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## MPEG-M: A digital media ecosystem for interoperable applications

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### ARTICLE INFO

#### Article history:

Received 5 April 2013

Accepted 23 October 2013

#### Keywords:

MPEG

IPTV

Middleware

Interoperability

Digital media

Multimedia architectures

### ABSTRACT

MPEG-M is a suite of ISO/IEC standards (ISO/IEC 23006) that has been developed under the auspices of Moving Picture Experts Group (MPEG). MPEG-M, also known as Multimedia Service Platform Technologies (MSPT), facilitates a collection of multimedia middleware APIs and elementary services as well as service aggregation so that service providers can offer users a plethora of innovative services by extending current IPTV technology toward the seamless integration of personal content creation and distribution, e-commerce, social networks and Internet distribution of digital media.

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## 1. Introduction

With the deployment of broadband networks enabling new ways to deliver and exchange multimedia services and the improvement of hardware performance allowing many service aspects to be implemented as web-service software, businesses related to media services are facing significant changes. These changes are opening new business opportunities for multimedia services, such as those generated by the recent introduction of IPTV services for which several standards have been or are being developed. Examples of already developed standards are: ITU-T Q.13/16, Open IPTV Forum, Alliance for Telecommunications Industry Solutions IPTV Interoperability Forum, Digital Video Broadcasting IPTV, Hybrid Broadcast Broadband TV and YouView.

However, most of the current IPTV efforts stem from rather conventional value chain structures thus standing in stark contrast with the buoyant web environment where new initiatives – sometimes assembling millions of users in a

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fortnight – pop-up almost daily with exciting new features, such as Apple's and Google's Application Programming Interfaces (APIs) enabling third parties to develop and provide applications and services [1,2].

At the same time we are witnessing cases where the closed delivery and content bundles offered by some operators are being either abandoned (e.g. mobile phone brands linked to a particular content service) or complemented with the possibility offered to users to freely access services (e.g., broadband, mobile and IPTV) of their choice. The latter becomes more eminent by the appearance of new operators offering service components (e.g., cloud services) and the need for these to be interoperable.

MPEG has been the provider of some enabling technologies and has developed a large portfolio of standards that can be assembled to provide multimedia services [3]. Continuing its approach of providing standards for the next generation of products, services and applications, MPEG has developed MPEG-M, a standard for advanced IPTV services. MPEG-M is based on a flexible architecture capable of accommodating and extending in an interoperable fashion many features that are being deployed on the web for delivering and consuming multimedia content (e.g., Hulu, Netflix or Apple TV), next to those enabled by the recent standard MPEG technologies (e.g., High Efficiency Video Coding and Dynamic Adaptive Streaming over HTTP [4,5]).

Thanks to the MPEG-M suite of standards, aimed at facilitating the creation and provisioning of vastly enhanced IPTV services, it is envisaged that a thriving digital media economy can be established, where *developers* can offer MPEG-M service components to the professional market because a market will be enabled by the standard MPEG-M component service API; *manufacturers* can offer MPEG-M devices to the global consumer market because of the global reach of MPEG-M services; *service providers* can set up and launch new attractive MPEG-M services because of the ease to design and implement innovative MPEG-M value chains; and *users* can seamlessly create, offer, search, access, pay/cash and consume MPEG-M services.

The MPEG-M suite of standards extends the devices capabilities with advanced features such as content generation, processing, and distribution by a large number of users; easy creation of new services by combining service components of their choice; global, seamless and transparent use of services regardless of geo-location, service provider, network provider, device manufacturer and provider of payment and cashing services; diversity of user experience through easy download and installation of applications produced by a global community of developers since all applications share the same middleware APIs; and innovative business models because of the ease to design and implement media-handling value chains whose devices interoperate because they are all based on the same set of technologies, especially MPEG technologies.

A brief overview of the MPEG-M suite of standards can be found in [6]. In contrast, this paper is focused on the detailed description of the MPEG-M digital media services ecosystem and its components providing all the necessary technical information (including access to the reference software) needed by developers who would like to build MPEG-M compliant applications and services; and, why not attract millions of users in a fortnight, too!

The rest of the paper is structured as follows: In [Section 2](#) the scope and objectives of the MPEG-M digital media services ecosystem are explained. In [Section 3](#) each of the individual MPEG-M standards described in detail including the functionalities offered by each of them. In [Section 4](#) a number of MPEG-M related developments offering various digital media applications and services are presented. In [Section 5](#) the critical decisions and choices that had to be made by the MPEG-M ad hoc group during the MPEG-M's life cycle development followed by related future developments are discussed. Finally, in [Section 6](#) the conclusions are presented by highlighting the major MPEG-M achievements.

## 2. Scope and objectives

The scope of the MPEG-M is to support the service providers' drive to deploy innovative multimedia services by identifying a set of Elementary Services (ESs) and defining the corresponding set of protocols and APIs to enable any user in an MPEG-M value chain to access those services in an interoperable fashion. Note that an MPEG-M value chain is a collection of users, including creators, end users and service providers that conform to the MPEG-M standard.

Assuming that in an MPEG-M value chain there is a Service Provider (SP) for each ES, a User may ask the Post Content SP to get a sequence of songs satisfying certain Content and User Descriptions (metadata). The "mood" of a group of friends could be a type of User Description.

With reference to [Fig. 1](#), the End User would contact the Post Content SP who would get appropriate information from both the Describe Content SP and the Describe User SP in order to prepare the sequence of songs according to the friends "mood" by using, for example, a semantic music playlist generator [7]. The End User would then get the necessary licenses from the Manage License SP. The sequence of songs would then be handed over to the Package Content SP, possibly in the form of an "MPEG-21 Digital Item", the latter being a container for Resources, Metadata, Rights and their interrelationships [8]. The Package Content SP will get the Resources from the Store Content SP and hand over the Packaged Content to the Deliver Content SP who will stream the Packaged Content to the End User.

In many real-world MPEG-M value chains, service providers would not be able to exploit the potential of the standard if they were confined to only offer ESs. Therefore service providers will typically offer bundles of ESs, known as Aggregated Services (ASs). In general, as shown in [Fig. 2](#), there will be a plurality of service providers offering the same or partially overlapping ASs, for example, a SP offering User Description Services, may offer Content Description Services as well.

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