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Information technology — Multimedia application format (MPEG-A) —

Part 15: Multimedia preservation application format

Technologies de l'information — Format pour application multimédia (MPEG-A) —

Partie 15: Format pour application de la conservation des multimédias

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Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work. In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/IEC JTC 1, *Information technology*, Subcommittee SC 29, *Coding of audio, picture, multimedia and hypermedia information*.

ISO/IEC 23000 consists of the following parts, under the general title *Information technology — Multimedia application format (MPEG-A)*:

— *Part 1: Purpose for multimedia application formats*

— *Part 2: MPEG music player application format*

— *Part 3: MPEG photo player application format*

— *Part 4: Musical slide show application format*

— *Part 5: Media streaming application format*

— *Part 6: Professional archival application format*

— *Part 7: Open access application format*

— *Part 8: Portable video application format*

— *Part 9: Digital multimedia broadcasting application format*

— *Part 10: Surveillance application format*

— *Part 11: Stereoscopic video application format*

— *Part 12: Interactive music application format*

— *Part 13: Augmented reality application format*

— *Part 15: Multimedia preservation application format*

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— *Part 16: Publish/subscribe application format*

— *Part 18: Media linking application format*

The following part is under preparation:

— *Part 17: Multiple sensorial media application format*

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Introduction

ISO/IEC 23000 (also known as "MPEG-A") is an MPEG standard that supports a fast track to standardization by selecting readily tested and verified tools taken from the MPEG body of standards and combining them to form a MAF (Multimedia Application Format). If a needed piece of technology is not provided within MPEG, then additional technologies originating from other organizations can be included by reference in order to facilitate the envisioned MAF.

The Multimedia Preservation Application Format (MP-AF ISO/IEC 23000-15) defines the Multimedia Preservation Description Information (MPDI). MPDI extends the concept of Preservation Description Information (PDI),[4] providing metadata addressing the specific requirements for preserving multimedia content.[13] MP-AF defines a metadata format that enables users to effectively exchange information (metadata) related to multimedia preservation operations and their outcomes. Typical examples include the description of integrity checking and related results, content migration from one system to another, replication of subparts or entire contents, content quality evaluation and related quality report, relationships between the source and output of any transformation process, etc. At the core of MP-AF is its data model definition provided through UML diagrams and formal descriptions and a normative XML-Schema implementation. The model has been harmonized with MPEG-21 Digital Item Declaration and the schema reuses considerable parts of existing MPEG technologies, most notably MPEG-21 and MPEG-7.

ISO/IEC 23000 also provides the industry with a coherent and consistent approach to manage multimedia preservation metadata supporting a variety of application scenarios, such a digitization, format migration, content restoration, etc. This includes various applications, hardware/software systems and processing methods used in different digital media administrative domains and being independent of technological changes.

ISO/IEC 23000 defines a data model for preservation metadata and its serialization in XML. It thus serves as an interoperable metadata format at the external interfaces of a digital preservation system. The most widely known and adopted reference model for digital preservation is the Open Archival Information System (OAIS),[4] a framework for understanding and applying concepts necessary for long-term preservation of digital information. In the following, the OAIS terminology is adopted for describing the several preservation notions addressed by MP-AF.

OAIS defines information packages (IP) at the ingest (submission – SIP) and delivery (dissemination – DIP) side of a preservation system. These packages enfold the object of digital preservation that is made up of the content items (one or more) and associated resources and metadata. Different packaging formats can serve as an implementation for the IP and the same type of wrapper could be used for submission, dissemination, as well as internal (archive) IPs. According to the OAIS guidelines, the Professional Archival Application Format (ISO/IEC 23000-6:2012, PA-AF), which has been designed to provide a standardized packaging format for digital files, fulfils the needs for a packaging format within MPEG technologies.

The basic objective of digital preservation is to enable the seamless communication of information over time and free from loss or corruption. Traditionally, this has been achieved by the conservation of physical media on which the information is inscribed and materially associated. If the physical object persists without alteration, the information remains unchanged and is being communicated to any person or system capable of receiving it.

Even if some physical change occurs, the essential characteristics of the information it carries may remain intact. For example, the ink in a textual document may have faded, but the text can remain fully readable. However, the persistence of digital information is complicated by several factors, mainly technological change. Obsolescence may make digital storage media unreadable and digital encodings indecipherable. Progress may make it desirable to use new software to process old data, but entails the risk that the output is not faithful to the source. For multimedia, the complexity is increased by the variety of formats used and the complexity introduced by the use of compression, codecs and wrappers.

For any use over time where the integrity of the data or fidelity to original properties are important, controls that are independent of the technologies used to store and process the data need to be imposed.

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The foundation for such controls is Preservation Description Information (PDI[4]). PDI is metadata and contextual information that identifies what is being preserved, defines its essential properties, describes requirements for processing it, and identifies processes which generated, used or modified Digital Items as well as their results.

Many organizations collecting multimedia content, such as archives, libraries, museums, etc. already have digital preservation systems in place. These organizations have sometimes the need to exchange multimedia assets and related metadata, for example

— to exchange assets between preservation systems/repositories within the organization or with related organizations,

— to change/upgrade their preservation systems,

— to exchange content with service providers, and

— to provide preservation services for other organizations.

These exchanges need to include preservation description information that enables the receiving organization both to assess the integrity and fidelity of the assets it receives and to establish a baseline for curation and use of the assets. The description may include metadata about content, structure and quality, as well as technical, historical and editorial information, and information about property and use rights and conditions.

The following are the purposes of the MP-AF in brief:

— to enable the exchange of multimedia assets (multimedia resources plus associated metadata) between different repositories by providing interoperable preservation description information;

— to enable archive management to react to specific events and determine when preservation actions, such as migration, are needed to maintain the accessibility of preserved multimedia content;

— to enable automatic assessment of preservation strategies and their execution;

— to enable archive management to avoid corruption or loss of multimedia assets when changes are made in the hardware, software or storage media used by the archive by providing standardized descriptors to characterize multimedia assets and to describe preservation actions and outcomes for long term preservation;

— to enable producers (originators of assets to be preserved) to provide the archive with sufficient descriptive information to assess, plan for, and carry out preservation processes that maintain the integrity and fidelity of the content;

— to enable consumers who need comprehensive and interoperable preservation description information (e.g. other archives and consumers who wish to use preserved assets in the production of new ones) to receive standard preservation description information together with multimedia assets.

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Information technology — Multimedia application format (MPEG-A) —

Part 15: Multimedia preservation application format

1 Scope

This part of ISO/IEC 23000 specifies the standard representation of the multimedia description information (MPDI) generated and used by an organization in the process of preserving a multimedia asset for the purpose of facilitating the exchange of multimedia content between archives or other stakeholders (e.g. publishers, broadcasters, service providers and the like), as well as subsequent preservation and use.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO/IEC 15938-4:2002/Amd 1, *Audio extensions*

ISO/IEC 15938-5, *Information technology — Multimedia content description interface — Part 5: Multimedia description schemes*

ISO/IEC 15938-5:2003/Amd 5, *Quality metadata, multiple text encodings, extended classification metadata*

ISO/IEC 21000-2, *Information technology — Multimedia framework (MPEG-21) — Part 2: Digital Item Declaration*

ISO/IEC 21000-3:2003, *Information technology — Multimedia framework (MPEG-21) — Part 3: Digital Item Identification*

ISO/IEC 21000-3:2003/Amd 1, *Related identifier types*

ISO/IEC 21000-3:2003/Amd 2, *Digital item semantic relationships*

ISO/IEC 21000-5, *Information technology — Multimedia framework (MPEG-21) — Part 5: Rights Expression Language*

ISO/IEC 21000-20, *Information technology — Multimedia framework (MPEG-21) — Part 20: Contract Expression Language*

ISO/IEC 21000-21, *Information technology — Multimedia framework (MPEG-21) — Part 21: Media Contract Ontology*

ISO 15924, *Information and documentation — Codes for the representation of names of scripts*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply. ISO and IEC maintain terminological databases for use in standardization at the following addresses:

IEC Electropedia: available at http://www.electropedia.org/

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ISO Online browsing platform: available at http://www.iso.org/obp

For the terms used in this document and not defined in this clause, please refer to the normative references.

3.1 MPEG-21 terminology

MP-AF terminology is consistent with the terminology adopted in MPEG-21. As the reader of the MP-AF specification may not be familiar with terminology from ISO/IEC 21000-2 MPEG-21 Digital Item Declaration (DID), the definitions of the following terms needed for the definition of MP-AF are included in 3.1.

3.1.1
Digital Item Identification
DII
standard (ISO/IEC 21000-3) used by MPEG-21 for identification of Digital Item and their components

3.1.2
Resource
individually identifiable asset such as a video or audio clip, an image, or a textual asset

Note 1 to entry: A resource may also potentially be a physical object (e.g. a video tape).

Note 2 to entry: All resources shall be locatable via an unambiguous address.

Note 3 to entry: The term asset in the definition has a different meaning than the MP-AF term Asset defined in 3.2.3.

3.1.3
Container
structure that allows Items and/or Containers to be grouped

Note 1 to entry: A Container itself is not an Item; containers are groupings of Items and/or Containers. *Descriptors* (3.1.6) allow for the "labelling" of Containers with information appropriate for the purpose of the grouping.

3.1.4
Item
grouping of sub-items and/or *components* (3.1.5) that are bound to relevant *Descriptors* (3.1.6)

Note 1 to entry: These descriptors contain information about the Item. An Item that contains no sub-items can be considered a whole. An Item that does contain sub-items can be considered a compilation. Items may also contain annotations to their sub-parts.

Note 2 to entry: The term Item from MPEG-21 DID is used synonymously with Digital Item in this part of ISO/IEC 23000.

3.1.5
Component
binding of a *Resource* (3.1.2) to a set of *Descriptors* (3.1.6)

Note 1 to entry: These descriptors are information concerning all or part of the specific resource instance. A Component itself is not an *Item* (3.1.4); Components are building blocks of Items. Components may be conditional (see MPEG-21 DID for details).

3.1.6
Descriptor
associates information with the enclosing entity

Note 1 to entry: This information may be a *component* (3.1.5) (such as a thumbnail of an image or a text component) or a textual statement. Descriptors may be conditional (see MPEG-21 DID for details).

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3.2 MP-AF Structure terminology

3.2 introduces the terms of the relevant entities in the MP-AF data model. While 3.2 provides definitions of the terms, the entities of the model are described in 5.2 (including visualization in Figure 1).

3.2.1
Work
creation that retains intellectual or descriptive attributes independently of its manifestations

Note 1 to entry: This concept is also referred to as creation or intellectual entity in other contexts.

3.2.2
Preservation Object
combines information describing the intellectual and artistic attributes of a *Work* (3.2.1) together with Digital *Items* (3.1.4) that encode the Work

Note 1 to entry: It includes technical, descriptive and preservation metadata and any other information needed to ensure consistent and reliable access to the Digital Item(s) over time. A Preservation Object may contain Digital Items pertaining to one or more particular *Representation(s)* (3.2.5) together with information and metadata specific to that Representation. It may also contain metadata common to all Representations. A Preservation Object may contain other Preservation Objects.

3.2.3
Asset
special type of *Preservation Object* (3.2.2) describing a *Work* (3.2.1) and the associated exploitation rights belonging to a known owner

Note 1 to entry: The entity holding the rights on the digital copies may be different from the one holding the rights on the Work itself.

3.2.4
Group
logical aggregation of related Preservation Objects

Note 1 to entry: It may represent a physical or virtual collection, a bunch of *Items* (3.1.4), a shipment, etc.

Note 2 to entry: The data model supports Preservation Objects to be composed of other Preservation Objects. A Group is an aggregation of Preservation Objects, but is not a Preservation Object itself.

3.2.5
Representation
specific and complete manifestation of the *Work* (3.2.1)

Note 1 to entry: Representations may differ in terms of technical or descriptive properties while sharing the same intellectual and/or descriptive attributes of the Work (e.g. different performances of the same Work, low vs. high definition representations of a movie).

Note 2 to entry: A Representation aggregates the whole set of *Essences* (3.2.6) plus any additional metadata needed for a complete presentation of a Work.

3.2.6
Essence
manifestation of a *Work* (3.2.1) or part of a Work; refers to the metadata needed for correctly rendering media content including all associated *Components* (3.2.7)

3.2.7
Component
entity holding specific technical metadata supporting the handling of the media resource referenced by a *Media Locator* (3.2.10)

Note 1 to entry: A Component can be a File or *Bitstream* (3.2.9). It manages a (virtual/internal) file structure, multimedia resources and (optionally) referenced metadata (e.g. controlled vocabularies, taxonomies, original content or metadata files).

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3.2.8
File
Component (3.2.7) materialized as a unit recognized by a computer system, subsystem, or application

3.2.9
Bitstream
Component (3.2.7) recorded as contiguous or non-contiguous data within a File

Note 1 to entry: If metadata are specific to streams or tracks (e.g. audio and video tracks of a file), Bitstream shall be used and descriptors shall be added on Bitstream level.

3.2.10
Media Locator
reference or identifier of a storage media volume, Item or part of an Item containing at least one *Component* (3.2.7)

3.3 MP-AF Description terminology

3.3.1
Common Core Metadata Set
contains basic technical and descriptive attributes, which can be easily mapped to different metadata formats in use (also outside the preservation domain)

3.3.2
Core Descriptive Metadata
basic set of editorial properties describing the Digital Item

EXAMPLE Title or subject.

3.3.3
Core Technical metadata
basic set of technical properties of the Digital Item or Component

EXAMPLE Video resolution or audio sampling rate.

3.3.4
Media
"multimedia" such as audio, video, medical imagery and the like

Note 1 to entry: When referring to the units of physical materials on which digital data are recorded, the terms "storage media" or "physical media" are used.

3.4 Multimedia Preservation Description Information (MPDI) terminology

The preservation description information (PDI) applies to multimedia assets being preserved. MPDI adapts and extends the concept of preservation description information from OAIS in order to better address the long term accessibility of multimedia assets. MPDI consists of metadata for Provenance, Context, Reference, Quality, Fixity, Integrity, Authenticity, and Rights. The requirements for MPDI are detailed in Reference [13].

3.4.1
Provenance
documents the chronology of events regarding the creation, modification, ownership and custody of a resource, such as who produced it and who has had custody since its origination; it provides information on the history of the multimedia content (including processing history).

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3.4.2
Context
circumstances that resulted in the production of the resource and how the preserved resource relates to other resources

EXAMPLE It may describe why and how the resource was created, it may indicate from which resources the current one has been derived, or it may specify the relationship to other resources.

3.4.3
Reference
information that is used for identifying the multimedia resources

Note 1 to entry: It provides one or more identifiers, or systems of identifiers, by which the resources may be uniquely and persistently identified. Reference information supports the linkage of identical or related resources that might be stored in separate repositories. These repositories may use different mechanisms for identifying resources (e.g. using different standards for representing local identifiers).

3.4.4
Quality
information related to the description of the technical condition of Digital Items and resources

Note 1 to entry: This information can at least partly be automatically extracted from content with specialized tools but often requires manual revision and validation. This manual work causes considerable costs, which is an additional reason for preserving it. Quality information includes audio and visual defects and characteristics, their collocation in time and space and their severity. Additionally, structural information and technical metadata of resources in relation to relevant standards are considered. This latter kind of information is contained in media container and bitstream metadata rather than in the multimedia content itself. Finally, it is also necessary to preserve the description of the hardware devices, tools and agents used for extracting and reviewing that quality information.

3.4.5
Fixity
encompasses the information ensuring that resources (as described by their properties) are not altered in an undocumented manner

Note 1 to entry: This information is also used to verify the integrity of Digital Items. Thus, if the fixity information for an Item changes over time, the Item has changed.

3.4.6
Integrity
state of a Digital Item indicating the fact of being complete and unaltered

Note 1 to entry: It can be proven by verifying the presence of all required parts in an unaltered (i.e. not modified) state.

3.4.7
Authenticity
information to enable an Agent to verify that an object is correctly identified and free from (intentional or accidental) corruption (i.e. capable of delivering its original message)

Note 1 to entry: The Agents that issue statements about authenticity should also be correctly identified. Authenticity encompasses identity and integrity. Identity comprises all those attributes necessary to determine what a thing is (e.g. the original recording of a Work). Integrity asserts that none of those essential attributes have changed, i.e. there are no significant differences neither in the same resource over time nor between two resources thought to be copies of the same asset. While identical copies are authentic, authenticity does not require complete equivalence. Thus, a digital version of an analog original may be an authentic copy of the Work if it can be shown that the differences between the two versions are not significant, e.g. all of the content is present and is structured the same way, and all important elements or attributes, such as title, creator, performer, remain the same.

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3.4.8
Rights
information concerning legal, regulatory or contractual provisions that affect ownership, control, access or use of resources insofar as they impact the long term preservation

EXAMPLE Intellectual property, copyrights, privacy, etc.

Note 1 to entry: Actions or events in the preservation of resources need to respect such rights.

3.5 MP-AF Process terminology

3.5.1
Activity
preservation action performed on at least one Digital Item or Component

Note 1 to entry: The activity is carried out by one or more *Operators* (3.5.2) known to the preservation system.

3.5.2
Operator
Agent (3.5.3) or a *Tool* (3.5.4) contributing to the execution of an *Activity* (3.5.1) by performing (part of) it or being used to perform it

3.5.3
Agent
person or legal entity (organization) involved in one or more Activities dealing with the processing of Digital Items or Components

3.5.4
Tool
device, system or software used for executing Activities dealing with the processing of Digital Items or Components

4 Abbreviated terms

AVDP	MPEG-7, Audiovisual Description Profile (ISO/IEC 15938-9:2005/Amd 1:2012)
CCDM	EBU, Conceptual Class Description Model
DID	ISO/IEC 21000-2 MPEG-21, Digital Item Declaration
DIDL	ISO/IEC 21000-2 MPEG-21, Digital Item Declaration Language
DII	ISO/IEC 21000-3 MPEG-21, Digital Item Identification
DIP	OAIS, Dissemination Information Package
EIDR	Entertainment Identifier Registry Association
EBU	European Broadcasting Union
ISAN	International Standard Audiovisual Number
MPDI	Multimedia Preservation Description Information
MP-AF	Multimedia Preservation Application Format (subject of this part of ISO/IEC 23000)
MPEG-A	ISO/IEC 23000, Application Formats
OAIS	Open Archival Information System

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