

Factors for Evaluating Preservation File Formats for Digital Video

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Sustainability Factors:

Disclosure: Degree to which complete specifications and tools for validating technical integrity exist and are accessible to those creating and sustaining digital content

Adoption: Degree to which the format is already used by the primary creators, disseminators, or users of information resources

Transparency: Degree to which the digital representation is open to direct analysis with basic tools, such as human readability using a text-only editor

Self-Documentation: Degree to which the format contains basic descriptive, technical, and other administrative metadata clarifying the nature of the contents

External Dependencies: Degree to which a particular format depends on particular hardware, operating system, or software for rendering or use

Impact of Patents: Degree to which the ability of archival institutions to sustain content in a format will be inhibited by patents

Technical Protection Mechanisms: Implementation of mechanisms such as encryption that prevent the preservation of content by a trusted repository

Quality Factors:

Normal rendering: includes playback of a single image stream with sound in mono or stereo through speakers or headphones; typical software provides user control over picture elements (brightness, hue, contrast), sound elements (volume, tone, balance), and navigation (fast forward, go-to-segment, etc.).

Clarity: refers to the degree to which "high image resolution" content may be reproduced within this format, and the ability to minimize compression loss or watermarking effects

Fidelity: refers to the degree to which "high fidelity" sound may be reproduced within this format

Sound field: refers to the degree to which formats may represent sound in terms of aural space or as complementary streams

Functionality beyond normal rendering: refers to a format's support for features beyond simple display, including automatic scaling of video stream to available bandwidth, support for animation, interactivity, etc.

Preservation File Formats for Digital Video: Essence

Sustainability & Quality Factors	MPEG-2 4:2:2 profile	MJPEG 2000 Core Coding, Lossless
Disclosure	Open standard	Open standard
Adoption	Widely used by broadcasters & cable	Not widely adopted
Transparency	Depends upon algorithms and tools to read; will require sophistication to build tools.	Depends upon algorithms and tools to read; will require sophistication to build tools.
Self-documentation	Technical (coding) information is contained in the bitstream in macroblock headers, slice headers, picture headers, GOP headers, and sequence headers (which provide data needed before decoding can begin, such as the size of the picture and the frame rate). Lacking in descriptive metadata	The structure includes boxes and headers that contain the technical metadata needed to manage the media streams. Boxes may be added by implementers, including boxes for XML metadata, IPR data, and UUIDs for application specific data
External Dependencies	Playback of surround sound requires multiple loudspeakers.	None
Impact of Patents	Managed by MPEG LA LLC; Licenses pertain to tools and not to streams or files per se.	Dependent on ISO Base Media File format, which identifies Apple and Matsushita Electric Industrial Co. as holders of relevant patents who are "willing to negotiate licenses under reasonable and non-discriminatory terms."
Technical Protection Mechanisms	None	None. Files may employ an optional IPR (Intellectual Property Rights) box that indicates whether an item is protected and provides an identifier.
Normal rendering	Good support.	Good support, including timescales that manage the playout of time-based media streams and hint tracks employed in streaming applications.
Clarity	Moderate to very good, given that this is a format for compression. Outcome will depend on the type and extent of compression, and the encoder used.	Excellent, especially when frames are compressed with lossless encoding. For lossy encoding, the outcome will depend on the type and extent of compression, and the encoder used.
Fidelity	Moderate to very good, given that the options for audio employ compression. The outcome will depend on the type and extent of compression, and the encoder used.	Excellent; the format supports LPCM encoding (as "raw" or "twos-complement" data) with no stated limit on sampling or bit depth.
Sound field	Multi-channel sound is supported. AAC provides for up to 48 main audio channels, 16 LFE channels, 16 overdub/multilingual channels, and 16 data streams.	The support for multiple tracks permits the use of multiple audio streams and/or individual streams encoded in structures like 5.1
Additional functionality	The MPEG-2 transport stream permits the multiplexing of multiple programs.	The specification discusses features like composition (the mixing or matrixing of tracks), random access, and fragmented movie files.

Preservation File Formats for Digital Video: Metadata Wrapper

Sustainability & Quality Factors	MXF	MPEG-21 DIDL	METS
Disclosure	Open standard	Open Standard	Open Standard
Adoption	There appears to be growing interest in MXF, an emerging standard, although it may not be widely adopted at this time. MXF is used by several production systems, notably the SONY IMX video recorders. Adoption by Digital Cinema Initiative may spur wider adoption	Extremely limited adoption of DIDL, although larger adoption of other parts of MPEG-21 standard, particularly Digital Rights Expression Language	Widely adopted in library community, but with extremely limited adoption outside of the community, primarily by other memory institutions (museums and archives).
Transparency	Transparent	Transparent	Transparent
Self-documentation	Extensive metadata is required by or may optionally be placed in MXF files, including structural metadata is about the structure and descriptive metadata. Depends on KLV encoding for metadata specified by SMPTE 336M-2001	Supports extensive metadata of a variety of types, as long as they are XML	Supports extensive metadata of a variety of types, as long as they are XML
External Dependencies	None	None	None
Impact of Patents	None, although MPEG-21 patent pool may apply.	IBM and Matsushita filed statements with ISO indicating that implementation of MPEG-21 may involve the use of patents they hold, which they will make available on 'reasonable and non-discriminatory' terms.	None, although MPEG-21 patent pool may apply.
Technical Protection Mechanisms	None	None	None
Flexibility in handling metadata			
Flexibility in handling essence			
Additional functionality			