Preservation Action Plan: Digital Video
National Archives and Records Administration (NARA)
DRAFT 20190801
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Electronic Record or Digital Surrogate Types and Associated Formats

Digital moving images consist of bitmap digital images or "frames" displayed in rapid succession at a constant rate, giving the appearance of movement. Digital Video
digital data. The information is made up of a sequence of data rather than as a continuous signal. Digital video is defined as video stream
Each frame is comprised of a series of pixels with resolution determined by the relative number of pixels in a frame (SD, HD, UHD). Digital video formats are generally composed of both a wrapper format, usually the common name associated with the file extension, and an encoding method or codec.

Essential Characteristics of this Record Type

To render an authentic digital video file one must preserve the structural and technical metadata that allows for proper transmission of the video stream (size, codec, frame rate, interlacing, chroma subsampling, duration, channels, and bit depth).

General requirements for digital video records: Migrate or digitize to standards appropriate for the accurate preservation of the original video, when converting analog material (e.g., video cassettes, open reel video, etc.). For reformatted video, 8-bit is acceptable but 10-bit is preferred.

Due to the variability and constant changes to most video file format specifications, some of the questions to consider when preserving video formats are:
● How do different platform or cross compatibility issues come into play?
● What tools are available to authenticate transforms from one format to another?
.
Appearance

Name	Definition	Function Description

Size	Determined by bit depth, frame rate, compression, sub/sampling rate, and duration	

Structure

Name	Definition	Function Description
Layout Structure	Embedded technical metadata describing, among other things: GUID, file size, format, duration, codec, frame rate, frame width, frame height, bit depth, and bit rate for video and audio components.	

Behavior

Name	Definition	Function Description
Display	Image	Video signal is made up of Luminance, Chrominance, and frame rate.

Audio	Sound is an audio waveform that has been created as, or converted into, digital form and can be heard during playback of the video.	

Context

Name	Definition	Function Description

Descriptive Metadata	This includes but is not limited to: Unique identification number; Title; Creator; Copyright: Summary	Digital Video Files could contain, or link to: metadata that describes any attribute that could be seen in a recording or provides information about the recording.
Technical Metadata	This includes but is not limited to: Originator: Unique identification number assigned by creator; origination date; coding history; levels	Digital Video Files could contain or link to: data on the recording/ digitizing process including signal chain specifics, sample rate and bit depth, and other elements.
Administrative Metadata	This includes but is not limited to: catalog URL; classification or access level	Digital Video Files could contain, or link to: metadata that describes how/ where to access the record

Current NARA Transfer Guidance for this Record Type

Preferred:
- None

Acceptable:
- Audio Video Interleaved Format (AVI)
- QuickTime File Format (MOV)
- Windows Media Video 9 File Format (WMV)
- Advanced Video Coding (MPEG 4)
- MPEG-2 Video (MPEG2)
- Material Exchange Format (MXF)

Current NARA Public Access/Reference Format(s) for this Record Type
This Plan references existing public access file formats for electronic records at NARA, determined with a survey of the available public access formats in the National Archives

Catalog. These references do not represent recommended public access formats under NARA policies. They are intended for informational purposes only.

Reference Format: MPEG 4 (H.264)

Public Access Format: MPEG 4 (H.264)

Comments and Notes

AVI - Multimedia Programming Interface and Data Specifications 1.0:
http://www.kk.iij4u.or.jp/~kondo/wave/mpidata.txt

MOV - Apple QuickTime File Format Specification (ISO/IEC 14496-14:2003):
https://developer.apple.com/library/archive/documentation/QuickTime/QTFF/QTFFPreface/qtffPreface.html#//apple_ref/doc/uid/TP40000939

WMV - Advanced Systems Format (ASF) Specification Revision 01.20.03 Microsoft Corporation December 2004: http://www.staroceans.org/e-book/ASF_Specification.pdf and https://docs.microsoft.com/en-us/windows/desktop/medfound/windowsmediavideo9encoder

MPEG 4 - ISO/IEC 14496-10:2003. Information technology -- Coding of audiovisual objects -- Part 10: Advanced Video Coding (formal name) MPEG4, Advanced Video Coding:
https://www.iso.org/standard/37729.html

MPEG 2 - ISO/IEC 13818-2:2000 Information technology -- Generic coding of moving pictures and associated audio information: Video: https://www.iso.org/standard/61152.html

MXF - ST 377-1:2011 Material Exchange Format (MXF) — File Format Specification:
https://www.amwa.tv/downloads/whitepapers/MXFPhysicalview.pdf and https://www.iso.org/standard/70018.html

FADGI - Digital File Formats for Videotape Reformatting -
http://www.digitizationguidelines.gov/guidelines/FADGI_VideoReFormatCompare_pt5_20141202.pdf

FADGI - Creating and Archiving Born Digital Video -
http://www.digitizationguidelines.gov/guidelines/FADGI_BDV_p3_20141202.pdf

FADGI Detailed Matrixes Digital File Formats for Reformatting videotape -
http://www.digitizationguidelines.gov/guidelines/video_reformatting_compare.html

Windows Media Video versions 7, 8, 9, 9.1, 9 Advanced

NARA Format ID: NF00447

Extension(s):
- asf

Documentation

- https://www.loc.gov/preservation/digital/formats/fdd/fdd000067.shtml
- https://www.loc.gov/preservation/digital/formats/fdd/fdd000095.shtml
- https://www.loc.gov/preservation/digital/formats/fdd/fdd000096.shtml
- http://www.staroceans.org/e-book/ASF_Specification.pdf
- https://en.wikipedia.org/wiki/Advanced_Systems_Format
- https://docs.microsoft.com/en-us/windows/desktop/wmformat/overview-of-the-asf-format
- http://www.nationalarchives.gov.uk/PRONOM/Format/proFormatSearch.aspx?status=detailReport&id=691
- https://docs.microsoft.com/en-us/windows/desktop/medfound/asf-file-structure

Risk and Prioritization Analysis

☐ **Low Risk**

✓ Moderate Risk

☐ **High Risk**

8   Numeric Risk Rating

8   Numeric Prioritization Rating

Proposed Preservation Plan

☐**Retain** file format in its existing format.

✓ Transform file to a new format.

      Selected Format: AVI

☐ **Procure/develop tools** to preserve, manage and provide access to records of this type in their existing form.

☐ **Procure/develop tools** to transform the format to the preferred normalized form.

☐ **Provide Additional Information** so that the record type remains understandable/usable over time.

☐ **Explore Additional Options**

Justification: The file format is well documented and ubiquitous, and there are open source tools available for transcoding. While this is a preferred format, AVI is the most stable of all the preservation formats, so files will be transcoded to AVI where possible.

Preferred Processing and Transformation Tool(s)

- *FFMPEG*

Preferred Viewer/Access Software

- *VLC*
- *Windows Media Player (with ASF codec)*
- *5KPlayer*

Audio Video Interleaved Format

NARA Format ID: NF00117

Extension(s):
- avi

Documentation

- https://cdn.hackaday.io/files/274271173436768/avi.pdf
- https://www.loc.gov/preservation/digital/formats/fdd/fdd000059.shtml
- https://www.loc.gov/preservation/digital/formats/fdd/fdd000442.shtml
- https://www.loc.gov/preservation/digital/formats/fdd/fdd000025.shtml
- http://www.jmcgowan.com/odmlff2.pdf
- https://ffmpeg.org/
- http://www.nationalarchives.gov.uk/PRONOM/Format/proFormatSearch.aspx?status=detailReport&id=655

Risk and Prioritization Analysis

✓ Low Risk
☐ **Moderate Risk**
☐ **High Risk**
28 Numeric Risk Rating
28 Numeric Prioritization Rating

Proposed Preservation Plan

✓ **Retain** file format in its existing format.
☐**Transform** file to a new format.
　　　　Selected Format:
☐ **Procure/develop tools** to preserve, manage and provide access to records of this type in their existing form.
☐ **Procure/develop tools** to transform the format to the preferred normalized form.
☐ **Provide Additional Information** so that the record type remains understandable/usable over time.
☐ **Explore Additional Options**

Justification: The file format is well documented, ubiquitous, and there are open source tools available for transcoding. It is the most stable of all preferred preservation formats for this record type.

Preferred Processing and Transformation Tool(s)

- *FFMPEG*

Preferred Viewer/Access Software

- *VLC*

QuickTime File Format

NARA Format ID: NF00393

Extension(s):
- mov

Documentation

- https://developer.apple.com/standards/qtff-2001.pdf
- https://developer.apple.com/library/archive/documentation/QuickTime/QTFF/QTFFPreface/qtffPreface.html#//apple_ref/doc/uid/TP40000939
- http://www.nationalarchives.gov.uk/pronom/fmt/797
- https://www.loc.gov/preservation/digital/formats/fdd/fdd000429.shtml
- https://www.loc.gov/preservation/digital/formats/fdd/fdd000389.shtml
- https://www.loc.gov/preservation/digital/formats/fdd/fdd000052.shtml
- https://en.wikipedia.org/wiki/QuickTime
-

Risk and Prioritization Analysis

Supply the Risk Level and Numeric Rating and the Prioritization Numeric Rating as generated with the Format Risk and Prioritization Matrix for this file format.

✓ Low Risk
☐ **Moderate Risk**
☐ **High Risk**
29 Numeric Risk Rating
29 Numeric Prioritization Rating

Proposed Preservation Plan

✓ **Retain** file format in its existing format.

✓ **Transform** file to a new format.
> **Selected Format:** AVI
☐ **Procure/develop tools** to preserve, manage and provide access to records of this type in their existing form.
☐ **Procure/develop tools** to transform the format to the preferred normalized form.
☐ **Provide Additional Information** so that the record type remains understandable/usable over time.
☐ **Explore Additional Options**

Justification: The file format is well documented, ubiquitous, and there are open source tools available for transcoding. However, the format is proprietary, there are cross compatibility

issues, and known issues with certain .mov codecs, which justifies the recommendation to transform to AVI where technically possible.

Preferred Processing and Transformation Tool(s)

- FFMPEG
- Wondershare

Preferred Viewer/Access Software

- QuickTime Player

Moving Picture Experts Groups (MPEG-1)

Extension(s)
- MPG
- MPEG
- MP1
- MP2
- MP3
- M1V
- M1A
- M2A
- MPA
- MPV

Documentation

- https://mpeg.chiariglione.org/
- https://www.loc.gov/preservation/digital/formats/fdd/fdd000035.shtml
- https://en.wikipedia.org/wiki/MPEG-1
- http://www.nationalarchives.gov.uk/PRONOM/Format/proFormatSearch.aspx?status=detailReport&id=659&strPageToDisplay=summary
- https://en.wikipedia.org/wiki/Moving_Picture_Experts_Group#Standards

Risk and Prioritization Analysis

✓ Low Risk

☐ **Moderate Risk**

☐ **High Risk**

32 Numeric Risk Rating

30 Numeric Prioritization Rating

Proposed Preservation Plan

✓ Retain file format in its existing format.

☐ **Transform** file to a new format.
> **Selected Format:**

☐ **Procure/develop tools** to preserve, manage and provide access to records of this type in their existing form.

☐ **Procure/develop tools** to transform the format to the preferred normalized form.

☐ **Provide Additional Information** so that the record type remains understandable/usable over time.

☐ **Explore Additional Options**

Justification: The file format is well documented, ubiquitous, and there are open source tools available for transcoding.

Preferred Processing and Transformation Tool(s)

- *FFMPEG*

Preferred Viewer/Access Software

- VLC
- Windows Media Player
- QuickTime Player

Moving Picture Experts Group (MPEG-2)

Extension(s):
- MPG
- MPEG
- MPEG2
- MPV
- MP2T
- MP1S
- MP2P
- X-MPG
- X-MPEG
- X-MPEG2A

Documentation

- https://mpeg.chiariglione.org/
- https://www.loc.gov/preservation/digital/formats/fdd/fdd000033.shtml
- https://www.loc.gov/preservation/digital/formats/fdd/fdd000032.shtml
- https://www.loc.gov/preservation/digital/formats/fdd/fdd000335.shtml
- https://www.loc.gov/preservation/digital/formats/fdd/fdd000034.shtml
- https://www.loc.gov/preservation/digital/formats/fdd/fdd000028.shtml
- https://en.wikipedia.org/wiki/MPEG-2
- http://www.nationalarchives.gov.uk/PRONOM/Format/proFormatSearch.aspx?status=detailReport&id=660
- https://en.wikipedia.org/wiki/Moving_Picture_Experts_Group#Standards

Risk and Prioritization Analysis

☐ **Low Risk**

✓ Moderate Risk

☐ **High Risk**

20 Numeric Risk Rating

20 Numeric Prioritization Rating

Proposed Preservation Plan

✓ **Retain** file format in its existing format.

☐**Transform** file to a new format.

> **Selected Format:**

☐ **Procure/develop tools** to preserve, manage and provide access to records of this type in their existing form.

☐ **Procure/develop tools** to transform the format to the preferred normalized form.

☐ **Provide Additional Information** so that the record type remains understandable/usable over time.

☐ **Explore Additional Options**

Justification: The file format is well documented, ubiquitous, and there are open source tools available for transcoding.

Preferred Processing and Transformation Tool(s)

- FFMPEG

Preferred Viewer/Access Software

- VLC
- Windows Media Player
- QuickTime Player

Moving Picture Experts Group (MPEG-4)

Extension(s):
- MP4
- MPA

Documentation

- https://mpeg.chiariglione.org/standards/mpeg-4/video
- https://www.loc.gov/preservation/digital/formats/fdd/fdd000081.shtml
- https://en.wikipedia.org/wiki/MPEG-4
- http://www.nationalarchives.gov.uk/PRONOM/Format/proFormatSearch.aspx?status=detailReport&id=660
- https://en.wikipedia.org/wiki/Moving_Picture_Experts_Group#Standards

Risk and Prioritization Analysis

✓ Low Risk

☐ **Moderate Risk**

☐ **High Risk**

29 Numeric Risk Rating

29 Numeric Prioritization Rating

Proposed Preservation Plan

✓ **Retain** file format in its existing format.

☐ **Transform** file to a new format.
   Selected Format: _____

☐ **Procure/develop tools** to preserve, manage and provide access to records of this type in their existing form.

☐ **Procure/develop tools** to transform the format to the preferred normalized form.

☐ **Provide Additional Information** so that the record type remains understandable/usable over time.

☐ **Explore Additional Options**

Justification: The file format is well documented, ubiquitous, and there are open source tools available for transcoding.

Preferred Processing and Transformation Tool(s)

- FFMPEG

Preferred Viewer/Access Software

- VLC
- Windows Media Player
- QuickTime Player

Video Object File

NARA Format ID: NF00437

Extension(s):
- vob

Documentation

- https://www.loc.gov/preservation/digital/formats/fdd/fdd000028.shtml
- https://en.wikipedia.org/wiki/MPEG_program_stream
- http://www.mpucoder.com/DVD/vobov.html
- https://en.wikipedia.org/wiki/DVD-Video

Risk and Prioritization Analysis

☐ **Low Risk**

✓ Moderate Risk

☐ **High Risk**

18 Numeric Risk Rating

16 Numeric Prioritization Rating

Proposed Preservation Plan

☐**Retain** file format in its existing format.

✓ Transform file to a new format.

    Selected Format: AVI

☐ **Procure/develop tools** to preserve, manage and provide access to records of this type in their existing form.

☐ **Procure/develop tools** to transform the format to the preferred normalized form.

☐ **Provide Additional Information** so that the record type remains understandable/usable over time.

☐ **Explore Additional Options**

Justification: The file format is well documented and ubiquitous, but is no longer supported in the marketplace. There are open source tools available for transcoding.

Preferred Processing and Transformation Tool(s)

- FFMPEG

Preferred Viewer/Access Software

- VLC

Advanced Systems Format

NARA Format ID: NF00109

Extension(s):
- asf

Documentation

- https://www.loc.gov/preservation/digital/formats/fdd/fdd000091.shtml
- https://www.loc.gov/preservation/digital/formats/fdd/fdd000100.shtml
- https://www.loc.gov/preservation/digital/formats/fdd/fdd000095.shtml
- https://docs.microsoft.com/en-us/windows/desktop/wmformat/overview-of-the-asf-format
- https://docs.microsoft.com/en-us/windows/desktop/medfound/asf-file-structure
- http://www.nationalarchives.gov.uk/PRONOM/Format/proFormatSearch.aspx?status=detailReport&id=693
- https://en.wikipedia.org/wiki/Windows_Media_Video

Risk and Prioritization Analysis

☐ **Low Risk**

✓ Moderate Risk

☐ **High Risk**

4   Numeric Risk Rating

-4   Numeric Prioritization Rating

Proposed Preservation Plan

☐**Retain** file format in its existing format.

✓ Transform file to a new format.

      Selected Format: AVI

☐ **Procure/develop tools** to preserve, manage and provide access to records of this type in their existing form.

☐ **Procure/develop tools** to transform the format to the preferred normalized form.

☐ **Provide Additional Information** so that the record type remains understandable/usable over time.

☐ **Explore Additional Options**

Justification: The file format is well documented and ubiquitous, but is no longer supported in the marketplace. There are open source tools available for transcoding.

Preferred Processing and Transformation Tool(s)

- FFMPEG

Preferred Viewer/Access Software

- VLC
- Windows Media Player
- 5KPlayer

Material Exchange Format

NARA Format ID: NF00245

Extension(s):
- mxf

Documentation

- https://www.amwa.tv/downloads/whitepapers/MXFPhysicalview.pdf
- https://www.iso.org/standard/70018.html

Risk and Prioritization Analysis

✓ Low Risk
☐ **Moderate Risk**
☐ **High Risk**
30 Numeric Risk Rating
30 Numeric Prioritization Rating

Proposed Preservation Plan

Recommended actions (more than one can be selected):

✓ **Retain** file format in its existing format.
☐ **Transform** file to a new format.
☐ **Procure/develop tools** to preserve, manage and provide access to records of this type in their existing form.
☐ **Procure/develop tools** to transform the format to the preferred normalized form.
☐ **Provide Additional Information** so that the record type remains understandable/usable over time.
☐ **Explore Additional Options**

Justification: The file format is well documented, ubiquitous, and there are open source tools available for transcoding. It is one of the most stable of all acceptable preservation formats for this record type.

Preferred Processing and Transformation Tool(s)

- FFMPEG

Preferred Viewer/Access Software

- VLC

- Windows Media Player
- 5KPlayer

Flash Video

NARA Format ID: NF00193

Extension(s):
- flv
- f4v

Documentation

- http://fileformats.archiveteam.org/wiki/FLV
- http://download.macromedia.com/f4v/video_file_format_spec_v10_1.pdf
- https://en.wikipedia.org/wiki/Flash_Video

Risk and Prioritization Analysis

☐ **Low Risk**

✓ Moderate Risk

☐ **High Risk**

10 Numeric Risk Rating

8   Numeric Prioritization Rating

Proposed Preservation Plan

Recommended actions

☐ **Retain** file format in its existing format.

✓ Transform file to a new format.

> AVI

☐ **Procure/develop tools** to preserve, manage and provide access to records of this type in their existing form.

✓ Procure/develop tools to transform the format to the preferred normalized form.

☐ **Provide Additional Information** so that the record type remains understandable/usable over time.

☐ **Explore Additional Options**

Justification: The file format is well documented and still supported, but is no longer ubiquitous.

Preferred Processing and Transformation Tool(s)

- Adobe Flash Player
- Adobe Animate
- VLC

Preferred Viewer/Access Software

- Adobe Flash Player
- VLC