PROGETTAZIONE E PRODUZIONE MULTIMEDIALE

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INTRODUCTION - Part II

- **A – Image formats**

I media digitali

- Nel passaggio da un media analogico ad uno digitale si deve tenere conto di due concetti basilari:

  - il campionamento (sampling): E' il partizionamento di un flusso continuo di informazione in quantità discrete, rispetto al tempo, lo spazio o entrambi.

  - la quantizzazione (quantization): E' la rappresentazione di una quantità usando un valore intero

▎ An image is a spatial representation of an object, a two dimensional or three dimensional scene or another image.

▎ An image might be thought of as a function with resulting values of the light intensity at each point over a planar region. For digital computer operations this function needs to be sampled at discrete intervals. The sampling quantizes the intensity values into discrete levels.

Risoluzione Cromatica

- Ad ogni pixel e' associata l'informazione cromatica del punto che il pixel rappresenta. Nel computer, tale informazione e' rappresentata con un certo numero di bit che puo' essere 1, 4, 8, 16, 24, o 32 bit di informazione. Per esempio, volendo visualizzare una immagine a toni di grigio, l'impiego di 4 bit per ogni pixel consentira' di visualizzare 16 diversi livelli di grigio. Diversamente, impiegando 8 bit per ogni pixel, sara' possibile visualizzare 256 diversi livelli di grigio.

- Il numero di distinti colori che un pixel puo' assumere determina la risoluzione cromatica dell'immagine. La massima risoluzione cromatica a cui il computer puo' lavorare e' vincolata alle caratteristiche della scheda video in particolare della memoria della scheda video. Dal momento che la memoria della scheda video e' fissa, tanto piu' alta e' la risoluzione spaziale, tanto piu' bassa sara' la risoluzione cromatica.

# Esempio di quantizzazione del colore
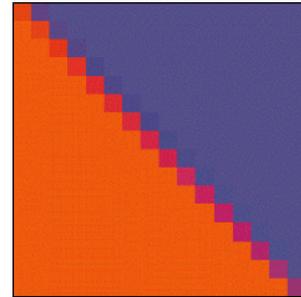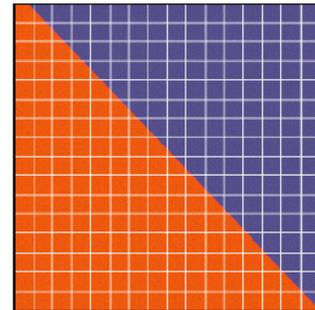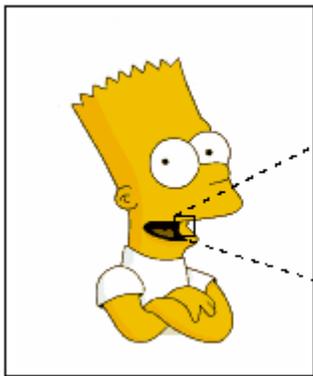
Risoluzione Spaziale

▌ **La precisione con cui le immagini vengono rappresentate sullo schermo dipende dalla risoluzione spaziale. Questa e' determinata dal numero di pixel distinti che possono essere visualizzati sullo schermo. Ancora una volta, tale grandezza e' vincolata dalle caratteristiche della scheda video.**

  ▌ **Schede VGA supportano una resoluzione di 640 pixels in larghezza per 480 pixels in altezza, con 16 distinti colori.**
  ▌ **Schede Super VGA supportano migliori risoluzioni, sia spaziali che cromatiche. A seconda della quantita' di memoria della scheda video, la risoluzione spaziale puo' variare da 640x480 a 1280x1024. Ovviamente, tanto piu' alta e' la risoluzione, tanto piu' nitida e chiara e' l'immagine.**
  ▌ **Standard SVGA resolutions:**
    640 x 480   800 x 600   1024 x 768   1280 x 1024
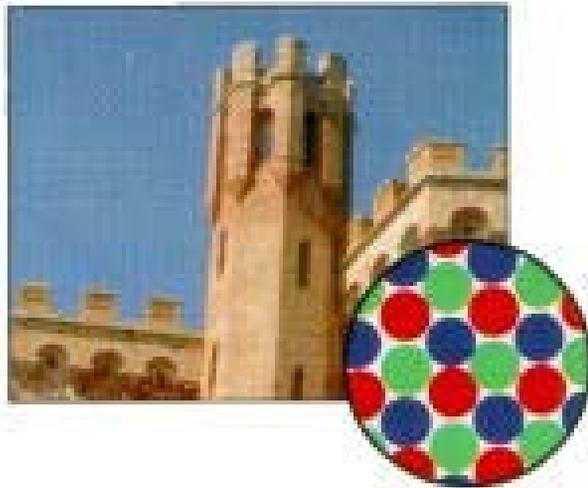
640 x 480
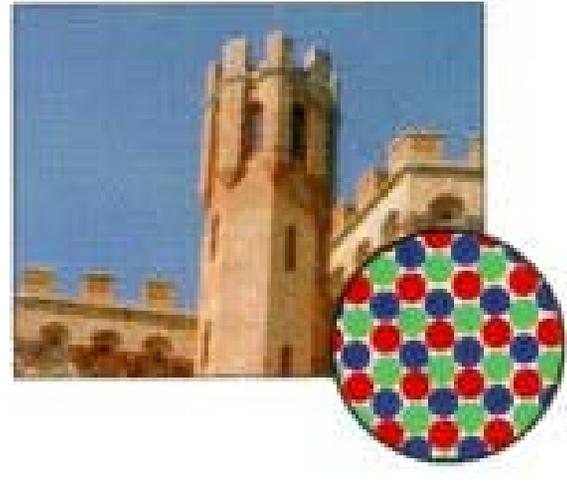
1024 x 768

SECT A – IMAGE FORMATS

■ There actually are three basic methods or graphic formats for a computer to render, or store and display, an image:

■ raster
■ Vector
■ meta

Raster image format

▊ A Raster format breaks the image into a series of colored dots called pixels. The number of ones and zeros (bits) used to create each pixel denotes the depth of color you can put into your images.

▊ Raster image formats can save at 8, 16, 24, and 32 bits-per-pixel. At the two highest levels, the pixels themselves can carry up to 16,777,216 different colors.

▊ The three main Internet formats, GIF, JPEG, and Bitmap, are all Raster formats.

█ Drawings, photos, images etc, which shall be used in a document need to be transformed into a digital format. This is done by scanning the image or take a photo with a digital camera. The image is then stored as a raster file, i.e. dot-pattern image.

█ Enlargement of a raster image. The quality is not improved.
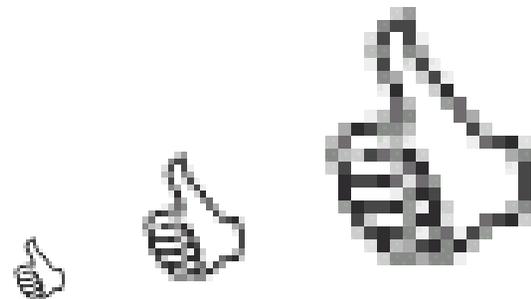
Some other Raster formats include the following:

- **CLP** Windows Clipart
- **DCX** ZOFT Paintbrush
- **DIB** OS/2 Warp format
- **FPX** Kodak's FlashPic
- **IMG** GEM Paint format
- **JIF** JPEG Related Image format
- **MAC** MacPaint
- **MSP** MacPaint New Version
- **PCT** Macintosh PICT format
- **PCX** ZSoft Paintbrush
- **PPM** Portable Pixel Map (UNIX)
- **PSP** Paint Shop Pro format
- **RAW** Unencoded image format
- **RLE** Run-Length Encoding (Used to lower image bit rates)
- **TIFF** Aldus Corporation format
- **WPG** WordPerfect image format

Vector Format

- An image stored in a vector format is an image defined by mathematically. Lines, curves, circles etc, which are stored as mathematical formulas. Compared to raster images only the formulas are stored. This makes the size of the file very small. The images don't loose focus when you zoom, since the lines are re-rendered.

- This formatting falls into a lot of proprietary formats made for specific programs. CorelDraw (CDR), Hewlett-Packard Graphics Language (HGL), and Windows Metafiles (EMF) are a few examples.
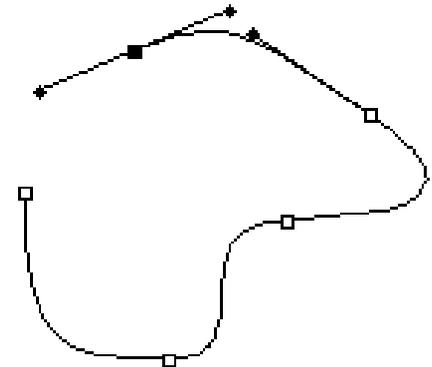
- A vector image gives a very high quality, it requires small storage space and is easy to edit. You should always try to save your vector images in a vector format. It is not possible to save photos, scanned images etc in a vector format.

- Examples of vector images are drawings, diagrams and illustrations.

- Enlargement of a vector image. The quality is still good

.
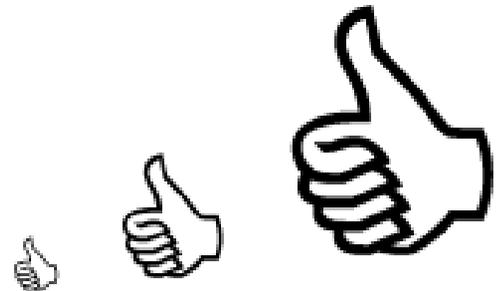
Meta Format

- An image in meta format is a combination of both of the two basic formats; vector and raster format. A meta image can include both vector and raster information.

- Photos are stored in raster format. In some cases you might want to put describing numbers, text and arrows in these images. Both text and arrows should be saved as vector information and not as raster to keep the good quality but the photos still needs to be in a raster format. The image below includes both vector and raster information. The storage is done in a meta format.

- Examples of meta images are scanned photos in which you want to include describing text.

■ Enlargement of a meta image. The quality is good for the vector information

thumb
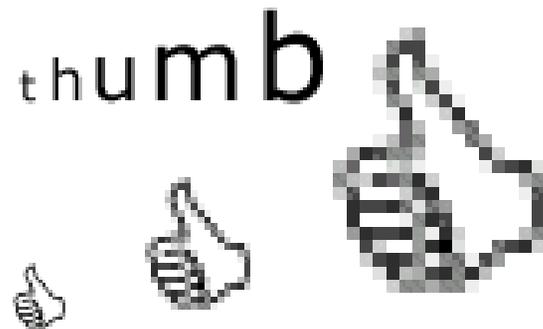
Raster Bitmap

- What's A Bitmap? Usually this question is followed with "How come it only works on Microsoft Internet Explorer?"

- Microsoft invented the Bitmap format. It would only make sense they would include it in their browser. Every time you boot up your PC, the majority of the images used in the process and on the desktop are Bitmaps.

Example of bitmaps:

0	0	0	0	0	0	0
0	0	1	1	1	0	0
0	1	1	1	1	1	0
0	1	1	0	1	1	0
0	1	1	0	1	1	0
0	1	1	0	1	1	0
0	1	1	0	1	1	0
0	1	1	1	1	1	0
0	0	1	1	1	0	0
0	0	0	0	0	0	0

■ Bitmaps can be compressed to a point. The process is called "run-length encoding." Runs of pixels that are all the same color are all combined into one pixel. The longer the run of pixels, the more compression.

■ Bitmaps that use the run-length encoding can carry either the common ".bmp" extension or ".rle". Another difference between the two files is that the common Bitmap can accept 16 million different colors per pixel. Saving the same image in run-length encoding knocks the bits-per-pixel down to 8. That locks the level of color in at no more than 256.

- **RUN-LENGTH ENCODING**

  Con questa tecnica si sostituisce una sequenza di simboli uguali con un solo simbolo accompagnato dal numero di volte che questo compare consecutivamente:

  ppppppppppp ppppppppppp ppppppppppp diventa $11p $11p $11p

- E' necessario definire l'impiego di un carattere speciale (in questo caso $). L'intero file puo' essere codificato con la sequenza:

  $11r $11r $11r
  $11p $11p $11p
  $11c $11c $11c

  Totale caratteri: 6+6+6 = 18
  Totale numeri: 3+3+3=9
  Dimensione file: 27Byte = 216bit

- Questa tecnica puo' essere impiegata anche per la codifica di immagini, traendo vantaggio dall'occorrenza di pixel consecutivi di ugual colore.

Bitmap Image 178KB

Run-Length Encoded Image 55.2KB

Raster GIF

- GIF, which stands for "Graphic Interchange Format," was first standardized in 1987 by CompuServe, although the patent for the algorithm (mathematical formula) used to create GIF compression actually belongs to Unisys. The first format of GIF used on the Web was called GIF87a, representing its year and version. It saved images at 8 bits-per-pixel, capping the color level at 256. That 8-bit level allowed the image to work across multiple server styles, including CompuServe, TCP/IP, and AOL.

- CompuServe updated the GIF format in 1989 to include animation, transparency, and interlacing. They called the new format, you guessed it: GIF89a. There's no discernable difference between a basic (known as non-interlaced) GIF in 87 and 89 formats.

GIF87a Image 61.4KB

GIF89a Image 61.4KB

■ **GIF animation**   GIF89a animation provides the ability to set the cell's (technically called an "animation frame") movement speed in 1/100ths of a second. An internal clock embedded right into the GIF keeps count and flips the image when the time comes.

■ The animation process has been bettered along the way by companies who have found their own method of compressing the GIFs further. As you watch an animation you might notice that very little changes from frame to frame. A whole new GIF image is put if only a sensible section of the frame needs to be changed.

- GIF **Transparency**   In transparent GIF the computer is told to hone in on one of them. It's done by choosing a particular red/green/blue shade already found in the image and blanking it out. The color is basically dropped from the palette that makes up the image. Thus whatever is behind it shows through.

- A transparent GIF is limited in that only one color of the 256-shade palette can be made transparent.

- The process is similar to "chroma key" used in television. A computer is told to hone in on a specific color, let's say it's green. Chroma key screens are usually green because it's the color least likely to be found in human skin tones. That chroma is then "erased" and replaced by another image.

- **Interlaced, non-interlaced GIF**   A NOT interlaced image, is filled in from the top to the bottom, one line after another.

- Interlacing is the concept of filling in every other line of data, then going back to the top and doing it all again, filling in the lines you skipped. Your television works that way. The effect on a computer monitor is that the graphic appears blurry at first and then sharpens up as the other lines fill in.

- That allows your viewer to at least get an idea of what's coming up rather than waiting for the entire image, line by line.

GIF89a Non-Interlaced Image 132KB   GIF89a Interlaced Image 55.4KB

Raster JPEG

▌ JPEG is a compression algorithm developed by the people the format is named ter, the Joint Photographic Experts Group. JPEG's big selling point is that its compression factor stores the image on the hard drive in less bytes than the image is when it actually displays. The Web took to the format straightaway because not only did the image store in fewer bytes, it transferred in fewer bytes.

▌ JPEGs are "lossy." That's a term that means you trade-off detail in the displayed picture for a smaller storage file. (save your JPEGs at 50% or medium compression).

▌ JPEG Image compression example

■ 50% compression means that 50% of the image is included in the algorithm. Since JPEG is lossy, bytes are lost at the expense of detail. You can see where the compression algorithm found groups of pixels that all appeared to be close in color and just grouped them all together as one.

■ The difference between the 1% and 50% compression is not too bad, but the drop in bytes is impressive.

- **Progressive JPEG**	A progressive JPEG works a lot like the interlaced GIF89a by filling in every other line, then returning to the top of the image to fill in the remainder.

- If you're going to use progressive JPEG, keep the compression up high, 75% or better

- Progressive JPEG Image compression example

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On the Internet, we have to deal with three main types of images: CompuServe GIF, JPEG, and Bitmaps. When do we use a specific image format?

GIF - The GIF format uses lossless compression to achieve medium levels of compression on images with up to 256 colors.

- GIF works best on images with few colors or images in which one color is dominant. It acts best on identical, adjacent pixels (or rows of identical, adjacent pixels).

- GIFs can store any number of colors from 2 to 256 and are often the best format within this range. There is no loss during the compression process as long as the original image had fewer than 256 colors. The key to using GIFs effectively is to use the smallest possible number of colors. Many colors retain their full quality with as few as 32 or even 16 colors.

- Also notable about GIFs is the fact that they can be transparent, animated, or both.

- **JPEG** - The JPEG format uses lossy compression to achieve high levels of compression on images with many colors.
  - The compression works best with continuous-tone images, that is, images where the change between adjacent pixels is small but not zero.

  - JPEG images generally store 16 or 24 bits of color and thus are best for 16- or 24-bit images.

  - Due to the noticeable loss of quality during the compression process, JPEGs should be used only where image file size is important, primarily on web pages.

- **TIFF** - The TIFF format is rarely seen on the web because it offers poor compression.

  - TIFF files can store up to 24-bit images with no loss, making them better than JPEG files for archiving images when space is not critical.

If your image is...

- Black and white   Use GIF ▪ [sample](#)
- Text on a plain backgrou   Use GIF ▪ [sample](#)
- Transparent or animated   Use GIF
- Computer-drawn line, cartoon art   Use GIF.
- Small images, like icons, buttons   Use GIF
- Predominantly (>80%) one color   Consider GIF

- 16/24-bit scanned photograph   Use JPEG   ■ sample
- Computer-drawn continuous-tone art Use JPEG ■ sample
- Scanned images and photographs   Use JPEG
- Large images/ images with a lot of detail Use JPEG