

How to understand the difference between Vector and Bitmap images

Over the years we have had many questions like:

Why is my screen capture pixilated when plotting it in large format?

Why does my CGM file including seismic data explode in size when saving it in a raster format like TIFF or JPEG – or CGM cell-array?

Why is it so bandwidth consuming to e-mail my digital image photos to colleagues?

We will try to describe the differences between Vector and Bitmap Images – the two major 2D graphic types. It is important to understand the difference to grasp phrases like dpi, resolution and size vs. quality.

Bitmap images consist of pixels in a grid. A pixel is the smallest element in a picture and can have one of more than 16 million colors to form the image you see on your screen. Most modern monitors have 90 – 100 pixels per inch (ppi) but that may vary.

To illustrate this, let's take an image you want to use as a desktop icon. Icons on the desktop are typically 32 pixels in each direction. In this case we have chosen a digital photography and saved it With only 32 pixels in each direction.

The Icon in the upper right corner is seen with typical screen resolution, whereas the enlarged image clearly shows the individual squares of color.



The large image shows how the upper right image looks when zoomed in or printed to a larger size. You can now clearly see the individual pixels that make up the image.

The above illustration also tells you that you need much more data to get a good print or to give you clear zoom view.

Screen resolution is telling you how many pixels in each direction of your monitor you can use – it used to be 1280 by 1024 pixels for good monitors, but now the standard moving towards 2600 x 1600 pixels. This is also the way your home television set is specified – for instance the HD standard is 1920x1080 pixels to give you the sharpest display. Very recently resolutions of 3840x2160 pixels have been introduced.

Part of the mystery of getting the best possible bitmaps is to keep the original pixels to the largest possible extent. When you reduce the size, pixels are thrown away by the software's resize command. Starting from an original with too few pixels (as in a capture of a small part of a screen) software will estimate color values when increasing the number of pixels. This may result in jagged lines or blurred contours – or pixellation.

EasyCopy supports the most common bitmap formats:

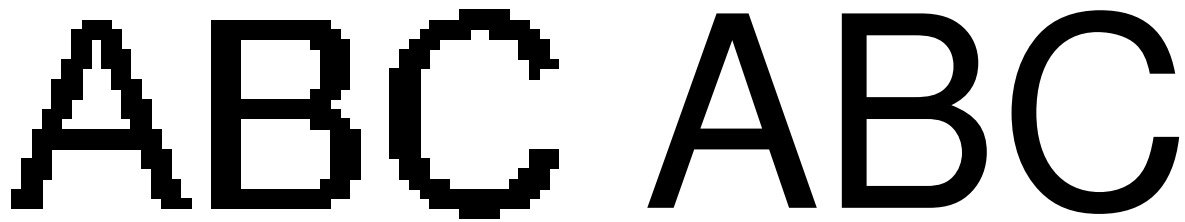
- BMP (Microsoft Bitmap)
- CALS Raster Type 1
- CCITT Group 3 and 4 (Tiff Class F)
- CGM cell-array (Computer Graphics Metafile)
- GIF (Graphics Interchange Format)
- HP Starbase
- JPEG (Joint Photographic Expert Group)
- JPEG 2000
- PBM (Portable Bitmap)
- PCX (PC Paintbrush)
- PNG (Portable Network Graphics)
- Silicon Graphics RGB
- SUN Raster
- TGA (Truevision Graphics Adapter)
- TIFF (Tagged Image File Format)
- XWD (X-Window Dump)

Vector Graphics:

Whereas bitmap images consist of a finite number of pixels in a grid, vector images consists of points and paths connecting them to describe an image. A line will have a starting point, width and height and an alphabetic letter will have a number in the ASCII table and a reference to a font definition.

A saved vector file normally does not take up much space on the disk because it will only be numbers saved no matter what the size is. For a rectangle you will need the x and y starting point and the width and height. In the case of bitmaps you will need to store information about all the pixels in the grid.

Another advantage of vector images is that they are scalable, that means that they can be resized to any size – large or small – without losing quality. They are simply redrawn with the new information.



These 2 figures represent a scaled up bitmap image to the left and a vector graphic image to the right. Note the sharpness in the right figure.

The ideal page layout program would primarily be a vector-based application which creates, imports, displays and prints native vector objects side by side with bitmaps. As computing power has become more affordable this seems to be the way to go.

EasyCopy with EasyCGM supports:

CGM+, CGM PIP and Seismic Extensions. CGM is short for Computer Graphics Metafile.

SVG short for Scalable Vector Graphics

PDF short for Portable Document Format (export to vector PDF from other vector formats only)

WMF and EMF short for Windows Metafile Format and Enhanced Metafile Format.

Metafile

Metafile is a generic term for a file format that can store multiple types of data. This commonly includes graphics file formats and can contain both raster and vector files.

When working with metafiles containing both raster and vector data it is important to be able to maintain the vector data with the advantages described above while dealing with the bitmap data intelligently, i.e. using the compression scheme most appropriate for the purpose.

The files used by the oil and gas industries are frequently CGM files containing vector graphics and seismic data. The Seismic data are contained in a highly compressed format to keep the file size as small as possible. Keeping it in its original form only including mark-up is important for usage such as viewing and plotting. This has however the disadvantage that the files cannot be imported into popular applications like PowerPoint ® and Word ® in the correct representation.

By keeping the vector data in its original form and converting the seismic data to jpeg with a reasonable amount of pixels the file will be compatible with most application – but it will grow in size or loose in quality. How much depends on how many pixels used when saving the seismic content. For presentation purposes 2000x2000 pixels are normally adequate, but if you need to zoom to details more pixels are needed.