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

**Part 15:
Multimedia preservation application
format**

**AMENDMENT 1: Implementation
guidelines for MP-AF**

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

*Partie 15: Format pour application de la conservation des
multimédias*

AMENDEMENT 1: Lignes directrices pour MP-AF





COPYRIGHT PROTECTED DOCUMENT

© ISO/IEC 2017, Published in Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Ch. de Blandonnet 8 • CP 401
CH-1214 Vernier, Geneva, Switzerland
Tel. +41 22 749 01 11
Fax +41 22 749 09 47
copyright@iso.org
www.iso.org

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 ISO documents 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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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 World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html.

Amendment 1 to ISO/IEC 23000-15:2016 was prepared by Technical Committee ISO/IEC JTC 1, *Information technology, SC 29, Coding of audio, picture, multimedia and hypermedia information*.

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

Part 15: Multimedia preservation application format

AMENDMENT 1: Implementation guidelines for MP-AF

Page 57, Clause 7

Insert Clause 8 and Clause 9

8 Implementation guidelines (non-normative)

8.1 General

8.2 to 8.4 provide an overview of three concrete use cases from professional digital preservation stakeholders. Their workflows and most relevant metadata are introduced, then MP-AF XML implementations addressing preservation needs from real-world use cases are reported. Terminology from Open Archival Information System (OAIS)^[4] is used, which defines information packages (IP) at the ingest (Submission IP - SIP) and delivery (Dissemination IP - DIP) side of a preservation system.

A typical format migration use case is presented in 8.2, which showcases a common necessity in digital preservation workflows. 8.3 focuses on “Audiovisual Digitization” scenario based on a concrete project that is currently under deployment at RAI Radiotelevisione Italiana (i.e. the National Italian Broadcaster). 8.4 deals with digitization of audio content of Short Play (SP) vinyl records and Master 1/2 inch tapes, a concrete activity performed at National Diet Library (NDL) of Japan. MP-AF compliant XML documents are reported entirely within source code boxes in this document and also included as separated XML files in the electronic inserts.

8.5 discusses the use of MP-AF in content archival and packaging (i.e. how to tie essences and metadata together).

8.2 Outsourcing format migration use case

8.2.1 General

This is a generic use case about basic format migration activities. Let’s suppose that the organization Fred&Alice Limited conceived, commissioned and/or produced an audiovisual work, e.g. a documentary about the rivers, mountains, and sites of the region where Fred was born. The Work is titled “Fred’s places” for which Fred&Alice Limited obtained an ISAN identifier, such as ISAN-XXXX-YYYY-ZZZZ. The Work is composed of two parts stored in two HD-XDCAM MXF (50 Mbits/s) files. The first part has a time length of 37 min and the second part of 23 min, representing the first and second part of the content. Fred&Alice Limited now needs another representation of the Work as DVD ISO image file for 1 hour of playback, to be later printed on DVDs and commercialized. They decided to rely on an external company, ACME Preservation for performing the format migration. Additionally, they are asking information regarding the quality control of the resulting essences and a complete documentation of media processing activities.

In the following we describe:

- the activities undertaken within the format migration process including the description of agents/tools and operators;

- the specific preservation information created in this scenario, which can be represented by specific MP-AF preservation descriptors like Fixity, Integrity and Rights.

8.2.2 Process overview

Fred&Alice Limited send to “ACME Preservation” a digital copy of the material, including the checksums of the involved files. ACME Preservation run an ingest process, verifying the fixity and the integrity of files by checksum calculation and comparison with the provided values. Ingestion also includes a format validity check, done by using an automatic tool. ACME Preservation discover that MXF files are not strictly compliant with some parts of the relevant SMPTE standard specifications, even if they can be correctly played in practical environments.

ACME Preservation inform Fred&Alice Limited about this minor problem and propose to fix it performing a simple file trans-wrapping. Fred&Alice Limited accept this proposal and also ask for the two parts of the programme to be merged in order to have a single MXF file as output.

The following metadata documenting this first part of the process is saved:

- date and venue of the operations;
- the software tool that detected the SMPTE compliance problem;
- the software tool used for performing the merging and trans-wrapping operation;
- tool used for validating the result of the trans-wrapping;
- the location of media files that represent the input and the result of the trans-wrapping operation;
- the time required for executing the trans-wrapping operation.

[Table 8](#) summarizes the sequence of activities carried out. The columns represent the respective responsibilities of each organization.

Table 8 — Sequence of activities

Activity	Fred&Alice Limited	ACME preservation
1	DIP creation including essences and required metadata in MP-AF format	
2		Conformance checking of the container with identification of possible violations
3		Merging files constituting multiple parts of the same programme; fixing of MXF wrapper in case of SMPTE standards violations, with logging of the operation in MP-AF format
4		Transcoding of essence to the target coding schemes with logging of the operation in MP-AF format
5		Quality control (i.e. formal check) of the resulting file with logging of the operation results in MP-AF format
6	Ingestion of the updated SIP containing the transcoded and trans-wrapped essence and the updated MP-AF metadata	

First, Fred&Alice Limited create the DIP to be delivered to ACME Preservation. It contains the following main entities:

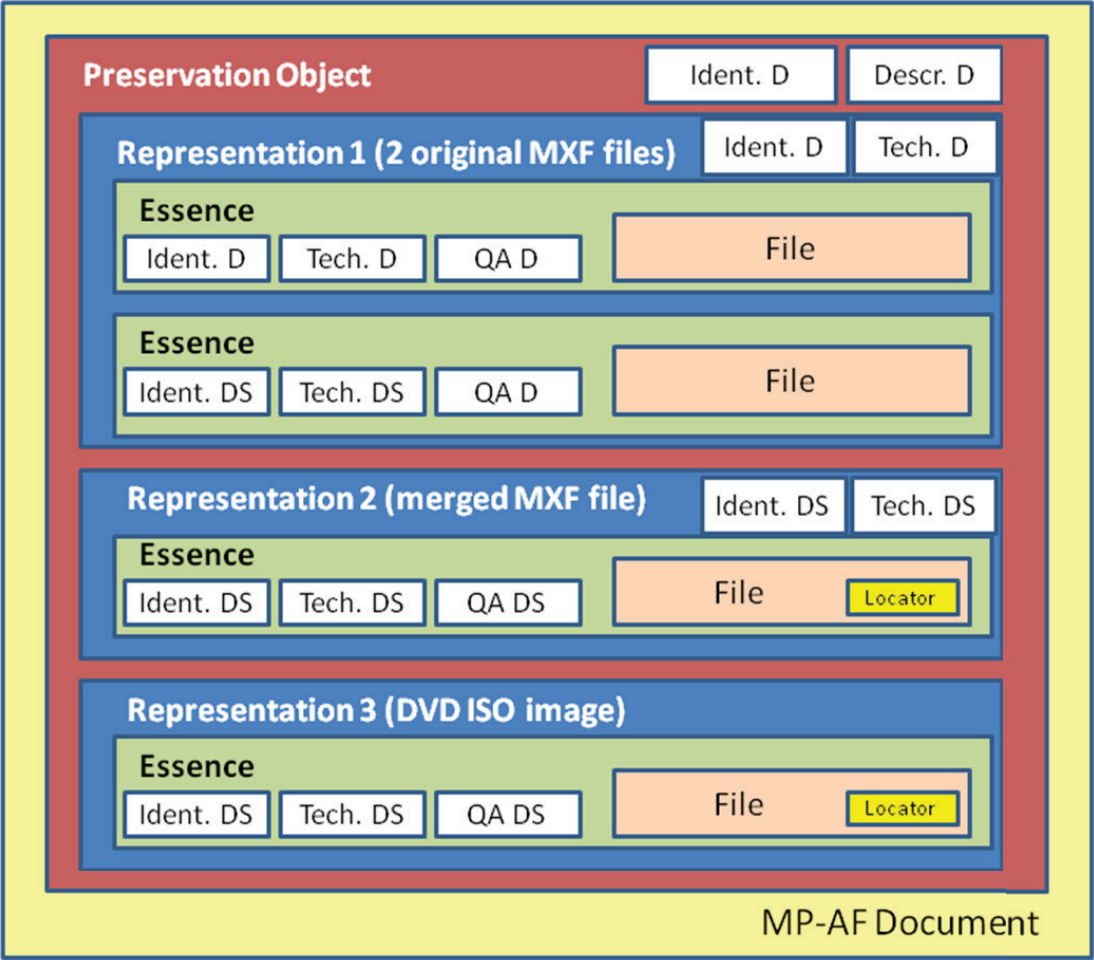
- the essence files;
- the relevant metadata in MP-AF XML format with:
 - a *DescriptiveMetadataDescriptor* containing basic descriptive metadata at preservation object level;

- the description of the representation (XDCAM in MFX) already available with Essence/Components (i.e. related to the first and second part of the video programme);
- *TechnicalMetadataDescriptors* containing technical metadata at preservation object and essence/bitstream level.

In the second stage, ACME Preservation receives the DIP and performs the requested migration/transcoding including quality control activities. Most importantly, ACME Preservation updates the MP-AF XML metadata document by adding the new representation given by the ISO image of the work. The package delivered by ACME Preservation to Fred&Alice Limited includes the following:

- a *PreservationObject* with two representations:
 - the old representation: two essences, each with a/v streams (no locators, as essence is not included);
 - the new representation: one essence with a/v streams (includes the locator of essence);
- *TechnicalMetadataDescriptor* containing technical metadata at preservation object and essence/bitstream level;
- *DescriptiveMetadataDescriptor* containing basic descriptive metadata at preservation object level;
- *QualityMetadataDescriptor* containing quality metadata for old representations;
- process metadata (i.e. description and configurations of the tools used in the process) documenting the derivation of the new representation;
- *QualityMetadataDescriptor* containing quality metadata for the new representation being assessed by ACME Preservation.

[Figure 18](#) shows a logical representation of the MP-AF document including the updates from ACME Preservation, reflecting the activities performed and the produced outputs. This updated MP-AF instance is delivered back to the Fred&Alice Limited's archive, together with the freshly created DVD ISO files.



Key

D	descriptor	Ident.	identification
DS	description scheme	Descr.	descriptive metadata
QA	analysis	Tech.	technical metadata

Figure 18 — Structure of MP-AF document delivered to Fred&Alice Limited

8.2.3 Preservation Information

8.2.3.1 General

Pre-existing and newly created preservation metadata created by ACME Preservation, are stored in MP-AF making use of the following specific descriptors:

8.2.3.2 Fixity

Fred&Alice Limited originally recorded the checksum (MD5) of all three provided files, which enables the verification of their fixity, ensuring that no bit changes have occurred. For a more robust check, they decided to add an alternative checksum (SHA1). Also they decide to store distinct checksum values for each component (video and audio) and for each video segment along the timeline.

NOTE The MP-AF Fixity Descriptor supports multiple checksums representations separately for each essence/component.

8.2.3.3 Integrity

Fred&Alice Limited is concerned about the fact that one of the two MXF files could get lost and one could be unaware that a part of the whole programme is missing (i.e. treating the file as a shorter version of the programme).

Fred&Alice Limited is tempted to concatenate the two files, but the operators are not sure about the technical quality of the result, so they keep the original parts in separate files.

NOTE MP-AF allows providing information that guarantees the integrity by means of an Integrity Descriptor, linked to specific Representations of the Preservation Object.

8.2.3.4 Rights

Fred&Alice Limited are the original producers of “Fred’s places” and they hold all the rights including the exploitation. They also have

- a document with free text description of the work,
- emails exchanged with other companies having technically contributed to the production, and
- the document for the request of ISAN registration.

One year ago, they granted exclusive rights to “Mountains and Rivers Entertainment Limited” for performing any kind of communication to the public and on any public performances in the country “Italy” [“ITA”, ISO country code: 380¹⁾]. The material delivered to “Mountains and Rivers Entertainment Limited” were created by means of transcoding from the MXF files, but no copy of it was kept by Fred&Alice Limited.

NOTE MP-AF allows providing such information through the Rights Descriptor linked to the specific Representation.

8.2.3.5 Quality

ACME Preservation performs file format compliance checks for the produced files. This results in a report containing the checks performed and the outcome reported by the automatic quality analysis tools. The XML report includes only few recommended tests for MXF wrapper consistency, but many others can be added.

1) ISO 3166-1 numeric.

8.2.4 XML Serialization of MP-AF Metadata

This subclause provides a complete XML serialization of MP-AF Metadata that formally validates against the normative schema provided by the standard. Useful comments are provided inline.

```
<DIDL xmlns="urn:mpeg:mef:schema:preservation:2015" xmlns:mpaf="urn:mpeg:mef:schema:preservation:2015" xmlns:didmodel="urn:mpeg:mpeg21:2002:02-DIDMODEL-NS" xmlns:mpeg7="urn:mpeg:mpeg7:schema:2004" xmlns:dii="urn:mpeg:mpeg21:2002:01-DII-NS" xmlns:dc="http://purl.org/dc/elements/1.1/" xmlns:ebucore="urn:ebu:metadata-schema:ebuCore_2014" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns:ipmpinfo="urn:mpeg:mpeg21:2004:01-IPMPINFO-NS" xmlns:didl="urn:mpeg:mpeg21:2002:02-DIDL-NS" xsi:schemaLocation="urn:mpeg:mef:schema:preservation:2015 mpaf.xsd urn:mpeg:mpeg21:2002:02-DIDL-NS mpeg21/did/didl.xsd">
  <DIDLInfo>
    <ProcessEntities>
      <!-- Checksum verification -->
      <Activity type="urn:mpeg:mef:cs:preservation:ActivityCS:2015:pa18" uri="a1">
        <Operator role="urn:mpeg:mef:cs:preservation:RoleCS:2015:pr01">http://my.org/qc/tool1</Operator>
        <!-- first part of the programme -->
        <Content relationType="uses" ref="http://my.org/essence1"/>
        <!-- second part of the programme -->
        <Content relationType="uses" ref="http://my.org/essence2"/>
      </Activity>
      <!-- Repairing/Rewrapping -->
      <Activity type="urn:mpeg:mef:cs:preservation:ActivityCS:2015:pa56" uri="a2">
        <Operator role="urn:mpeg:mef:cs:preservation:RoleCS:2015:pr01" operatorOnBehalfOf="http://my.org/people/doe">http://my.org/qc/tool2</Operator>
        <Content relationType="uses" ref="http://fred_alice.org/essence1"/>
        <Content relationType="uses" ref="http://fred_alice/essence2"/>
        <!-- The joined and transrapped MXF -->
        <Content relationType="creates" ref="http://fred_alice/essence3"/>
      </Activity>
      <!-- Quality Control/File-based made on joined-transwrapped MXF-->
      <Activity type="urn:mpeg:mef:cs:preservation:ActivityCS:2015:pa21" uri="a3">
        <Operator role="urn:mpeg:mef:cs:preservation:RoleCS:2015:pr01">http://acme.org/qc/tool4</Operator>
        <Content relationType="uses" ref="http://fred_alice/essence3"/>
      </Activity>
      <!-- Transcoding -->
      <Activity type="urn:mpeg:mef:cs:preservation:ActivityCS:2015:pa13" uri="a4">
        <Operator role="urn:mpeg:mef:cs:preservation:RoleCS:2015:pr01">http://acme.org/qc/tool3</Operator>
        <Content relationType="uses" ref="http://fred_alice/essence3"/>
        <!-- The proxy quality version of the entire programme -->
        <Content relationType="creates" ref="http://fred_alice/essence4"/>
      </Activity>
      <!-- Quality Control/File-based made on generated proxy version-->
      <Activity type="urn:mpeg:mef:cs:preservation:ActivityCS:2015:pa21" uri="a5">
        <Operator role="urn:mpeg:mef:cs:preservation:RoleCS:2015:pr01">http://acme.org/qc/tool4</Operator>
        <Content relationType="uses" ref="http://fred_alice/essence4"/>
      </Activity>
      <!-- Metadata Extractor -->
      <Operator xsi:type="mpaf:ToolType" uri="http://acme.org/qc/tool1" type="urn:mpeg:mef:cs:preservation:ToolCS:2015:pt25"/>
      <!-- MXF joiner and Trans-Wrapper -->
```

```

    <Operator xsi:type="mpaf:ToolType" uri="http://acme.org/qc/tool2" type="urn:mpeg:maf:cs:pres-
ervation:ToolCS:2015:pt18"/>
    <!-- Transcoder -->
    <Operator xsi:type="mpaf:ToolType" uri="http://acme.org/qc/tool3" type="urn:mpeg:maf:cs:pres-
ervation:ToolCS:2015:pt35"/>
    <!-- Proxy file analyzer -->
    <Operator xsi:type="mpaf:ToolType" uri="http://acme.org/qc/tool4" type="urn:mpeg:maf:cs:pres-
ervation:ToolCS:2015:pt14"/>
    <!-- Audiovisual technician -->
    <Operator xsi:type="mpaf:PersonType" uri="http://acme.org/people/doe" type="urn:mpeg:ma-
f:cs:preservation:AgentTypeCS:2015:pat12">
        <mpaf:Name>
            <mpeg7:GivenName>John</mpeg7:GivenName>
            <mpeg7:FamilyName>Doe</mpeg7:FamilyName>
        </mpaf:Name>
    </Operator>
</ProcessEntities>
</DIDLInfo>
<!-- The programme to be transcoded, made of 2 MXF files -->
<Item xsi:type="mpaf:PreservationObjectType" uri="http://fred_alice/pml">
    <Descriptor xsi:type="mpaf:IdentificationDescriptorType">
        <Statement xsi:type="mpaf:IdentificationStatementType" mimeType="text/xml">
            <mpaf:Identifier type="http://smpte-ra.org/umidreg/s330mex.html">urn:smpte:umid:060A2B-
340101010501010D12130000000123456789ABCDEF0123456789ABCDEF</mpaf:Identifier>
        </Statement>
    </Descriptor>
    <Descriptor xsi:type="didl:DescriptorType">
        <didl:Statement mimeType="text/xml" xsi:type="didl:StatementType">
            <ipmpinfo:IPMPGeneralInfoDescriptor>
                <ipmpinfo:ToolList>
                    <ipmpinfo:ToolDescription localID="AEEncrypt">
                        <ipmpinfo:IPMPToolID>http://www.w3.org/2001/04/xmlenc#aes128</ipmpinfo:IPMPToolID>
                        <ipmpinfo:Remote ref="urn:IPMPToolsServer:ToolEnc005-3485"/>
                    </ipmpinfo:ToolDescription>
                </ipmpinfo:ToolList>
            </ipmpinfo:IPMPGeneralInfoDescriptor>
        </didl:Statement>
    </Descriptor>
    <!-- Original master version, composed of 2 files for first and second part respectively -->
    <Item xsi:type="mpaf:RepresentationType" uri="http://fred_alice/repl">
        <Descriptor xsi:type="mpaf:IdentificationDescriptorType">
            <Statement xsi:type="mpaf:IdentificationStatementType" mimeType="text/xml">
                <mpaf:Identifier type="http://smpte-ra.org/umidreg/s330mex.html">urn:smpte:u-
mid:060A2B3401010 10501010D12130000000123456789ABCDEF0123456789ABCDEF</mpaf:Identifier>
            </Statement>
        </Descriptor>
        <Descriptor xsi:type="mpaf:TechnicalMetadataDescriptorType">
            <Statement xsi:type="mpaf:MPEG7TMStatementType" mimeType="text/xml">
                <TechMetadata>
                    <mpeg7:MediaProfile>
                    <mpeg7:MediaFormat>
                        <mpeg7:Content href="urn:mpeg:mpeg7:cs:ContentCS:2001:2">
                            <mpeg7:Name>Audiovisual</mpeg7:Name>
                        </mpeg7:Content>
                    </mpeg7:MediaFormat>

```

```

        </mpeg7:MediaProfile>
    </TechMetadata>
</Statement>
</Descriptor>
<Item xsi:type="mpaf:EssenceType" uri="http://fred_alice.org/essence1">
    <Descriptor xsi:type="mpaf:IdentificationDescriptorType">
        <Statement xsi:type="mpaf:IdentificationStatementType" mimeType="text/xml">
            <Identifier type="http://fred_alice/archiveID">abc123</Identifier>
        </Statement>
    </Descriptor>
    <Descriptor xsi:type="mpaf:TechnicalMetadataDescriptorType">
        <Statement xsi:type="mpaf:MPEG7TMStatementType" mimeType="text/xml">
            <TechMetadata>
                <mpeg7:MediaProfile>
                    <mpeg7:MediaFormat>
                        <mpeg7:Content href="urn:mpeg:mpeg7:cs:ContentCS:2001:2"/>
                        <mpeg7:FileFormat href="urn:mpeg:mpeg7:cs:FileFormatCS:2001:6">
                            <mpeg7:Name>Digital video format</mpeg7:Name>
                        </mpeg7:FileFormat>
                    </mpeg7:MediaFormat>
                </mpeg7:MediaProfile>
            </TechMetadata>
        </Statement>
    </Descriptor>
    <Descriptor xsi:type="mpaf:QualityDescriptorType">
        <Statement mimeType="text/xml" xsi:type="mpaf:QualityStatementType">
            <Description xsi:type="mpeg7:ContentEntityType">
                <mpeg7:MultimediaContent xsi:type="mpeg7:AudioVisualType">
                    <mpeg7:AudioVisual/>
                </mpeg7:MultimediaContent>
            </Description>
        </Statement>
    </Descriptor>
    <Component xsi:type="mpaf:FileType" uri="http://fred_alice.org/essence1.mxf">
        <Resource mimeType="application/mxf"/>
    </Component>
</Item>
<Item xsi:type="mpaf:EssenceType" uri="http://fred_alice.org/essence2">
    <Descriptor xsi:type="mpaf:IdentificationDescriptorType">
        <Statement xsi:type="mpaf:IdentificationStatementType" mimeType="text/xml">
            <Identifier type="http://fred_alice.org/archiveID">abc124</Identifier>
        </Statement>
    </Descriptor>
    <Descriptor xsi:type="mpaf:TechnicalMetadataDescriptorType">
        <Statement xsi:type="mpaf:MPEG7TMStatementType" mimeType="text/xml">
            <TechMetadata>
                <mpeg7:MediaProfile>
                    <mpeg7:MediaFormat>
                        <mpeg7:Content href=""/>
                        <mpeg7:FileFormat href=""/>
                    </mpeg7:MediaFormat>
                </mpeg7:MediaProfile>
            </TechMetadata>

```

```

    </Statement>
  </Descriptor>
  <Descriptor xsi:type="mpaf:QualityDescriptorType">
    <Statement mimeType="text/xml" xsi:type="mpaf:QualityStatementType">
      <Description xsi:type="mpeg7:ContentEntityType">
        <mpeg7:MultimediaContent xsi:type="mpeg7:AudioVisualType">
          <mpeg7:AudioVisual/>
        </mpeg7:MultimediaContent>
      </Description>
    </Statement>
  </Descriptor>
  <Component xsi:type="mpaf:FileType" uri="http://fred_alice.org/essence2.mxf">
    <Resource mimeType="application/mxf" ref="http://fred_alice.org/essence2.mxf"/>
  </Component>
</Item>
</Item>
<!-- Joined and fixed master version resulting in a single MXF file with its own wrapper compli-
ant to the latest SMPTE standard version -->
<Item xsi:type="mpaf:RepresentationType" uri="http://fred_alice/rep2">
  <Descriptor xsi:type="mpaf:IdentificationDescriptorType">
    <Statement xsi:type="mpaf:IdentificationStatementType" mimeType="text/xml">
      <Identifier type="http://smpte-ra.org/umidreg/s330mex.html">urn:smpte:umid:060A2B3401010
10501010D12130000000123456789ABCDEF0123456789ABCDEF</Identifier>
    </Statement>
  </Descriptor>
  <Descriptor xsi:type="mpaf:TechnicalMetadataDescriptorType">
    <Statement xsi:type="mpaf:MPEG7TMStatementType" mimeType="text/xml">
      <TechMetadata>
        <mpeg7:MediaProfile>
          <mpeg7:MediaFormat>
            <mpeg7:Content href="urn:mpeg:mpeg7:cs:ContentCS:2001:2"/>
          </mpeg7:MediaFormat>
        </mpeg7:MediaProfile>
      </TechMetadata>
    </Statement>
  </Descriptor>
  <Item xsi:type="mpaf:EssenceType" uri="http://fred_alice.org/essence3">
    <Descriptor xsi:type="mpaf:IdentificationDescriptorType">
      <Statement xsi:type="mpaf:IdentificationStatementType" mimeType="text/xml">
        <Identifier type="http://fred_alice.org/archiveID">abc567</Identifier>
      </Statement>
    </Descriptor>
    <Descriptor xsi:type="mpaf:TechnicalMetadataDescriptorType">
      <Statement xsi:type="mpaf:MPEG7TMStatementType" mimeType="text/xml">
        <TechMetadata>
          <mpeg7:MediaProfile>
            <mpeg7:MediaFormat>
              <mpeg7:Content href="urn:mpeg:mpeg7:cs:ContentCS:2001:2"/>
            </mpeg7:MediaFormat>
          </mpeg7:MediaProfile>
        </TechMetadata>
      </Statement>
    </Descriptor>
    <Descriptor xsi:type="mpaf:QualityDescriptorType">

```

```

<Statement mimeType="text/xml" xsi:type="mpaf:QualityStatementType">
  <Description xsi:type="mpeg7:ContentEntityType">
    <mpeg7:MultimediaContent xsi:type="mpeg7:AudioVisualType">
      <mpeg7:AudioVisual>
        <mpeg7:TemporalDecomposition criteria="http://mpeg7.joanneum.at/cs/QADecompositionCS#qualitymeasures">
          <mpeg7:Header xsi:type="mpeg7:DescriptionMetadataType">
            <mpeg7:Comment>
              <mpeg7:FreeTextAnnotation>Video and Audio quality annotations made automatically</mpeg7:FreeTextAnnotation>
            </mpeg7:Comment>
          </mpeg7:Header>
          <mpeg7:AudioVisualSegment>
            <mpeg7:MediaInformation>
              <mpeg7:MediaProfile>
                <mpeg7:MediaQuality xsi:type="mpeg7:ExtendedMediaQualityType">
                  <mpeg7:QualityRating type="objective">
                    <mpeg7:RatingValue xsi:type="mpeg7:zeroToOneType">1.0</mpeg7:RatingValue>
                    <mpeg7:RatingScheme style="higherBetter"/>
                  </mpeg7:QualityRating>
                  <mpeg7:QCProfile>
                    <mpeg7:Name href="http://acme.org/qc/mxfconformance"/>
                    <!-- This is the list of QC checks automatically made by the
tool -->
                    <mpeg7:QCItem>
                      <!-- Operational Pattern -->
                      <mpeg7:Name href="http://ebu.io/qc/items/0025W"/>
                      <mpeg7:InputParameter name="OperationalPatternExpected">0</mpeg7:InputParameter>
                    </mpeg7:QCItem>
                    <mpeg7:QCItem>
                      <!-- KAG size -->
                      <mpeg7:Name href="http://ebu.io/qc/items/0151W"/>
                      <mpeg7:InputParameter name="KAGsizeExpected">512</mpeg7:InputParameter>
                    </mpeg7:QCItem>
                    <mpeg7:QCItem>
                      <!-- Partition Status -->
                      <mpeg7:Name href="http://ebu.io/qc/items/0063W"/>
                      <mpeg7:InputParameter name="PartitionStatusHeaderExpected">Closed/Complete</mpeg7:InputParameter>
                      <mpeg7:InputParameter name="PartitionStatusBodyExpected">Closed/Complete</mpeg7:InputParameter>
                      <mpeg7:InputParameter name="PartitionStatusFooterExpected">Closed/Complete</mpeg7:InputParameter>
                    </mpeg7:QCItem>
                  </mpeg7:QCProfile>
                  <!-- This is the result of the checks -->
                  <mpeg7:QCItemResult>
                    <mpeg7:Name href="http://ebu.io/qc/items/0025W">
                      <mpeg7:Name>Operational Pattern</mpeg7:Name>
                    </mpeg7:Name>
                    <mpeg7:Output name="CheckResult">True</mpeg7:Output>
                    <mpeg7:ExecutionStatus>complete</mpeg7:ExecutionStatus>
                    <mpeg7:DetectionMethod>automatic</mpeg7:DetectionMethod>

```

```

        </mpeg7:QCItemResult>
        <mpeg7:QCItemResult>
            <mpeg7:Name href="http://ebu.io/qc/tests/0151W">
                <mpeg7:Name>KAG Size</mpeg7:Name>
            </mpeg7:Name>
            <mpeg7:Output name="CheckResult">True</mpeg7:Output>
            <mpeg7:ExecutionStatus>complete</mpeg7:ExecutionStatus>
            <mpeg7:DetectionMethod>automatic</mpeg7:DetectionMethod>
        </mpeg7:QCItemResult>
        <mpeg7:QCItemResult>
            <mpeg7:Name href="http://ebu.io/qc/tests/0063W">
                <mpeg7:Name>Partition Status</mpeg7:Name>
            </mpeg7:Name>
            <mpeg7:Output name="CheckResult">True</mpeg7:Output>
            <mpeg7:ExecutionStatus>complete</mpeg7:ExecutionStatus>
            <mpeg7:DetectionMethod>automatic</mpeg7:DetectionMethod>
        </mpeg7:QCItemResult>
    </mpeg7:MediaQuality>
</mpeg7:MediaProfile>
</mpeg7:MediaInformation>
</mpeg7:AudioVisualSegment>
</mpeg7:TemporalDecomposition>
</mpeg7:AudioVisual>
</mpeg7:MultimediaContent>
</Description>
</Statement>
</Descriptor>
<Component xsi:type="mpaf:FileType" uri="http://fred_alice.org/essence3.mxf">
    <Resource mimeType="application/mxf"/>
</Component>
</Item>
</Item>
<!-- Proxy version for CD ISO creation -->
<Item xsi:type="mpaf:RepresentationType" uri="http://fred_alice/rep3">
    <Descriptor xsi:type="mpaf:IdentificationDescriptorType">
        <Statement xsi:type="mpaf:IdentificationStatementType" mimeType="text/xml">
            <Identifier type="http://smpte-ra.org/umidreg/s330mex.html">urn:smpte:umid:060A2B3401010
10501010D12130000000123456789ABCDEF0123456789ABCDEF</Identifier>
        </Statement>
    </Descriptor>
    <Descriptor xsi:type="mpaf:TechnicalMetadataDescriptorType">
        <Statement xsi:type="mpaf:MPEG7TMSStatementType" mimeType="text/xml">
            <TechMetadata>
                <mpeg7:MediaProfile>
                    <mpeg7:MediaFormat>
                        <mpeg7:Content href="urn:mpeg:mpeg7:cs:ContentCS:2001:2"/>
                    </mpeg7:MediaFormat>
                </mpeg7:MediaProfile>
            </TechMetadata>
        </Statement>
    </Descriptor>
    <Item xsi:type="mpaf:EssenceType" uri="http://fred_alice.org/essence4">
        <Descriptor xsi:type="mpaf:IdentificationDescriptorType">
            <Statement xsi:type="mpaf:IdentificationStatementType" mimeType="text/xml">

```

```

        <Identifier type="http://fred_alice.org/archiveID">abc567</Identifier>
    </Statement>
</Descriptor>
<Descriptor xsi:type="mpaf:TechnicalMetadataDescriptorType">
    <Statement xsi:type="mpaf:MPEG7TMStatementType" mimeType="text/xml">
        <TechMetadata>
            <mpeg7:MediaProfile>
                <mpeg7:MediaFormat>
                    <mpeg7:Content href="urn:mpeg:mpeg7:cs:ContentCS:2001:2"/>
                </mpeg7:MediaFormat>
            </mpeg7:MediaProfile>
        </TechMetadata>
    </Statement>
</Descriptor>
<Descriptor xsi:type="mpaf:QualityDescriptorType">
    <Statement mimeType="text/xml" xsi:type="mpaf:QualityStatementType">
        <Description xsi:type="mpeg7:ContentEntityType">
            <mpeg7:MultimediaContent xsi:type="mpeg7:AudioVisualType">
                <mpeg7:AudioVisual/>
            </mpeg7:MultimediaContent>
        </Description>
    </Statement>
</Descriptor>
<Component xsi:type="mpaf:FileType" uri="http://fred_alice.org/essence4.iso">
    <Resource mimeType="application/octet-stream"/>
</Component>
</Item>
</Item>
</Item>
</DIDL>

```

Figure 19 — MP-AF XML representation of format migration example

8.3 Audiovisual Digitization Use Case

8.3.1 General

At the date of writing, RAI is undertaking a strategic internal project with the aim of digitizing its whole historical archive. This operation is done by moving the audio-visual content from old media carriers (e.g. Betacam tapes and 16 mm films) to master high quality files. Besides the essence, metadata have to be preserved with a special attention to technical and process metadata. This document does not dig into the details of the whole processing workflow or the technical aspects of the employed software tools. It focuses on describing the main metadata output that RAI intends to preserve and their collocation inside the MP-AF standard. The related MP-AF XML serialization included in this document is not to be understood as a final and complete version in use at RAI.

8.3.2 Process overview

Content migration is a complex process that includes a wide set of interdependent activities operated either automatically by specific software and devices or manually by specialized technicians and operators. [Figure 20](#) shows briefly the main activities involved in a simplified version of the workflow adopted in RAI, in this picture the temporal sequence of actions is represented from left to right. Each activity is summarized in 8.3.3, with specific focus on generated metadata and their representation in MP-AF.

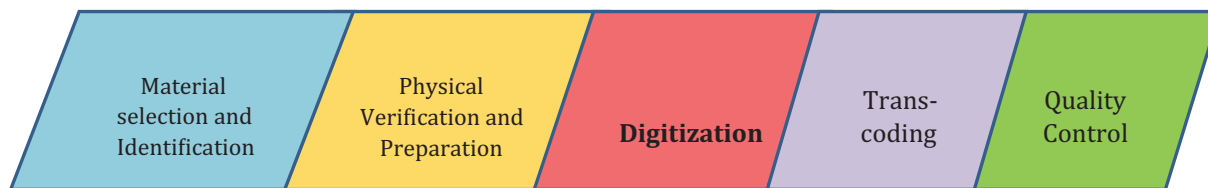


Figure 20 — Simplified migration workflow

8.3.3 Preservation metadata along the processing chain

8.3.3.1 General

Making reference to [Figure 20](#), the following subclauses briefly describe each activity and related produced metadata to be represented and preserved inside MP-AF.

8.3.3.2 Material selection and identification

In this phase, the analogue material is selected taking into account given priorities, numbers of copies and kind of original media available, rights, etc. The Selection and Identification is typically performed relying on the available information in legacy databases, collected metadata are related mostly to the identification of the editorial items stored on the media and their rights.

The MP-AF descriptors used for representing this information are

- *IdentificationDescriptor* for unique identification,
- *ContextDescriptor* for the description of the context (the RAI archives digitization project), and
- *ExploitationRightsDescriptor* for describing existing rights.

8.3.3.3 Physical verification and preparation

In this phase, a human operator (agent) checks the physical condition of the media and prepares it for the digitization (i.e. applying a barcode to a cassette needed for the following automation processes or repairing the splices in a film).

This phase is tracked in terms of recording who made the operation and/or the tools used (e.g. a Betacam cleaner). Additionally, some technical metadata are verified/completed here like the size and duration of the cassette if these are not available from the previous processing step.

Technical metadata is placed in *TechnicalMetadataDescriptor*, while the report from the cleaner is referenced as an external file. It is supposed that in this phase, the operator also checks the authenticity of the content, the result of this evaluation is stored within the *AuthenticityDescriptor*.