Digital Images – Bitmap and Vector

- Graphics on a screen are made up of tiny blocks called **pixels**. The more pixels on the screen, the higher the **resolution** and the better the quality of the picture will be. The higher the image resolution, the more **memory** is needed to store the graphic.

Image files can be either **bitmaps** or **vectors**.

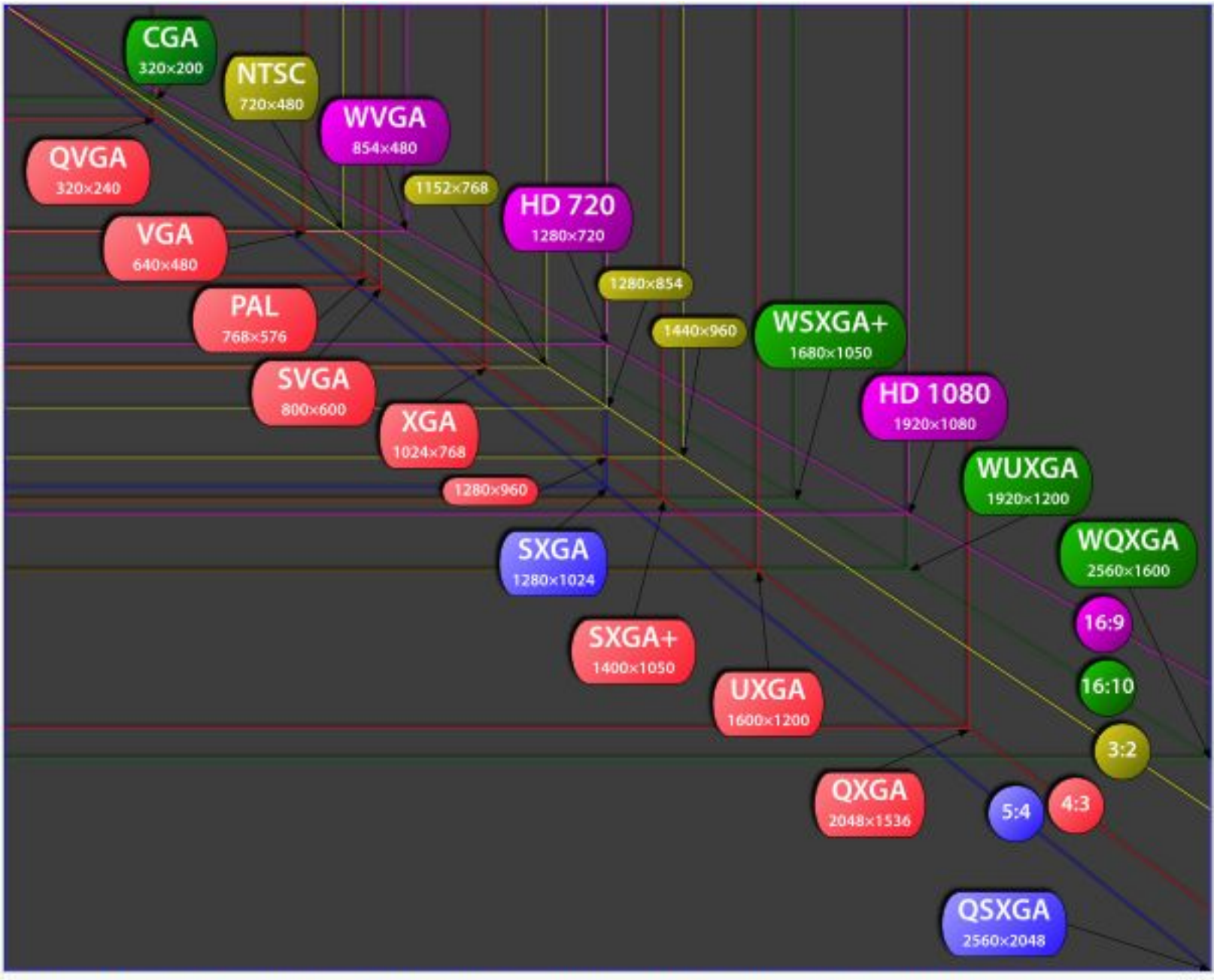
The higher the resolution, the more pixels are available. Therefore the crisper the picture

Example: Calculating screen resolutions

Using the diagram above we are going to work out how many pixels are required to display a single frame on a VGA screen.

Checking the resolution:

```
Height = 480
Width = 640
Area = Width * Height = Total Pixels
Area = 640 * 480 = 307200
```



There are many different video display formats out there, with different widths and heights, and total numbers of pixels

Colour Depth

The number of bits used to represent the colour of a single pixel

Colour depth	1 bit	2 bit	4 bit
Example			
Description	Mono-chrome, only stores black and white	stores 4 colours: RGB(70,61,55), RGB(79,146,85) RGB(129,111,134), RGB(149,146,166)	Stores limited colours
Number of colours per pixel	$2^1 = 2$	$2^2 = 4$	$2^4 = 16$

Colour depth	8 bit	24 bit
Example		
Description	close to reality	hard to see any difference between reality
Number of colours per pixel	$2^8 = 256$	$2^{24} = 16777216$

How to calculate the image size

Example: Calculating file size for different colour depths

All the images above are of the same resolution:

```
300*225 = 67500 pixels
```

If the first image uses 1 bit to store the colour for each pixel, then the image size would be:

```
Number of Pixels * Colour Depth = Image Size
      67500      *     1 bit    = 67500 bits
```

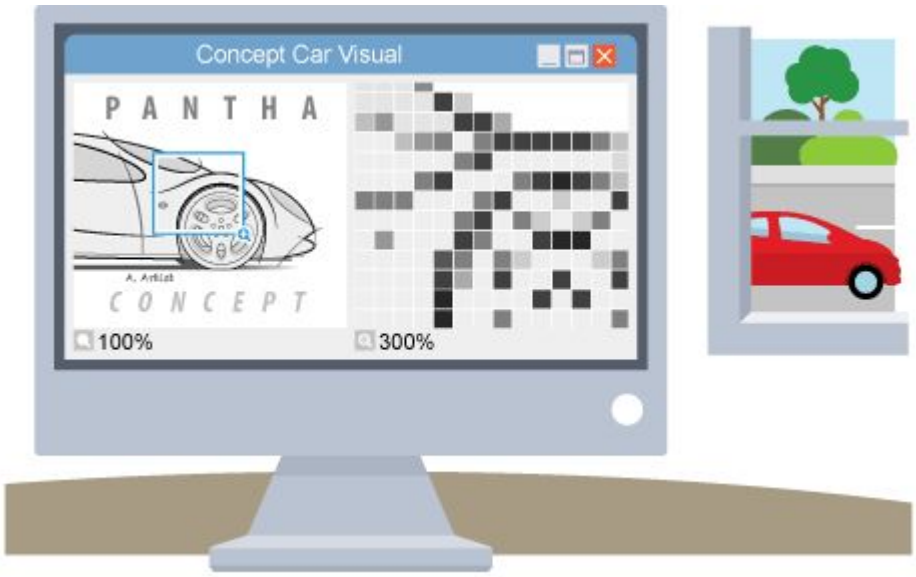
For the second image uses 2 bits to store the colour for each pixel, then the image size would be:

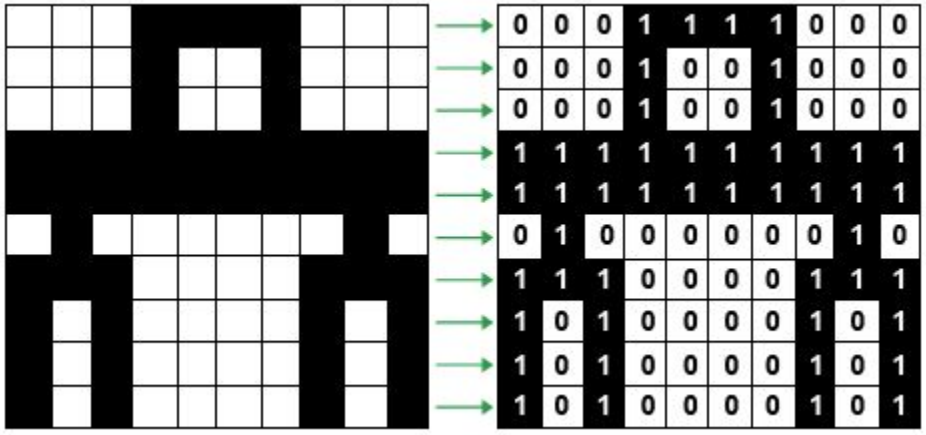
```
Number of Pixels * Colour Depth = Image Size
      67500      *    2 bit     = 135000 bits
```

▸ See the rest of the calculations:

Bitmaps

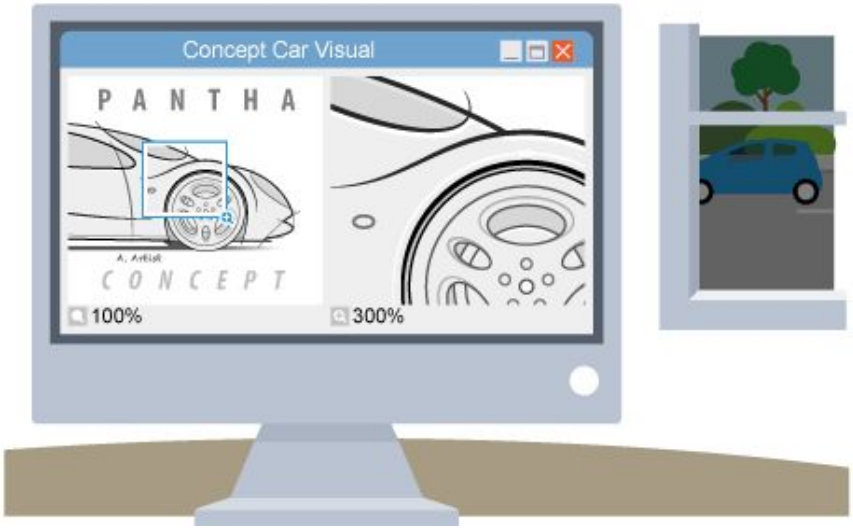
- Used in Digital Cameras, Smartphones and online also know as pixelmaps or raster graphics. E.g. : JPEG, GIF, PNG.
- Orgnized in coloured squres called pixels.
- Zooming a bitmap image makes it appear as poor quality.
- Each colour of an image is stored as a **binary** number. You need a binary value for each different colour. As each pixel is either black or white, this image can be encoded with a value of 0 for white and 1 for black.





Vectors – Vector Image

- Vector graphics are created in graphics packages and consist of shapes called **objects**.
- It is possible to edit **each object** separately, for example, change the shape, colour, size and position.
- Even if an object in a vector graphic is quite large, it doesn't need a lot of computer memory. Therefore the file size of a vector graphic is often very **small**.
- Vector graphics are **scalable** - ie when you resize them, they **do not lose quality**.
- Use the red slider to zoom into the vector graphic below. Notice how as you zoom further in, the image *scales* perfectly and does not lose quality.



- One of the most common vector file formats is SVG (scalable vector graphics), an open standard.
- It is possible to edit SVG image using numbers to change the size and color variables in html/ inforgraphics in HTML 5.

Vector graphics are used in:

- CAD packages
- AutoShapes in Microsoft Office
- animated movies
- encapsulated postscript (EPS)
- animation programmes such as Blender and Adobe After Effects
- image manipulation programmes such as Adobe Photoshop and GIMP
- Adobe portable document format (PDF)
- Windows meta-file (WMF)

Image Display

When a monitor or a printer displays a vector image it is **rasterised** - converted into a grid of pixels. Regardless of the file type, an image will always be outputted onto a screen or printed in pixels.

Differences between bitmap and vector graphics

The table below states the main differences between bitmap and vector graphics:

Comparision of bitmap and vector graphics

	Bitmap graphics	Vector graphics
What are they made up of?	Pixels of different colours	Objects
What can be edited?	Individual pixels	Individual objects
What is the file size?	Large, as the computer stores details of every pixel	Small, as the computer stores details of objects, which do not require much memory
What happens when they are resized?	They lose quality	They do not lose quality
How real do they look?	Real	Not real (many of them look like cartoon images)
Native formats that the software can read	.bmp	.svg
Common file formats	.bmp, .dib, jpeg, gif, tiff, .png	.cgm, .svg, .odg, .eps, .xml

Graphics software

Some software is better at creating and manipulating bitmaps or vector graphics.

Bitmap graphics software

Bitmap graphics can be created and edited using packages such as:

MS Paint
A simple overview of MS Paint, with links to basic tutorials.

Adobe Photoshop
Photoshop tips and tutorials from the Adobe website - basic to advanced level.

Vector graphics software

Vector graphics can be created using drawing packages, such as:

Adobe Illustrator
A list of tutorials, from basic level to advanced, from the Adobe website.

Adobe FreeHand
This site contains a comprehensive list of tutorials, from basic level to advanced, from the Adobe website.

CorelDRAW
There is a host of CorelDRAW tutorials, for older versions as well as the latest versions of the software.

Pro/DESKTOP
This website dedicated to Pro/DESKTOP is a bit old, but the Tutorials page is useful.