Image File Formats

There are two different types of image file formats: One that can be compressed, and the other raw. Compression is the reduction of data to reduce file size for storage. Compression can be "lossy" (such as JPEG) or "lossless" (such as TIFF LZW). Greater reduction is possible with lossy compression than with lossless schemes.

Lossless compression

Reduces the size of files by creating an internal shorthand that rebuilds the data as it originally were before the compression. Thus, it is said to be non-destructive to image data when used.

Lossy compression

A method of reducing image file size by throwing away unneeded data, causing a slight degradation of image quality. JPEG is a lossy compression method.

Images come in different forms: raster-based (bitmap) and vector-based (object-oriented). A vector image can be rasterized, yet it is not as easy to vectorize a raster image.

Raster / Bitmap

Raster images are made up of individual dots; each of which have a defined value that precisely identifies its specific color, size and place within the image. (Also known as bitmapped images.)

Bitmap images are laid out in pixels, much like dots of paint on a canvas. As such, bitmap objects are not independent entities, which can be singled out for manipulation, but patterned series of dots. To enlarge (or reduce) bitmap images, the number of pixels is increased (decreased), often giving the resulting image a jagged appearance.

Vector Graphic

A graphic image drawn in shapes and lines, called paths. Images created in Illustrator and Freehand (graphic design software) are vector graphics. They are usually exported to be bitmap images.

A vector Graphic consists of objects, each of which can be separately manipulated - e.g. sized, moved, (un)grouped, positioned to the back/front. The graphic components are calculated, hence can be sized without distortion. File formats include: AutoCAD DXF, CBM, EPS, HGL, PIC, DRW, WMF, WPG.

Vector graphics usually yield much smaller file sizes than bitmap files.

1-bit color

The lowest number of colors per pixel in which a graphics file can be stored. In 1-bit color, each pixel is either black or white.

8-bit color/grayscale

In 8-bit color, each pixel is has eight bits assigned to it, providing 256 colors or shades of gray, as in a grayscale image or a color GIF image.

24-bit color

In 24-bit color, each pixel has 24 bits assigned to it, representing 16.7 million colors. 8 bits - or one byte - is assigned to each of the red, green, and blue components of a pixel.

Most of the image file formats commonly found in use on a PC which support color do so using a palette structure, as this is the way most PC full color display cards work. An image stored in a palette structure file will have a maximum of 256 unique colors, drawn from a potential palette of 16 million.

For practical purposes this color arrangement is sufficient to reproduce pretty convincing color photographs. However, for a number of reasons, high end photographic manipulation software, color separation software and so on works better with a non-palette image, one in which every pixel is represented as a distinct color. In these images, every pixel consists of three bytes of color information, one each for the red, green and blue components of the pixel's color. Such pictures are referred to as RGB or twenty-four bit pictures. Among the formats which currently support 24-bit images are Targa, PCX, JPG, BMP, IMG and TIFF.

In order to convert twenty-four bit images into palette driven formats, such as GIF, imaging packages must "quantize" and then "dither" them. Quantizing a twenty-four bit image involves finding the 256 most unique colors in the image. Dithering involves replacing each RGB pixel in the image with a palette value which is more or less the same color allowing for the limitations of a 256 Colour format. In addition, dithering adjusts the colors of surrounding pixels to make the image as a whole look as much like the original twenty-four bit image as possible.

Additive Colors
Red, Green, and Blue are referred to as additive colors. Red+Green+Blue=White.

Bitmap
An image made up of dots, or pixels. Refers to a raster image, in which the image consists of rows or pixels rather than vector coordinates. Web graphics are bitmap images.

BMP files - Maximum bits: 24
BMP files are used as "wallpaper" under Windows Systems. BMP is the default picture format in Windows environment. They can be created using the Paintbrush application supplied with Windows, among other things. BMP files use no image compression, plan on your files being very large. Most Windows programs can open / import BMP files.

There is a very important aspect of color BMP files which you should bear in mind when you use this format. Windows uses a fixed palette which Windows Paint cannot go about changing, as doing so would make the screen and border colors change too. This means that transferring an image to the BMP format may result in some color shifts when BMP files are imported into Windows applications.

CMYK (Cyan, Magenta, Yellow, Black)
One of several color encoding system used by printers for combining primary colors to produce a full-color image. In CMYK, colors are expressed by the "subtractive primaries" (cyan, magenta, yellow) and black. Black is called "K" or keyline since black, keylined text appears on this layer.

Corel Draw CDR files -- Maximum bits: 24

Corel Draw's CDR files are vector graphics, but they contain small preview or thumbnail images which appear in the Corel Draw File Open dialog box. The preview images are very coarse, but they're useful for quickly ascertaining what's in a CDR file.

DWG (An acronym that stands for “drawing”)

AutoCAD’s default format. Created by AutoDesk, producer of AutoCAD, the most common engineering and architectural drafting software. Usually used by people who exchange AutoCAD drawings. The latest versions of some CAD and illustration packages like VectorWorks/MiniCAD, Microstation, Freehand, CorelDraw can open / import DWG files. Yet, DXF is still a better choice for exchanging AutoCAD files.

DXF (Drawing Interchange Format)

Created by AutoDesk. This vector file format can be opened / imported by most CAD and illustration software and this is why it is preferred over DWG. DXF vector information is imported / exported as an editable entity. DXF can contain 3-dimensional data and also keep the layered structure intact during import / export.

EPS (Encapsulated PostScript) files -- Maximum bits: 24

A graphic file format developed by Aldus, Adobe, and Altsys to allow exchange of PostScript graphic files (image information) between application programs. EPS contains vector information. EPS is the most widely used export format for illustration programs. If vector data within an EPS file is not converted into bitmap, the resulting file can yield very sharp prints in publishing. Some EPS exports render editable files and some not. For instance, an EPS exported from a CAD program can be imported into an illustration program as an editable file and be manipulated as a vector data.

Photoshop’s EPS is not a vector file. It is, like all Photoshop files, a bitmap image. If you form a path within a Photoshop file for purposes of clipping a certain portion of the particular image, you will have to save the Photoshop file in EPS format since EPS is the only format that can support the vectoral clipping path information. When page layout programs like QuarkXpress or PageMaker import EPS files that contain a clipping path, the clipped portion of the image will be visible and the rest invisible. A very common high quality publishing format like TIFF is not able to contain clipping path data.

Freehand FHD files -- Maximum bits: 24

Freehand’s FHD files are vector graphics, but they contain small preview or thumbnail images which appear in the Freehand File Open dialog box. The preview images are very coarse, but they're useful for quickly ascertaining what's in a Freehand file.

GIF files - Maximum bits: 8

Stands for Graphic Interchange Format, a raster oriented graphic file format developed by CompuServe to allow exchange of image files across multiple platforms. GIF is such a basic format that it can be read by almost any multimedia application including word processing software. These can range from monochrome to 256-color images in any size. Many GIF files contain text information, such as comment blocks, along with their images.

GIFs can contain multiple images, each using a common palette, or separate palettes for each image. Currently, there are two standard GIF file formats: 87a and 89a. The 89a

standard is backwards compatible with the 87a standard, and adds a few new features to the format, such as control blocks which allow the GIF file to contain timing information for displaying the multiple images within, and text comments.

GIF contains lossless LZW (Lempel-Zev-Welch) compression and this is why it is suitable for image files that contain homogeneous colored areas. Since LZW compression is effective on such files it helps creating small file sizes and makes GIF a preferred format for the internet.

GIF is also suitable for clipped images that are needed in the net environment. It is possible to select a particular color in the image and define this color as a transparent color not to be seen within the browser window.

There is also the option of interlaced or non-interlaced GIF. Interlaced GIF files load first with a very coarse preview version of the contained image and give a glimpse of what is going to be displayed, the image gets sharper as it continues to load.

GIF cannot be used in publishing.

Indexed color

A single channel system that allows up to 256 colors that are mapped according to a palette or color look-up table.

JPEG (Joint Picture Experts Group) JPG - Maximum bits: 24

The JPEG format is actually a combination of several elements, and it's important that you understand what it does before you use it. The JPEG algorithm reduces the amount of space a compressed image will occupy on disk by selectively removing details from the image. Pictures with fewer details compress more effectively. JPEG uses a combination of DCT and Huffman encoding to compress images.

The amount of detail removal is defined by the JPEG quality parameter available to all JPEG creation software. The higher the quality value, the better the picture quality; and vice versa. However, the higher the quality value, the larger the resulting image file, so if you want a really small size file you will have relatively bad quality picture. If the minimum picture size (therefore the worst image quality) option is selected, the resulting file may not be reopened in some cases. Optimally, it is best to use medium compression.

Note that several other programs, such as Lead Tools and Image Alchemy have defined their own formats with the extension JPG. They are not necessarily compatible with the JPEG standard. If you encounter an error reading a JPG file, you probably have a file from one of these sources. Once an image has been converted to JPEG, its lost details are lost for good, you can’t retrieve the first unspoiled version of your image.

Note also that repeatedly reading and writing the same image in the JPG format will successively degrade it. If you convert an image from another format, such as GIF, to JPG and then from JPG back to GIF, the final GIF file will usually be smaller than the original, but will likely look worse than the original.

JPEG's degrading effect on image files are particularly visible in images that contain homogeneously colored surfaces. JPEG is not a suitable format for such files since quality loss is much more apparent. JPEG is the most suitable compression method for photographic images containing lots of textures, shadows, gradations, blends.

There are two major types of JPEG - progressive, where a fuzzy images emerges into 100% decompression / clarity, and baseline or standard, where a clear image is revealed, part-wise, top-down. Progressive, or interleaved, decompression looks better over networks.

Kodak Photo-CD PCD files - Maximum bits: 24

Kodak Photo-CDs allow you to have conventional photographs converted to Kodak's proprietary CD-ROM format. The resulting files can be viewed, converted and treated like other PC file formats. In effect, having your photographs made into Photo-CDs will avail you of very high grade scanning, even if you don't own a scanner. Not all CD-ROM drives can access Photo-CDs. You might want to contact Kodak for a list of those that can.

Photo-CD image files usually reside in a directory named \PHOTO_CD\IMAGES on a Photo-CD. They're named by the following convention:
IMGxxxx.PCD (where xxxx is a four digit number, beginning with one for the first image)

Each PCD file contains a number of scans of the same image at different resolutions (4, 8, 16, 32, 64 base). The very low resolution images are used for thumbnail previews. Medium-level images are useful to view and work with Photo-CD scans in a PC environment. Very high resolution images can be used for publication or large size exhibition boards

The higher resolution images in a PCD file may require more memory than your system can provide under Windows.

PCX files (Z-Soft PC Paintbrush) - Maximum bits: 24

These are the files used to hold images for Z-Soft's PC Paintbrush package. These can range from monochrome to 24-bit images. These files use simple run-length-encoding compression, so complex images will not compress as well as they would in GIF or some other format employing more complex compression algorithms.

PDF (Portable Document Format)

A platform independent PostScript based file format. Created by Adobe Systems in its software program Adobe Acrobat as a universal browser. Files can be downloaded via the web and viewed page by page, provided the user is computer has installed the necessary plug-in which can be downloaded from Adobe's own website. Adobe Acrobat Reader can be freely downloaded from the internet in order to open PDF files. Acrobat Reader is not an editing software though, you cannot edit change the contents of the files. Some popular programs like Photoshop and Freehand can open PDF files. Photoshop ends up with a raster image, while Freehand converts the PDF file into a vector file.

PSD (PhotoShop Document)

If you don't select a particular format when you save an image in Photoshop it will be saved in PSD format, which is Photoshop's default format. It is the only image format that supports multiple layers. PSD format cannot be used in web and publishing. To do so, layered files

need to be flattened and be saved in an image format suitable for your particular purpose. PSD format has a built-in lossless compression utility.

PICT

A graphics file format used primarily on Macintosh computers. It is Macintosh operating systems' default format. PICT files can contain both object-oriented and bit-mapped graphics. There are two types: PICT I and PICT II. PICT II is the current standard. PICT II can be compressed and supports 24-bit color images. PICT is supported by most Mac and PC graphic programs.

PNG Files - Maximum bits: 24

The PNG, or Portable Network Graphics, format was created as a successor to GIF. It features lossless compression for images with up to twenty-four bits of color, and most of the other features of GIF. In most cases it will provide at least slightly lesser compression than GIF. PNG files can be interlaced or non-interlaced.

RGB

Short for Red, Green, and Blue; the primary colors used to simulate natural color on computer monitors and television sets.

RIFF (Resource Interchange File Format)

A file format for multimedia data on PCs; can contain bitmapped graphics, animation, digital audio, and MIDI files.

TGA files - Maximum bits: 24

The Truevision Targa format is used by several high end paint programs and things like ray tracing / rendering packages. It can handle images with up to sixteen million unique colors. TGA files use no image compression, plan on your files being very large.

TIFF (Tagged Image File Format) files - Maximum bits: 24

The standard file format for high-resolution bit-mapped graphics. TIFF files have cross-platform compatibility and offer lots of options to make it applicable to a wide variety of applications. TIFF supports monochrome, color and grey scale information, and makes use of lossless LZW (Lempel-Zev-Welch) compression, which is very effective in files that contain homogeneous colored areas.