Advanced Function Presentation Consortium

Presentation Object Subsets for AFP

AFPC-0002-03

AFPConsortium

Advanced Function Presentation

Third Edition (July 2016)

This edition applies to the Advanced Function Presentation architecture. This is the third edition produced by the AFP Consortium and replaces and makes obsolete the previous edition (AFPC-0002-02). This edition remains current until a new edition is published.

Changes between the previous edition and this edition are indicated in green and with a green vertical bar to the left of the change, although minor editorial fixes are not marked. The major change in this edition is the addition of the definition of the AFPC SVG Subset. In addition, entries were added to the glossary.

This publication is available from the AFP Consortium Web site at
http://www.afpcinc.org

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Chapter 1. Introduction

Advanced Function Presentation (AFP) datastreams allow inclusion of non-AFP objects. In some cases, such as TIFF, the formats can contain a wide variety of features and data formats. Some of these features may not be well defined, while others may be rarely used in practice. Popular formats may also be extended in various ways to support particular applications, or privately enhanced or modified by different vendors. A definitive list of features and extensions may not exist, which makes it very hard or impossible for AFP products to support all the possible features of each non-AFP object type.

This book describes *AFPC Subsets* for some of the object types that can be embedded in AFP. The members of the AFP Consortium (AFPC) have agreed that their products will support all the features and processing instructions described in each subset.

Each subset is a minimum set of functions supported by all the AFPC members. AFP products may support additional features that are not part of a subset. There is no guarantee, however, that a different product, even from the same vendor, will support these additional features in the same way.

Each subset is described in a separate chapter. Subsets are defined relative to the underlying object type. The specification assumes the reader is familiar with the object type that is the basis for the subset. In addition to the subset specification, each chapter will list the relevant Object-type Object IDs (OIDs) that can be used for the conformant objects and main references describing the object type. Appendix A, “Related Publications”, on page 19 lists references that apply to multiple object types.

Chapter 2. Tagged Image File Format (TIFF)

Tagged Image File Format (TIFF) is a rich image format that is also easily extended by using private tags. This makes TIFF a difficult format to process. Most of the image applications, however, use a contained TIFF subset. The purpose of this chapter is to define a TIFF subset that would be relatively straightforward to process, but still meet the needs of most printing applications, as well as cover most TIFF images encountered in practice. This subset is called the *AFPC TIFF Subset*.

AFPC TIFF Subset is defined relative to the whole TIFF 6.0 Specification. It is not defined relative to the "baseline TIFF" described in the specification, since the baseline subset is much too restrictive to be useful.

Overview

This section describes the main TIFF features included in the subset. The purpose is to give an overview and explain the rationale for some of the main restrictions. The Specification section describes the details from the technical perspective.

This TIFF subset is tuned for printing, with the assumption that the TIFF objects are included in the AFP data stream using the object container mechanism. Both single and multiple-page TIFFs are supported in this subset. Please see "Multi-page TIFFs" on page 7.

Thumbnails (reduced resolution images) are not supported in this subset, since thumbnails are not meant for printing.

Transparency mask images are not supported, since popular image processing programs used to generate and view images do not support them. Instead, transparency masks are supported via the **ExtraSamples** tag, as explained in "Transparency Masks" on page 7.

Tiled images are not supported, since they are seldom encountered in practice.

The old-style JPEG data (compression 6) has well-documented problems and is not supported. JPEG-compressed data is supported via the compression 7 mechanism defined in TIFF Tech Note 2 (see "References" on page 8 for a link to this tech note). Any image conforming to the AFPC JPEG subset (defined in Chapter 3, "Joint Photographic Experts Group (JPEG)", on page 9) is supported under compression 7.

TIFF allows private tags. Applications can obtain reserved tag IDs from Adobe for their private tags. If a receiver encounters an unknown tag, the TIFF specification instructs it to ignore it. If a receiver encounters a private tag that it understands and whose values conflict with a standard tag, the AFPC TIFF Subset gives priority to the standard tag.

Subset Specification

This subset is based on the TIFF Release 6.0 specification, combined with the TIFF Tech Note 2 (see "References" on page 8 for a link to this tech note), which defines a new way of incorporating JPEG-compressed data. Note that a *standard* tag means a tag described in TIFF Release 6.0 specification, not a tag in the baseline TIFF subset.

Fully Supported Standard Tags

The following standard TIFF tags are fully supported:

Table 1. Fully Supported Standard TIFF Tags

Hex Tag ID	Tag Name
X'FF'	SubfileType
X'100'	ImageWidth
X'101'	ImageLength
X'10A'	FillOrder
X'111'	StripOffsets
X'112'	Orientation
X'116'	RowsPerStrip
X'117'	StripByteCounts
X'11A'	XResolution
X'11B'	YResolution
X'11C'	PlanarConfiguration
X'11E'	XPosition
X'11F'	YPosition
X'122'	GrayResponseUnit
X'123'	GrayResponseCurve
X'124'	T4Options
X'125'	T6Options
X'13D'	Predictor
X'140'	ColorMap
X'211'	YCbCrCoefficients
X'212'	YCbCrSubsampling
X'214'	ReferenceBlackWhite

Standard Tags Supported with Restrictions

X'FE' – NewSubfileType

Thumbnail and transparency mask images are skipped. Please see "Multi-page TIFFs" on page 7 and "Transparency Masks" on page 7.

X'102' – BitsPerSample

1 and 8 bits per color channel. If the image has multiple channels, all channels must have the same bit depth. 1 bit data is supported only for Photometric Interpretations of 0 and 1 (i.e., black and white). All multichannel images must be 8 bits per channel.

Note: Extra samples that describe transparency masks can be 1-bit in planar images, regardless of the bit depth of the main color channels.

X'103' – Compression

Old-style JPEG compression (6) is not supported. JPEG compression 7 (details in TIFF Tech Note 2; see "References" on page 8 for a link to this tech note) is supported instead.

X'106' – PhotometricInterpretation

CIELab is assumed to have the D65 illuminant, which follows from the TIFF specification.

The YCbCr color space is treated as a device-dependent RGB color space that has been transformed using the default weights from the TIFF specification (ITU-R Recommendation BT.601, which was CCIR Recommendation 601-1 when the TIFF Specification was published). The YCbCrCoefficients tag is supported if the application has used different weights.

RGB and CMYK images that are otherwise unqualified are treated as device-dependent and receivers can interpret the color information as they deem appropriate.

Please see Appendix B, "Adobe APP14 JPEG Marker", on page 21 on issues related to processing of JPEG-compressed images generated by Adobe products.

X'115' – SamplesPerPixel

Only certain extra samples are supported. See "Transparency Masks" on page 7.

X'128' – ResolutionUnit

Relative resolution treated as inches (i.e., 1 treated as 2).

X'129' – PageNumber

The second value, indicating the total number of images in the file, is ignored.

X'152' – ExtraSamples

Only certain extra samples, carrying associated alpha data denoting transparency mask, are supported. See "Transparency Masks" on page 7.

Unsupported Standard Tags

The following unsupported tags are ignored:

Table 2. Unsupported Standard TIFF Tags

Hex Tag ID	Tag Name
X'107'	Thresholding
X'108'	CellWidth
X'109'	CellLength
X'10D'	DocumentName
X'10E'	ImageDescription
X'10F'	Make
X'110'	Model
X'118'	MinSampleValue
X'119'	MaxSampleValue
X'11D'	PageName
X'120'	FreeOffsets
X'121'	FreeByteCounts
X'12D'	TransferFunction
X'131'	Software
X'132'	DateTime

Table 2 Unsupported Standard TIFF Tags (cont'd.)

Hex Tag ID	Tag Name
X'13B'	Artist
X'13C'	HostComputer
X'13E'	WhitePoint
X'13F'	PrimaryChromaticities
X'141'	HalftoneHints
X'142'	TileWidth
X'143'	TileLength
X'144'	TileOffsets
X'145'	TileByteCounts
X'14C'	InkSet
X'14D'	InkNames
X'14E'	NumberOfInks
X'150'	DotRange
X'151'	TargetPrinter
X'153'	SampleFormat
X'154'	SMinSampleValue
X'155'	SMaxSampleValue
X'156'	TransferRange
X'200'	JPEGProc
X'201'	JPEGInterchangeFormat
X'202'	JPEGInterchangeFormatLength
X'203'	JPEGRestartInterval
X'205'	JPEGLosslessPredictors
X'206'	JPEGPointTransforms
X'207'	JPEGQTables
X'208'	JPEGDCTables
X'209'	JPEGACTables
X'213'	YCbCrPositioning
X'8298'	Copyright

Additional Supported Tags

X'8773' – ICCProfile

If the receiving product can color manage, it must use the ICC profile provided in the file.

Note: The receivers can use the information as appropriate in their color management scheme. For example, it is valid for the product to let the user override the embedded profile. It should also be noted that support of embedded ICC profiles is a system-level requirement, not a transform requirement. A print server can extract the ICC profile from the data, make an audit Color

Management Resource (CMR) based on it and send the TIFF to the printer with the profile removed and the CMR attached instead.

Multi-page TIFFs

TIFF files may contain multiple pages or images. If the TIFF file is being processed in a context where multiple images are not meaningful, the receiver will process only the first image. The “first” is defined according to the order described below.

If the TIFF file has multiple pages, the pages are ordered in the ordering specified by the **PageNumber** tag. Any images that do not contain the **PageNumber** tag are processed in the order in which they occur in the file, after the images that do contain the **PageNumber** tag. If no image in the file has a **PageNumber** tag, the images are processed in order.

The page numbers in **PageNumber** tags of different images do not have to be consecutive, but must be unique. If two images have the same **PageNumber** tag, the receiver should report an error.

Any thumbnail and transparency mask images found in processing are ignored and the above rules are applied by skipping them.

Transparency Masks

TIFF has two mechanisms for specifying the transparency mask. One is by using the **NewSubfileType** tag, where the image may be marked as a transparency mask. This tag has potential ambiguities and is not supported by image processing packages such as Gimp or Adobe Photoshop. Transparency Mask images are not supported by this TIFF subset.

The second mechanism for specifying the transparency mask is via extra samples. It is known that at least Photoshop can generate such data. This subset supports transparency masks specified via extra samples with the following conditions and restrictions:

- Both planar and interleaved data are supported.
- The **ExtraSamples** tag must be marked with 1, *Associated alpha data (with pre-multiplied color)*.
- If the image is interleaved, the mask channel must have the same bit depth as the other data.
- If the data is planar, the mask data may also be 1-bit.
- The image must be compressed using a lossless algorithm.
- If the mask value is nonzero for a pixel, that pixel is treated as foreground. Only the pixels that have the extra sample of zero are treated as background.
- Foreground pixels knock out the background. There is no blending, regardless of the extra sample mask value for the pixel.

Resources

Object-type OID

Images that conform to the TIFF Subset are marked with the following OID:

X'06072B120004010142'
AFPC TIFF Subset

Note: If a TIFF containing a transparency mask defined via the alpha channel is marked by one of the other TIFF OIDs, the receiver will ignore the transparency mask.

References

- *TIFF Revision 6.0 Specification*, Adobe Systems Incorporated, June 3, 1993. Available at `http://partners.adobe.com/public/developer/en/tiff/TIFF6.pdf`
- *DRAFT TIFF Technical Note 2*, March 17, 1995. Available at `http://www.remotesensing.org/libtiff/TIFFTechNote2.html`

Chapter 3. Joint Photographic Experts Group (JPEG)

Joint Photographic Experts Group (JPEG) defines a number of image compression schemes and several ways to organize the data. This subset is designed to cover all of the parts of the JPEG specification that the receivers can reasonably expect to encounter in practice. This subset is called the *AFPC JPEG Subset*.

JPEG is primarily defined as a compression format, but is also being widely used as a file format. Using JPEG as a file format depends on all emitters and receivers making common assumptions on image parameters, such as the color space, that are not explicitly defined in the data. These assumptions will be explicitly described in the specification of this subset.

Overview

This section describes the main JPEG features included in the subset. The purpose is to give an overview and explain the rationale for some of the main restrictions. The Specification section describes the details from the technical perspective.

JPEG-compressed data can be either sequential or hierarchical. The data can be compressed using either lossless or lossy algorithms. Hierarchical JPEG and lossless compression are not in widespread use and are not supported.

JPEG supports two types of entropy coding: Huffman and arithmetic. Arithmetic coding is rarely encountered in practice and is not supported. Arithmetic coding was subject to several patents, believed since expired. Intellectual property issues, complexity of the arithmetic coding, and potential performance penalties resulted in Huffman coding being used almost exclusively for images meant for interchange among different applications.

JPEG allows underlying image data to be either 8 or 12 bits per color channel. 12 bit images, used mainly for medical imaging, are not supported.

A number of file formats, like JPEG Interchange File Format (JFIF) and Exchangeable File Format (EXIF), use application markers to provide additional image information, such as resolution and thumbnail. Some may impose additional requirements on the data, such as the color space and gamma correction. This subset does not require support for such file formats.

Specification

Color Spaces

Images with one, three, and four components are supported. Single component images are assumed to be grayscale; i.e., zero is black, 255 is white. Three-component images are assumed to be RGB data encoded as YCbCr using the luma red, luma green, and luma blue values of 0.299, 0.587, and 0.114, respectively, as specified in ITU-R Recommendation BT.601, which was previously known as CCIR Recommendation 601-1.

Four-component images are assumed to be CMYK. CMYK may be present in a transformed form if the Adobe APP14 marker is present in the data; see Appendix B, “Adobe APP14 JPEG Marker”, on page 21.

If the receiving product can color manage, it must use the ICC profile provided via the APP2 (X'FFE2') marker. The receivers can use the information as appropriate in their color management scheme. For example, it is valid for the product to let the user override the embedded profile. It should also be noted that support of embedded ICC profiles is a system-level requirement, not a transform requirement. A print server can extract

the ICC profile from the data, make an audit Color Management Resource (CMR) based on it and send the JPEG to the printer with the profile removed and the CMR attached instead.

Please see Appendix B, “Adobe APP14 JPEG Marker”, on page 21 on issues related to processing of JPEG-compressed images generated by Adobe products.

Start of Frame (SOF) Markers

Start of Frame Markers are X'FFC0–3' , X'FFC5–7' , X'FFC9–B', and X'FFCD–F'. Each marker corresponds to a particular data organization (sequential or hierarchical), compression type (lossy or lossless), entropy coding (Huffman or arithmetic), and scan organization (sequential or progressive).

The Start of Frame Marker contains the frame header describing the image. The frame header contains the following fields:

frame header length
This value depends on the number of the color components.

sample precision
Must be 8.

number of lines
Must be nonzero. JPEG also allows a zero value, meaning that the image length will be specified later using the DNL marker. The DNL marker and zero length are not supported in the subset.

number of samples per line
The subset places no restrictions on this field. Any values allowed by JPEG are valid.

number of components in frame
Must be 1, 3, or 4.

frame component specfication
The subset places no restrictions on the fields in the component specification. Any values allowed by JPEG are valid. In particular, there are no restrictions on the subsampling factors.

The AFPC JPEG Subset supports the following SOF markers:

- X'FFC0' – Baseline DCT.
- X'FFC1' – Huffman Extended Sequential DCT.
- X'FFC2' – Huffman Progressive DCT.

Other SOF markers are not supported.

For the Huffman Progressive DCT data, both spectral selection and successive approximation are supported.

Note: If the “Progressive” option is chosen on saving a JPEG image, Adobe Photoshop will often generate an image that has been compressed using both progressive selection and successive approximation.

Other Issues

The viewers that present images on a display will generally scale a JPEG image to some reasonable output size, so the image resolution is irrelevant. Some of the applications that convert JPEG images to other formats will assume that the images were generated for displays and have the resolution of 72dpi. There are scanner products, however, that package scanned images as high-quality JPEGs that may have a resolution of 300dpi or higher.

AFP generators should include the Image Resolution Triplet X'9A' to describe the resolution of the input JPEG image. Alternatively, the output mapping option can be set to scale-to-fit or scale-to-fill to get the output of the

desired size. If neither of these are specified for a JPEG image, the receivers should assume that the image has been produced at the device output resolution.

Resources

Object-type OID

The generators should mark the images known to conform to the JPEG Subset with the following OID:

X'06072B120004010117'
AFPC JPEG Subset

References

- Pennebaker, William B., and Mitchell, Joan L., *JPEG: Still Image Data Compression Standard*. Van Nostrand Reinhold, New York, 1992. ISBN 0-442-01272-01.
- *ISO/IEC International Standard 10918-1*.
- *ITU–TSS Recommendation T.81*.

Chapter 4. Portable Network Graphics (PNG)

PNG (Portable Network Graphics) is a lossless image format.

The subset defined by this chapter is called the *AFPC PNG Subset*.

Overview

This section describes the main PNG features included in the subset.

Subset Specification

This subset is based on the ISO/IEC 15948:2004 PNG Specification.

Fully Supported Chunks

The following PNG chunks are fully supported:

Description	Chunks	Chunk Type
Image data	IDAT	Critical
Image trailer	IEND	Critical
Standard RGB color space	sRGB	Ancillary
Embedded ICC profiles	iCCP	Ancillary
Background color	bKGD	Ancillary

Chunks Supported with Restrictions

The following PNG chunks are supported with restrictions that are described in “Restrictions” on page 14:

Description	Chunks	Chunk Type
Image header	IHDR	Critical
Palette	PLTE	Critical
Transparency	tRNS	Ancillary

Unsupported Chunks

The following PNG chunks are ignored:

Description	Chunks	Chunk Type
Image gamma	gAMA	Ancillary
Primary chromaticities	cHRM	Ancillary
Text strings	iTXt, tEXt, zTXt	Ancillary

Description	Chunks	Chunk Type
Physical pixel dimensions	pHYs	Ancillary
Significant bits	sBIT	Ancillary
Suggested palette	sPLT	Ancillary
Palette histogram	hIST	Ancillary
Image last-modification time	tIME	Ancillary
Private chunks		
Additional public chunks		

Restrictions

Color Types and Bit Depths

In the IHDR chunk, all five color types (0, 2, 3, 4, and 6) are supported in this subset. However, the supported bit depths for the color types are restricted as follows:

Color Type	Allowed Bit Depths
0	1, 8
2	8
3	1, 8
4	8
6	8

Palette

The PLTE chunk defines a set of 1 to 256 palette entries. This chunk is required for color type 3, but is ignored for color types 2 and 6 (this is a slight deviation from the full PNG specification, which allows the PLTE chunk to be used optionally for color types 2 and 6).

Transparency

The tRNS chunk is supported with one restriction. For color type 3, all nonzero alpha values indicate that the color palette value is to be made fully opaque. The full PNG specification allows for color values to be made semi-transparent, but that option is not available in this subset.

Reserved and Safe-to-copy bits

The reserved bit and safe-to-copy bits in a chunk type code are normally only used by PNG generators, so they are ignored in this subset.

Other Support

Interlaced data order

Handling of interlaced data order is fully supported in this subset.

Compression

Currently, the only compression method defined in the PNG specification is method 0. The compression algorithm is deflate/inflate compression with a sliding window of at most 32768 bytes. All the details of the compression method defined in the PNG specification are supported in this subset.

Filter Algorithms

All five filter types of PNG filter method 0 of the PNG specification are fully supported in this subset. These are filter types 0 (None), 1 (Sub), 2 (Up), 3 (Average), and 4 (Paeth).

Color Management

PNG images are color managed in the same way as all other presentation objects in AFP. However, there can be PNG-specific processing, depending on the chunks found in the PNG:

- For a PNG with an iCCP chunk, the internal ICC profile specified by the iCCP chunk is used for color management unless overridden by an audit color conversion CMR on the PNG object.
- For a PNG with an sRGB chunk and no iCCP chunk, the resident sRGB ICC profile is used for color management unless overridden by an audit color conversion CMR on the PNG object.
- For a PNG image without iCCP or sRGB chunks, the image is color managed in AFP in the same way as any presentation object that does not specify internal color management information.
- The gAMA and cHRM chunks are ignored in all cases.

Resources

Object-type OID

Images that conform to the AFPC PNG Subset are marked with the following OID:

X'06072B120004010141'
AFPC PNG Subset

References

- *ISO/IEC International Standard 15948:2004*.

Chapter 5. Scalable Vector Graphics (SVG)

Scalable Vector Graphics (SVG) is a family of specifications of an XML-based file format for two-dimensional vector graphics, both static and dynamic (i.e. interactive or animated). The SVG specification is an open standard that has been under development by the World Wide Web Consortium (W3C) since 1999. SVG 1.1 became an official W3C recommendation on August 16, 2011.

The subset defined by this chapter is called the *AFPC SVG Subset*.

Overview

This section describes the main SVG features included in the subset. Embedding SVG in MO:DCA for presentation on a mostly static, high-resolution additive medium raises some questions and this chapter tries to provide some guidance to implementers.

To specify what is supported in the subset, this document references the feature strings as listed by SVG 1.1 in Appendix O: Feature Strings.

Subset Specification

The AFPC SVG Subset is defined as the SVG Static subset of SVG 1.1. See
`http://www.w3.org/TR/SVG11/feature#SVG-static`

There is one feature string in SVG-Static that needs additional consideration in this light, the Conditional Processing feature string. See
`http://www.w3.org/TR/SVG11/feature#ConditionalProcessing`

This feature could result in different visualizations based upon the capabilities of the SVG engine used to rasterize the graphics. A suggested way to resolve this and to ensure consistent visualization is to ensure the same branches are taken every time. It is therefore required that the renderer claims conditional processing support for features in SVG-Basic and nothing more. No extensions should be claimed to be supported and no system language should be reported.

Linked Resources

Implementations shall not attempt to contact external systems or services. Only the URIs mentioned by the Fully Qualified Name (X'02') triplet as Data Object Internal Resource References can be successfully resolved by the SVG renderer to secondary resources.

Fonts

The SVG renderer will have access to all OTF/TTF fonts referenced as secondary resources.

Pixel Size

A pixel is defined to be 1/96 inch in size.

Color Spaces

Even though SVG supports ICC profiles, the compositing formula specified in section 14.2 of the SVG 1.1 Specification assumes a three-valued color space, either sRGB, linearRGB, or deviceRGB depending on the values of the color-interpolation and color-rendering attributes. Given that all SVG shapes need to be composited at least once with the root canvas, all SVG images are in an RGB color space.

Compression

SVG images, being XML, contain many repeated fragments of text, so they are well suited for lossless data compression algorithms. When an SVG image has been compressed with the industry standard gzip algorithm, it is referred to as an SVGZ image. SVGZ images are fully supported in this subset. An SVGZ file is typically 20 to 50 percent of the original size.

Presentation Space Size

If the SVG viewport within the SVG object does not specify absolute width and height values, AFP Generators should include the Object Container Presentation Space Size triplet X'9C' to specify the presentation space size to use for the SVG object.

Resources

Object-type OID

Objects that conform to the AFPC SVG Subset are marked with the following OID:

X'06072B120004010144'
AFPC SVG Subset

This OID is also used for SVGZ objects, so implementations should look for the gzip header in the object to differentiate between the two serializations.

References

- *Scalable Vector Graphics (SVG) 1.1 (Second Edition), August 16, 2011*. Available at
  `http://www.w3.org/TR/SVG11/`
- SVG 1.1, Appendix O: Feature Strings
  `http://www.w3.org/TR/SVG11/feature.html`

Appendix A. Related Publications

This Appendix lists references that are of interest for more than one object type. The following are the related AFP architecture documents, available at the AFP Consortium Web site at

`http://www.afpcinc.org`

- Mixed Object Document Content Architecture (MO:DCA) Reference
- Intelligent Printer Data Stream (IPDS) Reference
- Color Management Object Content Architecture (CMOCA) Reference

Appendix B. Adobe APP14 JPEG Marker

Adobe products use the APP14 (X'FFEE') JPEG marker to describe the actual color information in the compressed JPEG data. The following description is based on researching the information publicly available and by experiment, since Adobe does not publicly document the data placed in the APP14 marker.

The marker has the length of 14, meaning there are 12 data bytes following the length. The data bytes are as follows:

Table 3. Adobe Application Tag 14 Syntax

Byte Offset	Name	Value	Meaning
0–4		Adobe	APP14 marker contains Adobe data
5–6	Encoder identifier tag	X'0064'	Photoshop
7–8	flag0	X'0000', X'8000'	**X'0000'** nothing specified **X'8000'** blend subsampling
9–10	flag1	X'0000'	**X'0000'** nothing specified
11	Transform flag	X'00' – X'02'	**X'00'** Unknown. 4–component data is assumed CMYK, 3–component RGB **X'01'** YCbCr **X'02'** YCCK

Notes:

1. flag0 contains hepful but optional data for the decoder (i.e., the decoder may safely ignore).
2. flag1 contains required decoder data (i.e., the decoder must use the information).

YCCK is obtained from CMYK by converting CMY to “YCC” using the RGB-to-YCbCr conversion formulas with the ITU-R Recommendation BT.601 (CCIR Recommendation 601-1) lumas:

lumaRed = 0.299

lumaGreen = 0.587

lumaBlue = 0.114

Y = lumaRed * cyan + lumaBlue * magenta + lumaGreen * yellow

Cb = (magenta – Y) / (2 – 2 * lumaBlue)

Cr = (cyan – Y) / (2 – 2 * lumaRed)

These formulas lead to “reverse video” Y, Cb, and Cr. The K channel is also reversed (i.e., “K” in YCCK is really 255-K). Thus, a YCCK value of 255,0,0,0 is black and a value of 0,0,0,255 is white.

This mechanism is the same regardless of whether the data is carried within TIFF or as standalone JPEG.

The meaning of “CMYK” (transform flag value of X'00' for 4-channel data) depends on whether the JPEG is standalone, or carried within TIFF. If carried within TIFF, CMYK is standard CMYK (0,0,0,0 is white). If within standalone JPEG, CMYK is reverse video; i.e., each component must be inverted via 255- before using (0,0,0,0 is black).

Note: This means that 4-component JPEG images that contain an Adobe APP14 marker with a transform flag value of zero cannot be converted to TIFF just by prepending the appropriate TIFF header to the JPEG data. CMYK values must be transcoded and inverted, or the TIFF will be reverse-video.

Glossary

A

addressable position. A position in a presentation space or on a physical medium that can be identified by a coordinate from the coordinate system of the presentation space or physical medium. See also *picture element*. Synonymous with *position*.

Advanced Function Presentation (AFP). An open architecture for the management of presentable information that is developed by the AFP Consortium (AFPC). AFP comprises a number of data stream and data object architectures:

- Mixed Object Document Content (MO:DCA) Architecture; formerly referred to as AFPDS
- Intelligent Printer Data Stream (IPDS) Architecture
- AFP Line Data Architecture
- Bar Code Object Content Architecture (BCOCA)
- Color Management Object Content Architecture (CMOCA)
- Font Object Content Architecture (FOCA)
- Graphics Object Content Architecture for AFP (AFP GOCA)
- Image Object Content Architecture (IOCA)
- Metadata Object Content Architecture (MOCA)
- Presentation Text Object Content Architecture (PTOCA)

AFP. See Advanced Function Presentation.

AFP Consortium (AFPC). A formal open standards body that develops and maintains AFP architecture. Information about the consortium can be found at `www.afpcinc.org`.

all points addressable (APA). The capability to address, reference, and position data elements at any addressable position in a presentation space or on a physical medium. Contrast with character cell addressing, in which the presentation space is divided into a fixed number of character-size rectangles in which characters can appear. Only the cells are addressable. An example of all points addressability is the positioning of text, graphics, and images at any addressable point on the physical medium. See also *picture element*.

B

background. The part of a presentation space that is not occupied with object data. Contrast with *foreground*.

background color. The color of a background. Contrast with *foreground color*.

band. An arbitrary layer of an image. An image can consist of one or more bands of data.

C

CMOCA. See *Color Management Object Content Architecture*.

CMR. See *color management resource*.

CMYK color space. The primary colors used together in printing to effectively create a multitude of other colors: cyan, magenta, yellow, and black. Based on the subtractive color theory; the primary colors used in four color printing processes.

color management resource. Objects that provide color management in presentation environments.

color model. The model by which a color is specified. For example, the RGB model specifies color in terms of three intensities for red (R), green (G), and blue (B).

Color Management Object Content Architecture (CMOCA). An architected collection of constructs used for the interchange and presentation of the color management information required to render a print file, document, group of pages or sheets, page, overlay, or data object with color fidelity.

coordinate system. A Cartesian coordinate system. An example is the image coordinate system that uses the fourth quadrant with positive values for the Y axis. The origin is the upper left-hand corner of the fourth quadrant. A pair of (x,y) values corresponds to one image point. Each image point is described by an image data element.

D

data element. A unit of data that is considered indivisible.

data stream. A continuous stream of data that has a defined format.

device dependent. Dependent upon one or more device characteristics.

device-independent color space. CIE-based color space that allow color to be expressed in a device-independent way. It ensures colors to be predictably and accurately matched among various color devices.

digital image. An image whose image data was sampled at regular intervals to produce a digital representation of

the image. The digital representation is usually restricted to a specified set of values.

E

embedded ICC profile. ICC profiles that are embedded within graphic documents and images. An embedded ICC profile allows users to transparently move color data between different computers, networks and even operating systems without having to worry if the necessary profiles are present on the destination systems.

exchange. The predictable interpretation of shared information by a family of system processes in an environment where the characteristics of each process must be known to all other processes. Contrast with *interchange*.

F

foreground. The part of a presentation space that is occupied with object data. See also *pel*. Contrast with *background*.

foreground color. A color attribute used to specify the color of the foreground of a primitive. Contrast with *background color*.

G

gzip. A widely-used, free software compression algorithm.

H

hexadecimal. A number system with a base of sixteen. The decimal digits 0 through 9 and characters A through F are used to represent hexadecimal digits. The hexadecimal digits A through F correspond to the decimal numbers 10 through 15, respectively. An example of a hexadecimal number is X'1B', which is equal to the decimal number 27.

I

ICC. See International Color Consortium.

ICC profile. A file in the International Color Consortium profile format, containing information about the color reproduction capabilities of a device such as a scanner, a digital camera, a monitor, or a printer. An ICC profile includes three elements: 128-byte file header, tag table, and tagged element data. The intent of this format is to provide a cross-platform device profile format. Such device profiles can be used to translate color data created on one device into another device's native color space.

image. An electronic representation of a picture produced by means of sensing light, sound, electron radiation, or other emanations coming from the picture or reflected by the picture. An image can also be generated directly by software without reference to an existing picture.

image point. A discrete X,Y coordinate in the image presentation space. See also *addressable position*.

Intelligent Printer Data Stream (IPDS). An architected host-to-printer data stream that contains both data and controls defining how the data is to be presented.

interchange. The predictable interpretation of shared information in an environment where the characteristics of each process need not be known to all other processes. Contrast with *exchange*.

International Color Consortium (ICC). A group of companies chartered to develop, use, and promote cross-platform standards so that applications and devices can exchange color data without ambiguity.

International Organization for Standardization (ISO). An organization of national standards bodies from various countries established to promote development of standards to facilitate international exchange of goods and services, and develop cooperation in intellectual, scientific, technological, and economic activity.

interoperability. The capability to communicate, execute programs, or transfer data among various functional units in a way that requires the user to have little or no knowledge of the unique characteristics of those units.

IPDS. See *Intelligent Printer Data Stream*.

ISO. See *International Organization for Standardization*.

J

JFIF. JPEG File Interchange Format. Three-component JPEG images. RGB data is assumed without gamma correction and the APP0 marker is used to specify the resolution and optionally the thumbnail.

JPEG. Joint Photographic Experts Group. An image compression standard.

L

lossless. A form of image transformation in which all of the data is retained. Contrast with *lossy*.

lossy. A form of image transformation in which some of the data is lost. Contrast with *lossless*.

M

Mixed Object Document Content Architecture (MO:DCA). An architected, device-independent data stream for interchanging documents.

O

orientation. The angular distance a presentation space or data block is rotated in a specified coordinate system, expressed in degrees and minutes. For example, the orientation of printing on a physical medium, relative to the X_m axis of the X_m,Y_m coordinate system.

P

physical medium. A physical entity on which information is presented. Examples of a physical medium are a sheet of paper and a display screen.

pel. The smallest printable or displayable unit on a physical medium. In computer graphics, the smallest element of a physical medium that can be independently assigned color and intensity. Picture elements per inch is often used as a measurement of presentation granularity. Synonymous with *pixel* and *picture element*.

picture element. The smallest printable or displayable unit on a physical medium. In computer graphics, the smallest element of a physical medium that can be independently assigned color and intensity. Picture elements per inch is often used as a measurement of presentation granularity. Synonymous with *pel* and *pixel*.

pixel. The smallest printable or displayable unit on a physical medium. In computer graphics, the smallest element of a physical medium that can be independently assigned color and intensity. Picture elements per inch is often used as a measurement of presentation granularity. Synonymous with *pel* and *picture element*.

PNG. Portable Network Graphics. A lossless image format.

presentation space. A conceptual address space with a specified coordinate system and a set of addressable positions. The coordinate system and addressable positions can coincide with those of a physical medium.

R

rotation. The orientation of a presentation space with respect to the coordinate system of a containing presentation space. Rotation is measured in degrees in a clockwise direction. Zero-degree rotation exists when the angle between a presentation space's positive X axis and the containing presentation space's positive X axis is zero degrees.

row. A subarray that consists of all elements that have an identical position within the high dimension of a regular two-dimensional array.

S

SVG. Scalable Vector Graphics. An XML-based vector image format.

T

TIFF. Tagged Image File Format. A rich and flexible image format.

Y

YCbCr. A three-component color space that approximately models how color is interpreted by the human visual system, with an intensity value and two color values. YCbCr and YCrCb use the same three values, but in a different order.

YCCK. CMYK data carried in the luminance-chrominance form. YCC are computed from CMY, while K is the black channel carried in the reverse-video form (K = 255 - K). See Appendix B, “Adobe APP14 JPEG Marker”.

YCrCb. A three-component color space that approximately models how color is interpreted by the human visual system, with an intensity value and two color values. YCbCr and YCrCb use the same three values, but in a different order.

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Presentation Object Subsets for AFP

AFPC-0002-03

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Advanced Function Presentation