure 1: Conceptual Overview of MPEG-A

4. How to create a MAF

MPEG has created a process for the creation of MAFs, which takes into account the specific conceptual nature of this new kind of MPEG standard. The work items of this process are depicted in Figure 2 and will be explained in this section.

The work towards a new MAF starts with a submission that gives evidence that there exists a need to develop and standardize such a new application format. To this end, proponents are requested to provide documentation that describes an anticipated application scenario that benefits from the existence of an appropriately designed standard for a Media Application Format. It is important for the submission to include an assessment of the positioning of the proposal in the technology landscape, pointing to solutions that may already exist, whether they are standards-based or proprietary.

MPEG requests documentation of industry support to successfully complete the work and to deploy the candidate format. This information is an important aspect for the go/no-go decision to be taken by MPEG, and is intended to capture momentum for a proposed MAF. The list of MAFs under consideration for standardization will be regularly updated and published on the MPEG Web site (mpeg.chiariglione.org) in order to solicit input and comments as well as contributions from interested parties [2]. If MPEG determines that there is enough demand to warrant a MAF, then the pertaining application scenario description is used to derive requirements based on which a new MAF standard is drafted.

Furthermore, MPEG requests documented commitment from companies to create and release reference software for the MAF. Application scenarios, which are lacking this evidence of support, will not be promoted to MAFs. Commitment is expressed and support is documented in the form of registered MPEG input contributions.

Based on such documentation, the proponents, with the help of knowledgeable MPEG experts, select the technologies that the MAF shall employ to arrive at a detailed technical specification for the

MAF. It is expected that the chosen technologies will be advanced enough in their respective standardization process that they will be at Final Draft International Standard (FDIS) stage or beyond, once the MAF itself reaches FDIS stage.

Since all people involved with MPEG standardization want the world to know what's new and what's cool, MPEG requests commitment from the proponents to produce relevant marketing material, including at least one white paper explaining the benefits of the new MAF.

Finally, participating experts check the validity of the specification. This activity indicates the completion of the work for a new MAF. Cross-checking of multimedia standards is done by exchanging bit streams among different parties and by checking if bits, which were created by one party according to the new specification can be decoded and displayed successfully by another party using a decoder implementation which has been built according to the specification.

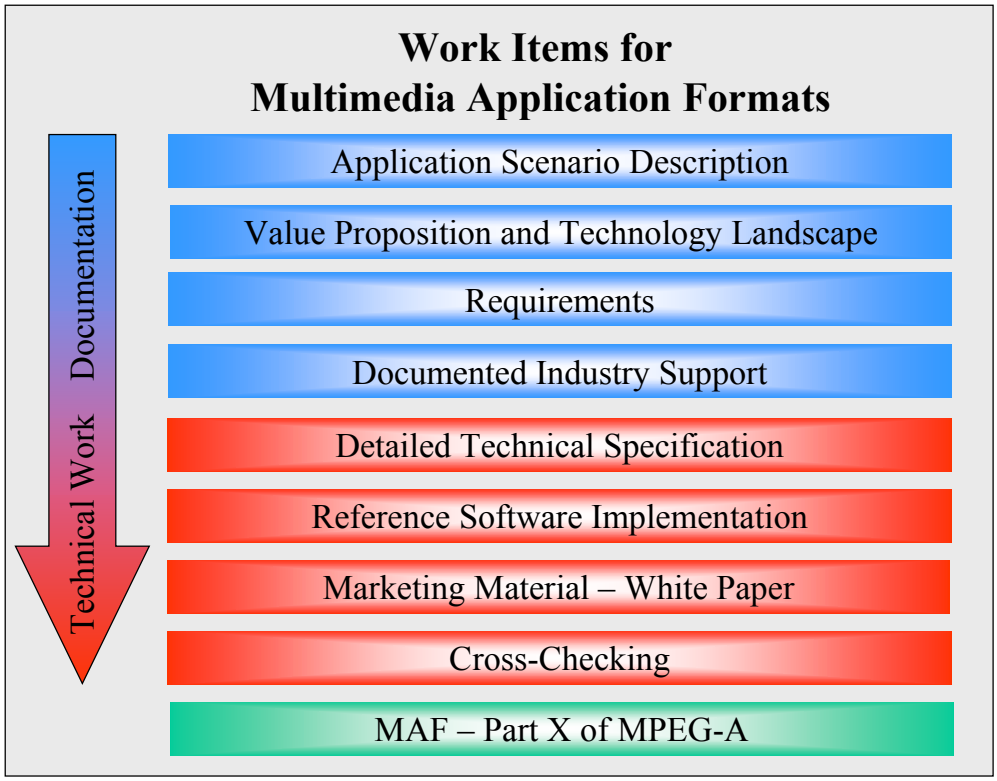

Figure 2: Work Items of the MPEG-A process for creating MAFs

5. Examples of MAFs

MPEG-A standardization has already started to work on several early proposals for MAFs, which are at various levels of maturity in the MPEG standardization process. Two of these MAFs have paved the way for future proposals and are introduced in this section.

5.1. Music Player MAF

The work for the Music Player MAF is finished and the resulting specification has reached FDIS (Final Draft International Standard) status within a very short period of time [1]. The corresponding standard will be published as ISO/IEC 23000-2.. TheMusic Player MAF specification shows how to carry MP3-coded audio information along with meta-data expressed as MPEG-7 data within the MPEG-4 and framework. (See also Figure 1.)

MPEG-1/2 Audio Layer III, also known as MP3, is one of the most widely used MPEG standards. Since MP3 was specified, MPEG has developed a number of additional standards. MPEG-4 specifies what the industry expects to be another very successful specification, the MPEG-4 File Format, while MPEG-7 specifies meta-data, not only signal-derived but also archival meta-data such as Artist, Album and Song Title. As such, MPEG-4 and MPEG-7 represent an ideal environment to support the current "MP3 music library" user experience and to extend that experience in new directions.

Moving MP3 into the MPEG-4 world supports everything that users know and expect, while offering the capability to deliver a much richer music experience.

5.2. Photo Player MAF

Based on a motivation similar to the previous example, work is under way towards a Photo Player MAF, which is currently anticipated to be published as ISO/IEC 23000-3. This example demonstrates the integration of MPEG and non-MPEG technologies into one MAF. This activity aims to define a MAF to support the handling of digital pictures such as are shot with consumer digital cameras.

In the Digital Camera space, JPEG is the predominant compression format. Consumers appreciate the ease with which digital photographs can be taken, copied, post-processed and shared. However, within only a few months time an enthusiastic user creates a collection consisting of thousands of digital photographs. The size of the collection turns performing common tasks such as searching for particular photographs of interest into a tedious and time-consuming exercise.

As a consequence, there is a demand for providing suitable metadata, such as information about the photo content (e.g. the subject being photographed or the event where the shot was taken), author, shoot location, imaging parameters, etc. Such metadata needs to be stored in a standardized format that can be easily interchanged among various digital devices.

The need to store metadata generated early in the acquisition process has been reflected in the EXIF standard, which is commonly adopted by camera manufacturers. However, while there is no doubt that the EXIF standard is very useful, it is limited in scope to basic acquisition-related information such as camera parameters (focal length, aperture, exposure time), the camera manufacturer and the time of image capture. EXIF does not support more advanced meta-data such as needed for content-based search and retrieval. This is a role call for MPEG to combine presumable elements from MPEG-4, MPEG-7 and JPEG for the specification of a Photo Player MAF.

6. Benefits to the Industry

The main purpose of MAFs is to reduce the effort involved in selecting MPEG technologies and combining them to meet the specific needs of an application area. Firms and industries interested in an application area for which a MAF exists can benefit from a ready-made format specification that has been put together by a team of experts. This can be used as a starting point to developing products, possibly by introducing any necessary extensions.

Using MPEG standards is particularly interesting since all MAFs come with a reference software implementation, which can be used for either experimenting with the standard or for a speedy development of corresponding products and services. Compare this to the daunting task that industry currently faces of poring through thousands of pages of ISO standards to find the few elements they may need to create standards-based products.

In some cases, firms may choose to adopt a strictly conformant implementation of the MAF, thus facilitating interoperability across products by using standardized media formats which comprise the latest multimedia technology and which are designed to meet the needs of a specific application domain.

Alternatively, firms and industries interested in using MPEG technologies may consider providing input to MPEG in order to initiate the process leading to the specification of a new MAF.

7. Conclusion – a Call for Action

MPEG-A and its Multimedia Application Formats is a new kind of MPEG standard that is intended to re-emphasize the industrial relevance of standards and to be driven by industry needs for more complete technical specifications, which are completed in a short period of time. MPEG provides a treasure-trove of state-of-the-art multimedia technology, and the MPEG-A standard provides an easier path for leveraging these technologies. MPEG encourages the industrial community to play an active role in the development of MAFs to fit their needs.

References:

[1] ISO/IEC JTC 1/SC 29/WG 11. ISO/IEC FDIS 23000-2, *MPEG Music Player Application Format*.

[2] ISO/IEC JTC1/SC29/WG11/N7070, Busan, Korea, April 2005. *MAFs under Consideration***.** [to be accessed through http://mpeg.chiariglione.org].

[3] ISO/IEC JTC 1/SC29/WG 11/N7069, Busan, Korea, April 2005. ISO/IEC PDTR 23000-1, *Purpose of Multimedia Application Formats*.