Federal Agencies
Digital Guidelines Initiative

Significant Properties for Digital Video

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The FADGI Audio-Visual Working Group
http://www.digitizationguidelines.gov/audio-visual/

Significant Properties for Digital Video

By the Federal Agencies Digital Guidelines Initiative (FADGI)
Audio-Visual Working Group
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Approved by Working Group: October, 2024

Send comments to feddigitization@loc.gov

What is this document?

Initially inspired by the Significant Significant Properties work presented at iPRES2018, FADGI sought to delve deeper into the area of significant properties for digital video to provide definitions for common terms and how changes in these typical criteria would impact the digital video content, technical parameters and display. It is the revision of a draft version released in 2019.

Note on formatting: Aside from this introduction, the following pages are formatted for Tabloid size paper (11” x 17”).

This project comprises three components:

- Significant Properties for Digital Video Criteria and Definitions
- Comparing Significant Properties in Use Cases
- Resources and References

Scope and expectations

- The audience for this project is entry to mid-level practitioners and not expert engineers.
- The scope of this project follows the "80/20 rule" in which the criteria explores what is found in typical digital video - the 80% of cases - rather than special cases - the 20% of outliers. This project isn't meant to be comprehensive but instead, representative of common parameters.
- The value of this project is to provide both technical and summary (plain language) explanations as well as typical values/examples of how the data is presented to help practitioners identify the values in reports and systems.
- A key feature is an overview of the impact of change - what happens if the significant property is altered in some way over time or through migration.

Change list from draft version published in 2019 (superseded by this document)

- Mapping of the significant properties to use cases at three federal agencies (in the "Comparing Significant Properties in Use Cases" worksheet)
- Adjusting the criteria and definitions for clarity and readability
- Adding additional depth to the "Relevant Standards" column
- Removing the "How is this data represented through metadata in commonly used open source tools?" columns because this data falls out of sync with application updates and revisions. Users can typically identify the data points through the "Typical Values" column.
- Updating resources and references
- Removing the "In depth/More information" worksheet. Much of these data was incorporated into the main criteria page.
- Discontinuing the "FADGI Significant Properties for Digital Video - Context" page because it mostly contained disclaimers about the 2019 draft version and is no longer relevant.

Significant Properties for Digital Video (2024)

FADGI AV Working Group; Last updated: 10/10/2024

Class of Significant Property (from JISC report)	Significant Property Name	Definition	Additional notes if needed	Reference for definition - see also Resources + References	Typical values (not exhaustive list)	Impact of change on this property	Relevant standards if applicable	Map to FADGI Creating and Archiving Born Digital Video High Level Recommended Practices (2014)
Content	Duration	The length of time (in hours, minutes, seconds and frames) a video lasts when played back from start to finish. Also referred to as 'length,' 'run time' or 'total running time.' Unless otherwise noted, duration is the full run time of the video file but can also be at a component level such as track or other smaller segments of the file. Two common types of duration which may exist in same file: 1) file duration which include headers with color bars, slates which run before program content etc.; and 2) program content only from the first frame to final frame of the fade out/ring out.	n/a	Adapted from Tektronix Glossary of Video Terms and Acronyms	May be expressed in a variety of configurations including the ISO 8601 format of hh:mm:ss, which represents hours, minutes, and seconds. Also may use the following formats to accommodate frames: hh:mm:ss;ff (drop frame timecode) or hh:mm:ss:ff (non-drop frame timecode). Sometimes expressed as whole numbers (for example, 30,500 milliseconds) or as a decimal number (for example, 30.5 minutes). 10s 444ms (MediaInfo = Duration_string)	Changing the duration can result from cutting out content, changing the playback speed or a replaced counter somewhere along the signal chain. All of these result in changing the playback experience and potentially losing or misrepresenting data.	ISO 8601 DateTime format; ISO 8601 - Wikipedia ST 12-1:2014 - SMPTE Standard - Time and Control Code (standard no longer available. See also SMPTE timecode - Wikipedia	n/a
Content	Number of Video Channels, Tracks or Streams	Number of video channels, tracks or streams present in a single file. While a single video track is common, some wrappers can contain multiple video tracks within the same file.	Sometimes the terms "tracks", "channels" or "streams" are used interchangeably but they have distinct meanings. A track is "a distinct element of audiovisual information, such as the picture, a sound track for a specific language, or the like. DVD-Video allows one track of video (with multiple angles), up to 8 tracks of audio, and up to 32 tracks of subpicture." A stream is "a collection of digital data of one type; such as a video stream, an audio stream or a subtitle stream. Each stream may also have channels within it." A channel is "an independent signal path. Stereo recorders have two such channels. Quadraphonic ones have four."	Adapted from Tektronix Glossary of Video Terms and Acronyms	Represented by whole integer value ("1", "2", etc)	It's important to understand and document the correct number of tracks/channel to capture the entire content contained within the file.	Depends on wrapper. .mxf, .mkv, .mov, other wrappers that allow multiple video streams in a single file. See https://www.loc.gov/preservation/digital/formats/index.html for more details on specific formats.	n/a

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Content	Number of Audio Channels or Audio Tracks	Number of audio channels or tracks present in a single file. There are multiple methods in which audio may be organized. A single audio track may contain a single channel or, for example, a group of 4 channels.	Audio channels can be mono (one channel), stereo (two audio channels which form a left and right stereo pair encoded in a single bit stream) as well as a variety of other options such as AES3 audio pair, 5.1 surround sound (6 channel mixes), 7.1 surround sound (8 channel mixes) and more. An audio track is an instantiation of audio that is recorded onto physical media or in a file. Audio tracks may contain more than one channel of audio. WAV files for example typically contain two channels of audio in a stereo mix configuration. There are other types of tracks that can contain more than two audio channels, such as the various types of Dolby AC-3 encoded tracks (up to 8 channels), a Dolby E (for "editable") track that can contain up to 8 channels of audio formatted as an AES3 audio pair; or a DTS audio track which can be up to 8 channels encoded with the DTS proprietary codec and appearing on consumer formats such as DVD and Blu-ray and in files intended for theatrical presentation such as DCPs (digital cinema packages) and IMF (Interoperable mastering format) files. In audio software a track will appear as a single unit on a software's timeline, but it can contain one or more audio channels.	Adapted from Tektronix Glossary of Video Terms and Acronyms and FADGI Glossary	Represented by whole integer value ("1", "2", etc)	It's important to understand and document the correct number of tracks/channel to capture the entire content contained within the file.	Depends on wrapper. See https://www.loc.gov/preservation/digital/formats/index.html for more details on specific formats.	RP 3.13 Select formats that can contain and label complex audio configurations including multiple channels and sound fields beyond mono and stereo
Context	Supplementary Metadata	Metadata that augments the information required for system integration or specification compliance. Supplementary metadata is often represented by organization specific descriptive (“cataloging”) or administrative metadata, or by specialized forms of process metadata that documents the general facts about the system, settings, facility, and operator when a video signal is transferred, e.g., in a reformatting (tape to file) activity. Some of this data may be essential to proper playback, for example, some cameras create packages of files with files that can inform how the files should be read and played back, containing either/both technical information about the video files themselves and information about how the file components or tracks relate to each other, such as disk, clip, or playlist information, or video stream frame rate, frames per second, and aspect ratio. Depending on the camera original format, sometimes these files must be retained in order to guarantee accurate playback of the files. Supplementary metadata can be embedded within the file or carried as a separate sidecar file, sometimes as XML or other structured data.	n/a	Adapted from SMPTE RDD 48 definition of Supplementary Metadata	n/a	Removing accompanying data files from camera original formats increases the risk that files will not be able to be played back as intended, or that they may not be able to reconstructed at all.	n/a	RP 2.2 Document relationships between the video object and other files, such as closed captions, scripts, location notes and other supplemental material

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Rendering/Appearance	Display Aspect Ratio (DAR)	Display Aspect Ratio (DAR) is the ratio between the width and height of the frame at the time of playback. DAR is a metadata field present in most audiovisual containers (though absent in some, including AVI) that is used by playback software and platforms to properly render the width and height of the frame proportionally so that the image is not stretched or narrowed.	DAR can be calculated with the following equation: DAR = SAR × PAR A file can potentially display conflicting DARs. Some file containers, like AVI, may not clearly document aspect ratio, resulting in a file presentation that may stretch or adjust from the original intended image. However, even though AVI does not include a standard PAR or DAR field, there are workarounds that allow for these characteristics of the file to be documented. Some software will include PAR and DAR information in additional RIFF chunks at the end of the file; others use the XMP chunk in the file to document this information. It is also possible to use a codec such as FFv1 or others that specifically document the DAR information. For playback and transcoding, some applications allow users to force a certain desired DAR in software settings. The three values related to aspect ratios are intertwined. SAR is an immutable value that is unchanging over time or unable to be changed. It is the size of the file. DAR is the rendering of the file, and PAR is what has changed to achieve that. (See PAR and DAR for more information)	Display aspect ratio - Wikipedia	Standard definition: 4:3; High definiti	DAR is useful for normalizing the display of video content across broadcast standards at the point of playback. For example: A digitized NTSC image is stored in a frame of 720x486 pixels, while a digitized PAL image is stored in a frame size of 720x576 pixels. If either an NTSC or PAL video were to be displayed with square pixels according to their stored frame size without accommodating for DAR, both would result in the displayed image having a distorted width. The NTSC image would be wider than it should be, and the PAL image would be narrower than it should be. The inclusion of DAR in the video container ensures that the playback systems render the image as intended, rather than depending on the size of the frame that the image is stored in. In this case, the NTSC pixels are made narrower and the PAL pixels are made wider so that the resulting images are rendered as 4:3. It is also possible to use DAR to properly display anamorphic video content. In this case, a widescreen (16:9) image is made narrower to fit inside of a standard definition frame. In the case of NTSC, a file with 720x486 pixels can be used the 16:9 image. If this file is displayed without accommodating for DAR, the image would be extremely distorted, much narrower than intended. However, the DAR information in the file (in this case, the DAR is set to 16:9) will inform the playback system that the pixels should be stretched widthwise in order to properly display the 16:9 content.	ITU Rec 601: https://www.itu.int/rec/R-REC-BT.601/ ITU Rec 709: https://www.itu.int/rec/R-REC-BT.709 ITU Rec 2020: https://www.itu.int/rec/R-REC-BT.2020 ITU Rec. 2100 - HDR for TV: https://www.itu.int/rec/R-REC-BT.2100	RP 1.5 Select larger picture sizes over smaller picture sizes (information related to DAR and SAR, but not explicitly the same)
Rendering/Appearance	Pixel Aspect Ratio (PAR)	PAR (Pixel Aspect Ratio) is the ratio between the width and the height of each individual pixel that makes up a video frame. Pixels within a frame are all of a uniform size, and while they may be square, they often are not. If the pixels are square, the PAR value is 1:1 or 1, since the width and the height of the pixels are equal to one another. It is common for NTSC video files to have a PAR of 10:11, or approximately 0.91. In this case the pixels are non-square rectangles that are slightly taller than they are wide.	PAR can be calculated with the following equation: PAR = DAR / SAR Note that some sources (including Wikipedia) suggest that "PAR is also known as sample aspect ratio and abbreviated SAR, though it can be confused with storage aspect ratio." The three values related to aspect ratios are intertwined. SAR is an immutable value that is unchanging over time or unable to be changed. It is the size of the file. DAR is the rendering of the file, and PAR is what has changed to achieve that. In other words, PAR is adjusted in order to get the appropriate DAR from the given SAR of the file, as the pixel dimensions of a file (SAR) are immutable. If the desired DAR is different than the SAR, the PAR must be adjusted to be either larger or smaller than 1:1, which represents a perfectly square pixel. For example, a 720x480 file has a SAR of 3:2, but must be displayed with a DAR of 4:3 to be rendered properly. In this case, a PAR of 8/9 must be set in order for the file to be displayed properly, or in other worse, the pixels must be slightly taller than they are wide.	Adapted from Tektronix Glossary of Video Terms and Acronyms and FADGI Glossary	Square: 1:1NTSC: 10:11 (4:3 DAR)N	Pixel aspect ratio is fundamental to how an image is scaled and displayed on screen. Changes may result in stretched or squeezed images.	ITU Rec 601: https://www.itu.int/rec/R-REC-BT.601/ ITU Rec 709: https://www.itu.int/rec/R-REC-BT.709 ITU Rec 2020: https://www.itu.int/rec/R-REC-BT.2020 ITU Rec. 2100 - HDR for TV: https://www.itu.int/rec/R-REC-BT.2100	n/a

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Rendering/Appearance	Storage Aspect Ratio (SAR)	SAR (Storage Aspect Ratio) is the width and height of a video frame expressed as a ratio. For example, a video frame with a width of 720 pixels and height of 480 pixels (720x480) would have a SAR of 3:2.	SAR can be calculated with the following equation: SAR = DAR / PAR Note that some sources (including Wikipedia) suggest that "PAR is also known as sample aspect ratio and abbreviated SAR, though it can be confused with storage aspect ratio." The three values related to aspect ratios are intertwined. SAR is an immutable value that is unchanging over time or unable to be changed. It is the size of the file. DAR is the rendering of the file, and PAR is what has changed to achieve that. In other words, PAR is adjusted in order to get the appropriate DAR from the given SAR of the file, as the pixel dimensions of a file (SAR) are immutable. If the desired DAR is different than the SAR, the PAR must be adjusted to be either larger or smaller than 1:1, which represents a perfectly square pixel. For example, a 720x480 file has a SAR of 3:2, but must be displayed with a DAR of 4:3 to be rendered properly. In this case, a PAR of 8/9 must be set in order for the file to be displayed properly, or in other worse, the pixels must be slightly taller than they are wide.	Adapted from PAR, SAR, and DAR: Making Sense of Standard Definition (SD) video pixels	2:1: An image with 200 pixels wide by 100 pixels high 22:15: An image with 704 pixels wide by 480 pixels high 4:3: An image with 640 pixels wide by 480 pixels high 5:4: A 576i video with 720 pixels wide by 576 pixels high 16:9: A video shot at 1280 pixels wide by 720 pixels high	SAR is stored in the metadata of each video frame, and a decoder uses this information to adjust the video to account for how it was sampled and how it should render. Changes may result in stretched or squeezed images.	ITU Rec 601: https://www.itu.int/rec/R-REC-BT.601/ ITU Rec 709: https://www.itu.int/rec/R-REC-BT.709 ITU Rec 2020: https://www.itu.int/rec/R-REC-BT.2020 ITU Rec. 2100 - HDR for TV: https://www.itu.int/rec/R-REC-BT.2100	n/a
Rendering/Appearance	Image Size	Often referred to as resolution, the image size is the basic measurement of how much visual information is represented in the image. The size of the image is measured in pixels for the horizontal dimension (width) and lines for the vertical dimension (height). The horizontal dimension is listed first and the two values are separated by an "x".	Image size can have a direct impact on file size because larger images hold more data which can increase overall file size.	Adapted from Tektronix Glossary of Video Terms and Acronyms	NTSC broadcast – 330 x 485; NTSC	While the display and rendering of the video will depend on other factors as well, this value represents information that cannot be recouped once lost. If image size is scaled up dramatically for display, may introduce visual artifacts and muddyness.	ITU Rec 709: https://www.itu.int/rec/R-REC-BT.709 ITU Rec 2020: https://www.itu.int/rec/R-REC-BT.2020 ITU Rec. 2100 - HDR for TV: https://www.itu.int/rec/R-REC-BT.2100	RP 1.5 Select larger picture sizes over smaller picture sizes

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Rendering/Appearance	Audio bit depth	Bit depth determines the encoded dynamic range of an audio event and is represented by the number of bits used for each individual sample to encode digital audio. The higher the bit depth, the greater the range between quietest and loudest value of the signal, resulting in more detail and higher fidelity of the audio captured.	n/a	Adapted from FADGI Glossary	16, 24, 32 Native bit rate for audio in digital video is normally 16 or 24-bit	Lower bit depths signifies lower signal to noise ratio and potential for less accurate digital representation of signal. When working with born digital content, strive to maintain a minimum audio bit depth equal to that of the original when possible.	IASA-TC 04: Guidelines on the Production and Preservation of Digital Audio Objects	RP 1.7 Select higher bit depths over lower bit depths RP 2.3 Identify the file characteristics at the most granular level possible, including the wrapper and video stream encoding Description talks about video characteristics only but the same can be said about audio
Rendering/Appearance	Audio sampling rate	Sampling rate (sometimes referred to as sampling frequency) defines the number of samples per second (or per other unit) taken from a continuous signal to make a discrete or digital signal. Measured in hertz (Hz) or kilohertz (kHz), it is usually expressed in samples per second (i.e. 44100 samples per second can be expressed as either 44100 Hz, or 44.1 kHz).	The Nyquist–Shannon sampling theorem (Nyquist principle) states that perfect reconstruction of a signal is possible when the sampling frequency is greater than twice the maximum frequency of the signal being sampled. For example, the approximate upper limit of human hearing is around 20 kHz, so a sampling frequency of 40 kHz or greater is needed to reach this theoretical reconstruction and avoid aliasing or distortion of the audio signal. While higher sampling rates encode audio outside of the human hearing range, the overall effect of higher sampling may improve the audio quality. When capturing born digital the sampling frequency should at minimum equal that of the original signal.	Adapted from FADGI Glossary	Most common sampling rates: 44.1 kHz, 48 kHz, 96 kHz, 192 kHz. 48 kHz is common for audio in digital video, albeit it may be higher or lower depending on the original source material (TC-06).	For many, sample rate conversion downwards (i.e. 48 kHz to 44.1 kHz) diminishes the high frequencies that are out of range for human hearing. However, continual down sampling for derivatives may eventually result in loss of quality over time. Spoken word is less sensitive to reductions in sampling rate versus music or other content with more dynamic range.	IASA-TC 04: Guidelines on the Production and Preservation of Digital Audio Objects	RP 1.7 Select higher bit depths over lower bit depths RP 2.3 Identify the file characteristics at the most granular level possible, including the wrapper and video stream encoding Description talks about video characteristics only but the same can be said about audio
Rendering/Appearance	Video bit depth	Video bit depth, also known as color depth or bits per pixel, is the number of bits used to represent each color channel or component in a sample of video. It's a measure of the level of detail in color information stored in an image. For example, an 8-bit RGB video can have up to 256 (2^8) values per channel (red, green, blue), a 10-bit RGB video can have up to 1024 (2^10) values per channel and 12-bit video up to 4096 (2^12).	8-bit had previously been the standard bit depth for digital videos in both television and film production. With more cameras that can record in higher bit depths, more easily accessible color grading software, and more widely available HDR televisions, 10-bit, 12-bit, 16-bit or higher depth video is becoming more common.	Adapted from FADGI Glossary	Typical values: 8-bit, 10-bit, 16-bit	The higher the bit depth, the more numbers of colors may be represented, resulting in a higher quality image. However, it can also increase file size and require more processing power which can slow down the workflow if a system isn't equipped to handle it.	EBU R 103 Video Signal Tolerance in Digital Television Systems See also IASA-TC 06: Guidelines for the Preservation of Video Recordings	RP 1.7 Select higher bit depths over lower bit depths
Rendering/Appearance	Video bit rate	Video bitrate is the number of bits that are conveyed or processed per unit of time, usually measured in bits per second (bps), kilobits per second (kbps), megabits per second (mbps), or gigabits per second (gbps). A higher bitrate means more information and better quality, but it also requires more storage and bandwidth. Bit rate is one means used to define the amount of compression used on a video signal. For example uncompressed D1 has a bit rate of 270 Mbps. MPEG-1 has a bit rate of 1.2 Mbps. Factors affect bit rate include upload speed, video compression, device compatibility, streaming platform/destination, bandwidth limits, encoder, video content and network connection.	n/a	Adapted from Tektronix Glossary of Video Terms and Acronyms	Standard definition: 1080p: 8 Mbps 720p : 5 Mbps 480p: 2.5 Mbps High definition: 2160p (4k): 44-56 Mbps□ 1440p (2k): 20 Mbps 1080p:10 Mbps 720p: 6.5 Mbps	Changing a video's bitrate can affect the image quality, file size, and also impact processing time and resource needs.	See IASA-TC 06: Guidelines for the Preservation of Video Recordings	RP 1.6 Select higher bit rates over lower bit rates

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Rendering/Appearance	Video bit rate mode (constant/variable)	The bit rate mode or setting can be either constant or variable. Constant bit rate (CBR) remains the same from the start to the end of the encoded stream. Variable bit rate (VBR) means that bit rate changes over the course of the stream. The encoder allocates a higher bitrate (and therefore more storage space) to compress the more complex segments of frames while lower bitrate/less space is allocated to less complicated details. The average of these rates can be calculated to produce an average bitrate for the file.	CBR is appropriate for video production with little or no variability in the background, such as conference and interview videos. CBR ensures a consistent flow of data so that the video will not freeze or buzz while streaming video to the platform. CBR is useful for streaming multimedia content on limited capacity channels as it takes advantage of all of the capacity (using maximum bit rate, not the average). CBR would not be the optimal choice for storage as it would not allocate enough data for complex sections (resulting in degraded quality) while wasting data on simple sections. The VBR is suitable useful especially if there are a lot of randomly moving objects in the video, such as raindrops or heavy snow.	CBR: https://en.wikipedia.org/wiki/Constant_bitrate VBR: https://en.wikipedia.org/wiki/Variable_bitrate	CBR or VBR	VBR may be more challenging for playback because the rate is constantly changing but it also provides much higher video quality without massive file sizes. It's best used for videos that will be either progressive downloads (like on YouTube or Vimeo) or direct downloads.	n/a	n/a
Rendering/Appearance	Frame rate (frames per second)	Frame rate is the speed at which film or video is recorded and/or played back. The frame rate is often expressed as "frames per second" (fps). Frame rate impacts the visual consistency of motion. A higher frame rate means that more images are being captured per second, which results in smoother motion (and better slow-motion) than with lower rates.	Selected video games and other animation (as well as security camera footage) can have much slower fps rates, some as low as 1 fps. Studies have demonstrated that extremely low frame rates (under 4 frames per second) negatively impact viewer experience, while frame rates as low as 4 or 5 can support acceptable performance. See, for example, https://web.cs.wpi.edu/~claypool/papers/fr-rez/paper.pdf. . The human eye will not perceive a "flicker" if the rate is equal to or greater than 24fps.	Adapted from Tektronix Glossary of Video Terms and Acronyms Additional info on frame rate: https://gizmodo.com/why-frame-rate-matters-1675153198 (includes a basic visual of how frame rates affect moving images)	Pre-1926 film: 18-22 fps with very few at 24 fps; Standard film: 24 fps; Television NTSC: 29.97 fps; Television PAL: 25 fps	Frame rate changes impact the visual experience of motion. For visual examples of frame rate changes, see https://frames-per-second.appspot.com/	Standard film: 24fps (frames per second); Television (NTSC): 29.97fps; Television (PAL/SECAM): 25fps	RP 1.10 Stay within the range of common frame rates of 24-30 frames per second (fps) RP 2.7 Select appropriate technical characteristics for the video encoding if transcoding, normalizing or otherwise changing the video stream to meet business needs RP 2.12 Retain original frame rates is video data is transcoded, even when they are beyond the standard 24-30fps
Rendering/Appearance	Color model	Color model refers to a set of parameters that a system uses to represent color. When using binary or numerical values to store a color value, the color model defines how these values are stored and what colors they represent.	There are two main categories of color models, additive which are based on transmitted light and and subtractive which are based on reflected light. RGB is an additive color model, in which colors are represented as a mixture of Red, Green, and Blue values. YUV, also known as Y'UV, is a subtractive color model because it separates color information from brightness information (Y for luma) from color information (U and V), which allows for the processing of luminance without affecting color. FYI that, unlike RGB, YUV is not an acronym.	Adapted from Tektronix Glossary and FADGI Glossary. See also https://en.wikipedia.org/wiki/Color_model	Examples of common color models for video are RGB and YUV/Y'UV	Changes to the color model impact the display in that the range of colors reproduced may be larger or smaller than the original data. This can be challenging for color correction as well.	n/a	n/a

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Rendering/Appearance	Color space	Color space refers to a range of colors that can be represented by a particular color model. Most color spaces are limited in the colors that they can represent and focus on providing a detail representation of a subset of the colors visible to the human eye, rather than providing a full representation of any possible color. The Commission Internationale de l'Éclairage/CIE 1931 color chart visualizes all colors that can be seen by the human eye. Color spaces are often visualized as a shape that is overlayed on top of the CIE 1931 color chart, with the shape showing the boundary of which colors within CIE 1931 chart can be represented by the color space.	n/a	Definition adapted from FADGI Glossary More info about CIE 1931 color chart: https://en.wikipedia.org/wiki/CIE_1931_color_space	Rec 601 Rec 709 Rec 2020 Rec. 2100 ACES (AC1) DaVinci Wide Gamut ARRI Wide Gamut CIE 1931 XYZ	Color space conversion is the transformation of the representation of a color from one color space to another, typically when data is exchanged inside a color-managed chain. Issues when the wrong color space is used include washed out or oversaturated colors or the destination space, such as a monitor, can't reproduce specific details.	ITU Rec 601: https://www.itu.int/rec/R-REC-BT.601/ ITU Rec 709: https://www.itu.int/rec/R-REC-BT.709 ITU Rec 2020: https://www.itu.int/rec/R-REC-BT.2020 ITU Rec. 2100 - HDR for TV: https://www.itu.int/rec/R-REC-BT.2100 ACES (AC1): Defined by SMPTE 2065-1; https://docs.acescentral.com/specifications/acescc/#specification DaVinci Wide Gamut: https://documents.blackmagicdesign.com/InformationNotes/DaVinci_Resolve_17_Wide_Gamut_Intermediate.pdf ARRI Wide Gamut: https://www.arri.com/en/learn-help/learn-help-camera-system/image-science/log-c CIE 1931: https://en.wikipedia.org/wiki/CIE_1931_color_space	n/a
Rendering/Appearance	Color gamut	Color gamut is a subset or range of colors within the color space that can be reproduced on an output device. Monitors, projectors, and other image reproduction devices often have limitations to the colors they can accurately display, and the color gamut of a device defines the limitations. Similarly to color spaces, color gamuts can be visualized as a shape that is overlaid on tape of the CIE 1931 color chart. Since a color gamut is a subset of a color space, meaning that a gamut can accurately reproduce less colors than are defined by its associated color space, the shape of the gamut will be slightly smaller than the shape of the color space.	n/a	Adapted from Tektronix Glossary and FADGI Glossary. See also https://en.wikipedia.org/wiki/Gamut For diagram of gamut values against CIE 1931 color space chart, see https://en.wikipedia.org/wiki/DCI-P3#/media/File:CIE1931xy_gamut_comparison_of_sRGB_P3_Rec2020.svg.	Rec 2020: current HDR standard sRGB: Internet use standard NTSC 1953: Legacy SDR standard DCI-P3: Theater standard	Color gamut is limited by the parameters of the display device such as a monitor. For example, if a monitor is limited to Rec 709 display but the color gamut is set to another value, such as Rec 2020, the monitor can not accurately display the Rec 2020 color gamut so the intended color gamut may not be represented to the user.	ITU Rec 2020: https://www.itu.int/rec/R-REC-BT.2020 (current HDR standard) IEC 61966-2-1:1999: Multimedia systems and equipment - Colour measurement and management - Part 2-1: Colour management - Default RGB colour space - sRGB: https://webstore.iec.ch/en/publication/6169 (Internet use standard) NTSC 1953: https://docs.fcc.gov/public/attachments/DOC-308674A1.pdf (Legacy SDR standard) DCI-P3:Digital Cinema System Specification: https://documents.dcimovies.com/DCSS/release/1.4.5/Digital-Cinema-System-Specification-1.4.5.pdf; see also SMPTE EG 432-1:2010 - Digital Source Processing — Color Processing for D-Cinema: https://my.smpte.org/s/product-details?id=a1BVR0000007NZN and SMPTE RP 431-2:2011 - D-Cinema Quality — Reference Projector and Environment: https://my.smpte.org/s/product-details?id=a1BVR0000007Nbp. (Theater standard)	n/a
Rendering/Appearance	Color channels	Color channels are the parameters used by a color model to represent color. In an RGB color channel there are three channels, R, G, and B, representing the amount of Red, Green, and Blue respectively. In digital video it is common to use the YUV color model, which has three channels.	A 10-bit YUV file stores each color channel as a 10-bit value for each pixel in the video. This means that the color of each pixel is defined by a combination of three 10-bit values, one for each color channel.	Adapted from FADGI Glossary	Examples include: - three color channels Red, Green, Blue for RGB; - three color channels to represent luma/brightness (Y) and U and V channels provide colour information for YUV	Color channels are linked to the color model value.	n/a	n/a

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FADGI AV Working Group; Last updated: 10/10/2024

Class of Significant Property (from JISC report)	Significant Property Name	Definition	Additional notes if needed	Reference for definition - see also Resources + References	Typical values (not exhaustive list)	Impact of change on this property	Relevant standards if applicable	Map to FADGI Creating and Archiving Born Digital Video High Level Recommended Practices (2014)
Rendering/Appearance	Chroma sampling	Because the human eye is less sensitive to color than to brightness, video codecs default to encoding the luma plane (Y') at full resolution, while using half or even quarter resolution for the chroma planes (Cb', Cr'). While slightly sacrificing video quality, this will result in data reduction and contributes to smaller file sizes.	The subsampling scheme is commonly expressed as a three-part ratio J:a:b (e.g. 4:2:2) or four parts, if alpha channel is present (e.g. 4:2:2:4). The parts are (in their respective order): - J: horizontal sampling reference (width of the conceptual region). Usually, value = 4. - a: number of chrominance samples (Cr, Cb) in the first row of J pixels. Common values = 4, 2, 1 - b: number of changes of chrominance samples (Cr, Cb) between first and second row of J pixels. b is usually either zero or equal to a (except in rare irregular cases like 4:4:1 and 4:2:1, which do not follow this convention). Common values = 4, 2, 1, 0 - Alpha: horizontal factor (relative to first digit). May be omitted if alpha component is not present, and is equal to J when present.	See FFmpeg definition of chroma subsampling: https://trac.ffmpeg.org/wiki/Chroma%20Subsampling See Wikipedia for explanation of values: https://en.wikipedia.org/wiki/Chroma_subsampling	4:1:0 4:1:1 4:2:0 4:2:2 4:4:1 4:4:4 4:2:2:4 4:4:4:4	Higher chroma sampling values can contribute to reduced file sizes but can also can lead to visible artifacts, such as color bleeding and loss of detail in the color channels.	ITU Rec 709: https://www.itu.int/rec/R-REC-BT.709 ITU Rec 2020: https://www.itu.int/rec/R-REC-BT.2020 ITU Rec. 2100 - HDR for TV: https://www.itu.int/rec/R-REC-BT.2100	RP 1.8 Use higher chroma subsampling ratios rather than lower
Rendering/Appearance	File format (wrapper/container)	A wrapper or container format encapsulates its constituent video and audio bitstreams/encodings as well as embedded metadata and other components such as timecode, captions and more into a single file with a extension such as .mkv, .mov, .avi and .mxf.	n/a	Adapted from FADGI Glossary and Sustainability of Digital Formats: Formats, Evaluation Factors, and Relationships	There are many digital video file formats such as .mov, .mkv, .avi and .mxf. See a larger list on the Sustainability of Digital Formats: https://www.loc.gov/preservation/digital/formats/fdd/video_fdd.shtml For an evaluation of common formats for video see IASA-TC 06 Guidelines for the Preservation of Video Recordings	Different wrappers have different capacity for the files' components, especially beyond the imagery data. Some include better support for internal metadata, multiple audio tracks, timecodes and more.	Depends on specific format. See https://www.loc.gov/preservation/digital/formats/fdd/video_fdd.shtml for details.	RP 2.3 Identify the file characteristics at the most granular level possible, including the wrapper and video stream encoding; RP 3.7 Select video encoding and wrapper formats that are well-supported now and future focused; RP 3.8 Select video encoding and wrapper formats that are non-proprietary
Rendering/Appearance	Encoded bitstream	An encoding defines the way the picture and sound essence data is structured at the lowest level. The encoding also determines how much data will be captured: what is the sampling rate and how much information will be captured at each sample? Other encoding features include the frame rate and the bit depth at each pixel or macropixel although the specific characteristics of a file bitstream are determined by the codec that was used to encode the file. Generally speaking, a bitstream cannot be transformed into a standalone file without the addition of file structure such as a wrapper or container. Example of digital video encoded bitstreams are Apple ProRes 4444, AVC/H.264, AV1 and VP9 and digital audio encoded bitstreams include L/PCM, AAC and FLAC.	n/a	Adapted from FADGI Glossary and Sustainability of Digital Formats: Formats, Evaluation Factors, and Relationships	There are many digital video codecs such as Apple ProRes 4444, AVC/H.264, AV1 and VP9. See a larger list on the Sustainability of Digital Formats: https://www.loc.gov/preservation/digital/formats/fdd/video_fdd.shtml Example of digital audio encoded bitstreams include L/PCM, AAC and FLAC. See a larger list on the Sustainability of Digital Formats: https://www.loc.gov/preservation/digital/formats/fdd/sound_fdd.shtml. For an evaluation of common formats for video see IASA-TC 06 Guidelines for the Preservation of Video Recordings	Changes in the encoding of the video data can have significant impacts on the visual appearance and technical fidelity of the information. Different encodings have different parameters they can support such as compression, color space, sampling rates and more.	Depends on codec	RP 2.3 Identify the file characteristics at the most granular level possible, including the wrapper and video stream encoding

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Class of Significant Property (from JISC report)	Significant Property Name	Definition	Additional notes if needed	Reference for definition - see also Resources + References	Typical values (not exhaustive list)	Impact of change on this property	Relevant standards if applicable	Map to FADGI Creating and Archiving Born Digital Video High Level Recommended Practices (2014)
Structure	Scan type	Generally speaking, video frames can be structured in two different ways- as a single image (progressive) or as two alternating fields (interlaced), where each field contains half of the lines needed to represent the entire picture. This Scan Type is typically determined by the method by which the video was created, and/or by the display system the video was intended to be shown on. All analog video, and some early digital video tape systems (MiniDV, DVCAM and DVCPRO) were recorded interlaced. Digital files created from these sources are stored as interlaced. Most modern video formats are progressive, since that is currently the prevailing display system. Videos created during the transition period between standard definition and high definition video may be interlaced or progressive. There is a third, less common scan type called Segmented Frame (also known as Progressive Segmented Frame, PsF, sF, and SF). Segmented frame is a hybrid scan type meant to distribute progressive content using interlaced systems. This scan type has fallen out of favor because interlaced display systems are no longer used to broadcast or distribute content. Segmented frame files are common from the early 2000's, when high definition files were being created but before progressive systems completely took over.	Analog video is typically interlaced. Digital video may be either interlaced or progressive.. All HDTVs are progressive-scan displays — so even if the signal being sent to the HDTV is interlaced, the HDTV will convert it to progressive scan for display on the screen.	Adapted from Tektronix Glossary and IASA-TC 06: Guidelines for the Preservation of Video Recordings	Interlaced (i), Progressive (p), Progressive segmented frame (PsF) Scan type may be expressed with the resolution info: 480i, 720p, 1080i, 1080p, etc. Or with the frame rate info: 59.94i, 24p, 24PsF, etc.	Going from interlaced to progressive: It is fairly easy to transcode from an interlaced to progressive file using deinterlacing filters (most video editing/transcoding software has these built in and the process is seamless). Recommendation: If you have interlaced video and need to make derivatives for access purposes then it's probably a good idea to create a progressive file for end-users who will view the content on a progressive monitor. You should keep your preservation file in its native scan type. Going from interlaced to interlaced: Make sure that you maintain the field order. See the TATE website for good description of how to get more information about what scan type your video may be: https://www.tate.org.uk/about-us/projects/pericles/sustaining-consistent-video-presentation	ITU Rec 709: https://www.itu.int/rec/R-REC-BT.709 ITU Rec 2020: https://www.itu.int/rec/R-REC-BT.2020 ITU Rec. 2100 - HDR for TV: https://www.itu.int/rec/R-REC-BT.2100	RP 2.3 Identify the file characteristics at the most granular level possible, including the wrapper and video stream encoding RP 2.7 Select appropriate technical characteristics for the video encoding if transcoding, normalizing or otherwise changing the video stream to meet business needs
Structure	Timecode	Timecode is an annotation of elapsed time along a track in which each frame or field is assigned a unique digital code number from an electronic clock. Timecode is expressed hours:minutes:seconds and frames. A file may carry multiple timecodes which may be continuous or non-continuous, especially if the file is the result of digitization of an analog videotape. Its primary use is synchronization of various data streams but it can also have important uses in search and discovery to mark or find a specific point in the video. Note that SMPTE 12-1-2014 states that "time code is a combination of the terms " 'time and control code' encompasses all aspects of the time address, flag bits, and binary groups for user-defined data codes, as well as two methods of modulation of the resulting codewords. It is commonly abbreviated to simply "time code" (note that some users spell this "timecode")."	Timecode may be documented as drop frame or non-drop frame. Drop frame drops 2 frames every minute except on every 10th minute to account for 29.97/s frame rate to allow it to correspond a real-time clock. For video produced in countries that used to transmit NTSC in the analog era, their current video production standards use the fractional frame rates used in the NTSC analog era: 23.98 fps for 24 frame film material, 29.97 and 59.94 fps for video. In the cases of video using these fractional frame rates, the SMPTE timecodes usually used are of the "drop frame" (DF) variety. Frames numbers (not actual frames of video) were omitted/skipped at defined points in the runtime of a video to keep the runtime of the video in sync with the actual runtime of the program. Since timecode is, essentially, a frame counter that shows you the hours, minutes, seconds, and frames, it's will drift from the actual runtime by 4.2 seconds per hour if frame numbers were NOT dropped during length of a program. It is a method for keeping the frame count that is time code from not also accurately representing the run time of a program. In the former PAL & SECAM countries which are based on 25 fps frame rates, timecode is non-drop frame.	IASA-TC 06: Guidelines for the Preservation of Video Recordings	Drop frame: HH:MM:SS;FF (with a semicolon [;] separating seconds and frames) Non-drop frame: HH:MM:SS:FF (with a colon [:] separating seconds and frames)	Timecode is an essential tool for synchronisation for projects with multiple camera inputs, image tracks, audio tracks and the like. It identifies specific points in the timeline to the most granular level defined. This also faciliatesthe alignment of captions, subtitles, description and transcripts.	SMPTE standards can be downloaded for free: https://pub.smpte.org/doc/12/ SMPTE ST 12-1:2014 Time and Control Code; SMPTE ST 12-2:2008 Transmission of Time Code in the Ancillary Data Space; SMPTE ST 12-3:2016 Time Code for High Frame Rate Signals and Formatting in the Ancillary Data Space; EBU R 122 Material Exchange Format Timecode Implementation	RP 1.9 Generate a high integrity and continuous master timecode; RP 3.14 Select formats that can support robust timecode data

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Structure	File size	The size of a file including all its components and tracks, expressed in units based on a byte (kilobyte [KB], megabyte [MB], gigabyte [GB], etc.) File size, when written to a file system, may be reported as slightly higher than the actual size because a file system may round the size up to include any unused space left over in the last block used by the file.	n/a	n/a	Expressed in units based on a byte (kilobyte [KB], megabyte [MB], gigabyte [GB], etc.) depending on the amount of data.	Changes in expected file size can be an indicator of data change or loss in the file so can be a first sign that additional analysis is needed.	n/a	n/a
Content	Captions	Captions provide a textual display of spoken dialogue and indicate other sounds on visual displays, such as television monitors, computer screens and projected video. They are intended for display over a timeline, in synchronization with image and sound essence. Captions identify content including speakers on and off camera, sound effects such as "telephone ringing" or "footsteps" and as well as music and other aural content. Captions can be classified as either "closed" or "open". Closed captions are timed text information and, depending on media player support, can be turned on or off. They may often be carried in a sidecar file such as WebVTT, TTML or SMIL but can also be embedded in the file. In contrast, open caption are permanently embedded or integrated into the video stream and therefore, always on view and cannot be turned off.	In the analog NTSC standard the closed captions are carried in line 21. In uncompressed digital video they are carried in the SMPTE ST436 defined closed caption space in the video frame header. In lossy compressed video it is carried (if captions are permitted by the compression scheme: some early compression types did not allow closed captions to be carried) in the video user bits in the header of the compressed video frames. Closed captions are always carried attached to video frames since the timing of the captions to specific frames of video is critical. External sidecar closed captions can be formatted as plain text (such as WebVTT/.vtt and SubRip/.srt) or as XML (such as Timed Text Markup Language or TTML). However, external sidecar files are dependent on media player support. The terms ‘caption’ and ‘subtitle’ are defined in this resource according to their use in US Federal Communications Commision (FCC) rules (https://www.govinfo.gov/content/pkg/PLAW-111publ260/pdf/PLAW-111publ260.pdf) and the US Code of Federal Regulation (CFR: https://www.ecfr.gov/current/title-47/chapter-I/subchapter-C/part-79). Other locales may use these terms interchangeably or even in the reverse.	See FADGI's Accessibility Features for Digital Audiovisual Collections Content NTSC: Consumer Electronics Association standard ANSI/CTA-608-E (CEA-608); ATSC (aka DTV): ANSI/CTA-708-E (CEA-708)	n/a	Captions are required by US regulations according to https://www.ecfr.gov/current/title-47/chapter-I/subchapter-C/part-79.	Closed caption data stored as ANSI/CTA-608-E (CEA-608) and ANSI/CTA-708-E can be extracted and stored as a sidecar Timed Text file such as SMPTE Timed Text or EBU Timed Text. CRF Rule: 47 CFR § 79 Accessibility of Video Programming: https://www.ecfr.gov/current/title-47/chapter-I/subchapter-C/part-79 FCC Disability Rights Office: Twenty-First Century Communications and Video Accessibility Act of 2010: Public Law 111–260 111th Congress An Act Section 202 Video description and closed captioning: https://www.govinfo.gov/content/pkg/PLAW-111publ260/pdf/PLAW-111publ260.pdf WCAG: For pre recorded content: Closed or open captions required to fulfill WCAG 2.0, Level A success criterion 1.2.2: https://www.w3.org/WAI/WCAG21/Understanding/captions-prerecorded.html For live content: Closed or open captions required to fulfill WCAG 2.0, Level AA success criterion 1.2.4: https://www.w3.org/WAI/WCAG21/Understanding/captions-live.html Section508: Create Accessible Synchronized	RP 2.2 Document relationships between the video object and other files, such as closed captions, scripts, location notes and other supplemental material

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Class of Significant Property (from JISC report)	Significant Property Name	Definition	Additional notes if needed	Reference for definition - see also Resources + References	Typical values (not exhaustive list)	Impact of change on this property	Relevant standards if applicable	Map to FADGI Creating and Archiving Born Digital Video High Level Recommended Practices (2014)
Content	Subtitles	Subtitles are timed text of spoken audio dialog that is usually, but not always, presented in a language other than the language of the sound essence. Subtitles can be delivered as closed or open captions as well as external sidecar files (such as WebVTT or TTML).	The terms 'caption' and 'subtitle' are defined in this resource according to their use in US Federal Communications Commision (FCC) rules (https://www.govinfo.gov/content/pkg/PLAW-111publ260/pdf/PLAW-111publ260.pdf) and the US Code of Federal Regulation (CFR: https://www.ecfr.gov/current/title-47/chapter-I/subchapter-C/part-79). Other locales may use these terms interchangeably or even in the reverse.	See FADGI's Accessibility Features for Digital Audiovisual Collections Content	n/a	Subtitles are impactful for understanding of the content but they are not an acceptable method for conforming with the synchronized media standards according to Create Accessible Synchronized Media Content | Section508.gov and do not meet the bar for digital accessibility compliance.	No official standard but see Captions/Subtitles | Web Accessibility Initiative (WAI) | W3C for more information.	RP 2.2 Document relationships between the video object and other files, such as closed captions, scripts, location notes and other supplemental material
Structure and/or Rendering/Appearance	Field order	Field Order (also referred to as Field Dominance) determines which of the two fields that make up a frame is displayed first. An analog frame is made up of two fields, each field containing every other line in the frame. On an interlaced display, such as a CRT, each field is displayed one after another. Digital files created from analog content, and early digital video content (such as MiniDV, DVCAM, DCVPro, etc…) are stored as interlaced to retain the original organization of the content. However, when an interlaced file is displayed on a progressive display (such as a computer monitor) both fields are displayed at the same time. Digital files containing interlaced content should define their Field Order to express which of the two fields would be displayed first in an interlaced system, despite them being displayed simultaneously in a progressive system. This field must be properly defined to playback a digital file in an interlaced display system. This field is also referenced during de-interlacing, either by a playback system with built-in de-interlacement, or when transcoding to a new de-interlaced file. Field Order must be defined in order for this de-interlacement to occur properly, or the resulting image will contain interlacing artifacts.	SMPTE standard 125M-1995 references fields as field 1 (odd) and field 2 (even); video editing and transcoding software usually refers to field order in interlace video as top or bottom field.	SMPTE STANDARD SDTV Component Video Signal Coding 4:4:4 and 4:2:2 for 13.5 MHz and 18 MHz Systems	Upper field first, lower field first Top field first, bottom field first Field 1, Field 2 Field Order is often expressed as Top Field First (TFF) or Bottom Field First (BFF). It can also be expressed as Odd or Even. TFF and Odd both refer to the field containing odd numbered lines, and BFF or Even both refer to the field containing even numbered lines.	If field order is mixed up, motion can appear staggered or video may look jittery. See this post for more info: https://www.provideocoalition.com/field_order/ Brief mention of field order problems: "If the ordering of the fields is altered so that the images appear in the wrong order the effect can be substantial." See: https://www.tate.org.uk/about-us/projects/pericles/sustaining-consistent-video-presentation Recommendation: Maintain field order of source video. Typically, digitized NTSC content is BFF, and digitized PAL content is TFF, but it is not uncommon to find anomalies.	IASA-TC 06 Guidelines for the Preservation of Video Recordings SMPTE 125M: SDTV Component Video Signal Coding 4:4:4 and 4:2:2 for 13.5 MHz and 18 MHz Systems	RP 2.3, 2.7, 2.10

FADGI Significant Properties for Digital Video - 2024	Remco van Veenendaal/ Significant Significant Properties	FADGI Creating and Archiving Born Digital Video High Level Recommended Practices (2014)	Sustaining Consistent Video Presentation | Tate	NARA sample QC report - Baton output	NMAAHC sample QC report	acquisition and QC workflow - high level summary	LC NAVCC MI SNL1840 Travis Kelce Repeat - Baton output	LC NAVCC MI A2015_004_0 01_008 - Baton output	Video Lab Analog Digitization QC - Baton output
Duration	X			X	X		X	X	X
Number of Moving Image/Video Channels or Tracks	X			X	X		X	X	X
Number of Audio Channels or Audio Tracks	X	RP 3.13 Select formats that can contain and label complex audio configurations including multiple channels and sound fields beyond mono and stereo		X	X	X	X	X	X
Supplementary Metadata	X	RP 2.2 Document relationships between the video object and other files, such as closed captions, scripts, location notes and other supplemental material		(No but file may not have supplementary metadata to evaluate)	(No but file may not have supplementary metadata to evaluate)	(No but file may not have supplementary metadata to evaluate)	(No but file may not have supplementary metadata to evaluate)	(No but file may not have supplementary metadata to evaluate)	(No but file may not have supplementary metadata to evaluate)
Display Aspect Ratio (DAR)	X		X		X		X	X	X
Pixel Aspect Ratio (PAR)									
Storage Aspect Ratio (SAR)					X				
Image Size	X	RP 1.5 Select larger picture sizes over smaller picture sizes	X		X	X	X	X	X
Audio bit depth	X			X	X	X	X	X	X
Audio sampling rate	X			X	X	X	X	X	X
Video bit depth	X	RP 1.7 Select higher bit depths over lower bit depths		X	X	X	X	X	X
Video bit rate	X	RP 1.6 Select higher bit rates over lower bit rates			X	X	X	X	X
Video bit rate mode (constant/variable)									X (listed as min and max rates so must be variable)
Frame rate (frames per second)	X	RP 1.10 Stay within the range of common frame rates of 24-30 frames per second (fps)		X	X	X	(listed as not found so perhaps not declared in metadata)	X	X
Color model	X		X		X				
Color space	X		X		X				
Color gamut									
Color channels									
Chroma sampling		RP 1.8 Use higher chroma subsampling ratios rather than lower	X	X	X	X	X	X	X
File format (wrapper/container)		RP 2.3 Identify the file characteristics at the most granular level possible, including the wrapper and video stream encoding; RP 3.7 Select video encoding and wrapper formats that are well-supported now and future focused; RP 3.8 Select video encoding and wrapper formats that are non-proprietary		X	X	X	X	X	X
Encoded bitstream	X	RP 2.3 Identify the file characteristics at the most granular level possible, including the wrapper and video stream encoding	X	X	X	X	X	X	X

FADGI Significant Properties for Digital Video - 2024	Remco van Veenendaal/ Significant Significant Properties	FADGI Creating and Archiving Born Digital Video High Level Recommended Practices (2014)	Sustaining Consistent Video Presentation | Tate	NARA sample QC report - Baton output	NMAAHC sample QC report	acquisition and QC workflow - high level summary	LC NAVCC MI SNL1840 Travis Kelce Repeat - Baton output	LC NAVCC MI A2015_004_001_008 - Baton output	Video Lab Analog Digitization QC - Baton output
Scan type	X	RP 1.4 Select High Definition (HD) video encoding over Standard Definition (SD)	X		X	X	X	X	X
Timecode		RP 1.9 Generate a high integrity and continuous master timecode; RP 3.14 Select formats that can support robust timecode data		(but maybe file did not have timecode to evaluate)	(but maybe file did not have timecode to evaluate)	(but maybe file did not have timecode to evaluate)	X (checked for but not present)	X	X
File size	X			X	X (confirm this - maybe just size at more granular level)		X	X	X
Captions		RP 2.2 Document relationships between the video object and other files, such as closed captions, scripts, location notes and other supplemental material		X	(but maybe file did not have captions to evaluate)	(but maybe file did not have captions to evaluate)	X (checked for but not present)	X (checked for but not present)	
Subtitles		RP 2.2 Document relationships between the video object and other files, such as closed captions, scripts, location notes and other supplemental material		(but maybe file did not have subtitles to evaluate)	(but maybe file did not have subtitles to evaluate)	(but maybe file did not have subtitles to evaluate)	X (checked for but not present)	X (checked for but not present)	
Field order							X	X	X

AMIA Hack Day 2014: Video Characterization Comparison Viewer	https://wiki.curatecamp.org/index.php/Association_of_Moving_Image_Archivists_&_Digital_Library_Federation_Hack_Day_2014
CRF Rule: 47 CFR § 79 Accessibility of Video Programming	https://www.ecfr.gov/current/title-47/chapter-I/subchapter-C/part-79
DCI-P3:Digital Cinema System Specification	https://documents.dcimovies.com/DCSS/release/1.4.5/Digital-Cinema-System-Specification-1.4.5.pdf
Digital Television (DTV) Closed Captioning (ANSI/CTA-708-E S-2023 & Errata)	https://shop.cta.tech/products/digital-television-dtv-closed-captioning
DPC Technology Watch Guidance Note July 2021 Preserving Moving Images Data Types Series - 2021	https://www.dpconline.org/docs/technology-watch-reports/2477-preserving-moving-images/file
EBU R 103 Video Signal Tolerance in Digital Television Systems	https://tech.ebu.ch/docs/r/r103.pdf
EBU R 122 Material Exchange Format Timecode Implementation	https://tech.ebu.ch/docs/r/r122.pdf
EBU R 122: Material Exchange Format Timecode Implementation	https://tech.ebu.ch/docs/r/r122.pdf
FADGI Accessibility Features for Digital Audiovisual Collections Content	https://www.digitizationguidelines.gov/guidelines/accessibilty_AV_collections.html
FADGI Creating and Archiving Born Digital Video, Part III. High Level Recommended Practices	http://www.digitizationguidelines.gov/guidelines/FADGI_BDV_p3_20141202.pdf
FADGI Glossary	http://www.digitizationguidelines.gov/glossary.php
FCC Disability Rights Office: Twenty-First Century Communications and Video Accessibility Act of 2010: Public Law 111–260 111th Congress An Act Section 202 Video description and closed captioning:	https://www.govinfo.gov/content/pkg/PLAW-111publ260/pdf/PLAW-111publ260.pdf
ffmpeg Documentation	https://ffmpeg.org/ffmpeg-all.html
Framework for the definition of significant properties	https://www.kdl.kcl.ac.uk/fileadmin/documents/digifutures/materials/preservation/DF09_prsrv_knight-definingSigProperties.pdf
How to handle data recorded on P2 cards	https://pro-av.panasonic.net/manual/html/VARICAM_35(VQT5K88A-9(E))/chapter04_04_07.htm
IASA-TC 04: Guidelines on the Production and Preservation of Digital Audio Objects	https://www.iasa-web.org/tc04/audio-preservation
IASA-TC 06: Guidelines for the Preservation of Video Recordings	https://www.iasa-web.org/tc06/guidelines-preservation-video-recordings
IEC 61966-2-1:1999: Multimedia systems and equipment - Colour measurement and management - Part 2-1: Colour management - Default RGB colour space - sRGB:	https://webstore.iec.ch/en/publication/6169
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Netflix Originals Delivery Specifications, version OC-3-3	https://partnerhelp.netflixstudios.com/hc/en-us/articles/214806618-Netflix-Originals-Delivery-Specifications-v3-3
NTSC 1953	https://docs.fcc.gov/public/attachments/DOC-308674A1.pdf
PAR, SAR, and DAR: Making Sense of Standard Definition (SD) video pixels - By Katherine Frances Nagels	https://bavc.org/blog/par-sar-and-dar-making-sense-standard-definition-sd-video-pixels
Recommendation ITU-R BT.2020: Colour gamut conversion from Recommendation ITU-R BT.2020 to Recommendation ITU-R BT.709	https://www.itu.int/dms_pub/itu-r/opb/rep/R-REP-BT.2407-2017-PDF-E.pdf
Recommendation ITU-R BT.601-7:Studio encoding parameters of digital television for standard 4:3 and wide-screen 16:9 aspect ratios	https://www.itu.int/dms_pubrec/itu-r/rec/bt/R-REC-BT.601-7-201103-I!!PDF-E.pdf
Recommendation ITU-R BT.709-6: Parameter values for the HDTV standards for production and international programme exchange	https://www.itu.int/dms_pubrec/itu-r/rec/bt/R-REC-BT.709-6-201506-I!!PDF-E.pdf
Section508: Create Accessible Synchronized Media Content | Section508.gov: Captions:	https://www.section508.gov/create/synchronized-media/#captions
SI OCIO Born-Digital Camera-Original Video: Practices and Risks	https://docs.google.com/spreadsheets/d/1OvZkGkizNnx_nZ9OVDOkJJlVFuIMK_7FYKC77YhoUac/edit#gid=0
Significant Properties Report Andrew Wilson InSPECT Work Package 2.2	http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.109.7923&rep=rep1&type=pdf
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SMPTE RDD 48 SMPTE Registered Disclosure Doc - MXF Archive and Preservation Format Registered Disclosure Document	https://www.digitizationguidelines.gov/guidelines/MXF_app_spec.html
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SMPTE ST 12 Time and Control Code - Family of standards	https://pub.smpte.org/doc/12/
SMPTE ST 377-1:2011 Material Exchange Format (MXF) File Format Specification	https://ieeexplore.ieee.org/ielx7/8984679/8984680/08984681.pdf
Sustainability of Digital Formats, Library of Congress	https://www.loc.gov/preservation/digital/formats/index.html
Sustaining Consistent Video Presentation by Dave Rice	https://www.tate.org.uk/about-us/projects/pericles/sustaining-consistent-video-presentation
Tektronix Glossary of Video Terms and Acronyms	https://download.tek.com/document/25W_15215_1.pdf
The Significant Properties of Moving Images, Mike Coyne and Mike Stapleton, 2008, JISC	https://web.archive.org/web/20091118154024/http://www.jisc.ac.uk/media/documents/programmes/preservation/spmovimages_report.pdf
Twenty-First Century Communications and Video Accessibility Act of 2010: Public Law 111–260 111th Congress An Act Section 202 Video description and closed captioning	https://www.govinfo.gov/content/pkg/PLAW-111publ260/pdf/PLAW-111publ260.pdf
WCAG For live content: Closed or open captions required to fulfill WCAG 2.0, Level AA success criterion 1.2.4	https://www.w3.org/WAI/WCAG21/Understanding/captions-live.html
WCAG: For pre recorded content: Closed or open captions required to fulfill WCAG 2.0, Level A success criterion 1.2.2:	https://www.w3.org/WAI/WCAG21/Understanding/captions-prerecorded.html
Wikipedia	https://en.wikipedia.org/wiki/Main_Page