Objectives

- Describe the capabilities and limitations of bitmap images.
- Cite the various file types used in multimedia.
- Get images into computer by scanner, digital camera, disks and the web.
- Develop an understanding of the concepts and tools needed to work with those images.
- learn some of the basic concepts of graphic programs including: Resolution, File sizes, and File formats- TIF, JPEG, GIF, BMP

Information Delivery

- Images or Graphics are used to **convey information** in multimedia products.
- For example, a picture of an automobile engine is much more effective than text that merely describes it.

Creation of multimedia images

- The type of still images created depends on:
  - Display resolution,
  - Hardware, and
  - Software capabilities.
- Access to the right tools and right hardware for image development is important!
  - E.g., graphic designers like to have large, high-resolution monitors or multiple monitors

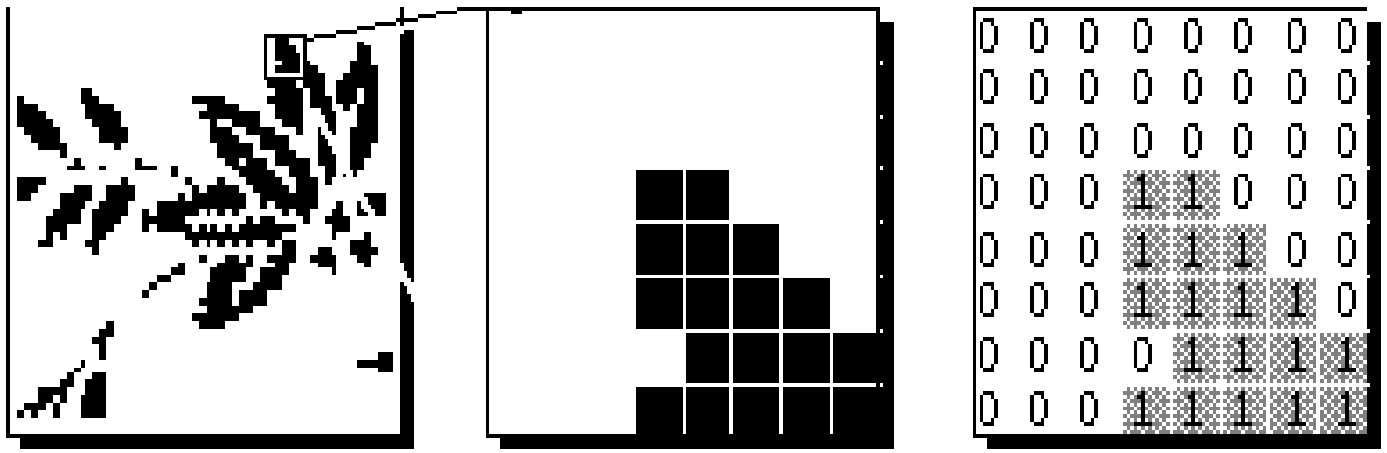
Types of Still Images

Still images are generated in two ways:

- Vector-drawn graphics.
- Bitmaps (or *raster-based*) .

Bitmaps

- Bitmap is derived from the words ‘bit’, which means the simplest element in which only two digits are used, and ‘map’, which is a two-dimensional matrix of these bits.
- A bitmap is a data matrix describing the individual dots of an image that are the smallest elements (pixels) of resolution on a computer screen or printer.

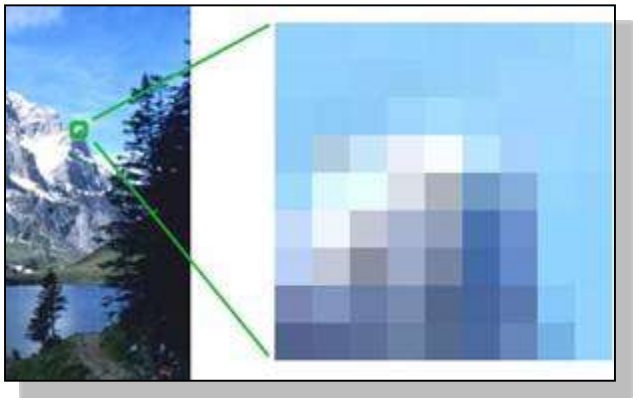


Bitmaps

- Bitmaps are an image format suited for creation of:
  - Photo-realistic images.
  - Complex drawings.
  - Images that require fine detail.
- Bitmapped images are known as paint graphics.
- Bitmapped images can have varying bit and color depths.

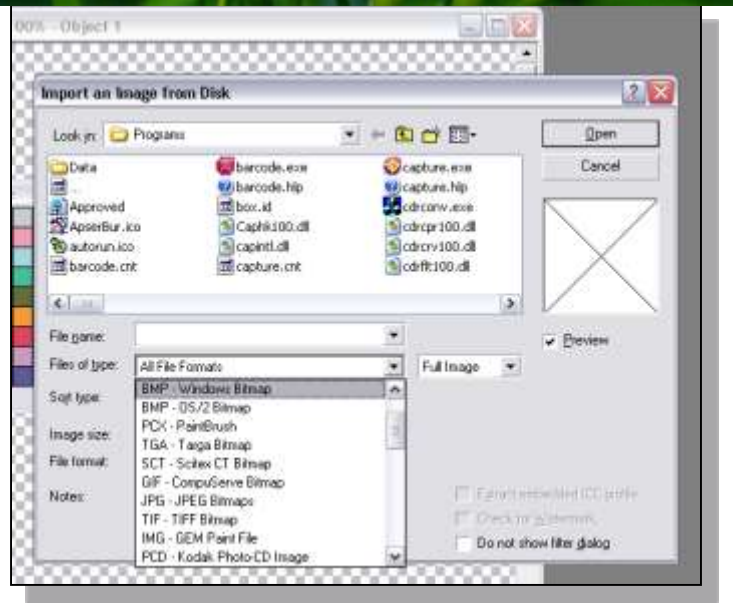
Bitmap Images

- Bitmap images (also called raster images) are made with pixels (picture element), which look like rectangles.
- All the pixels, when combined for visual images, are called continuous tone images (contones).
- Bitmap images are resolution dependent, and this must be taken into consideration when producing images of different size and quality.



Advantages of Bitmap Images

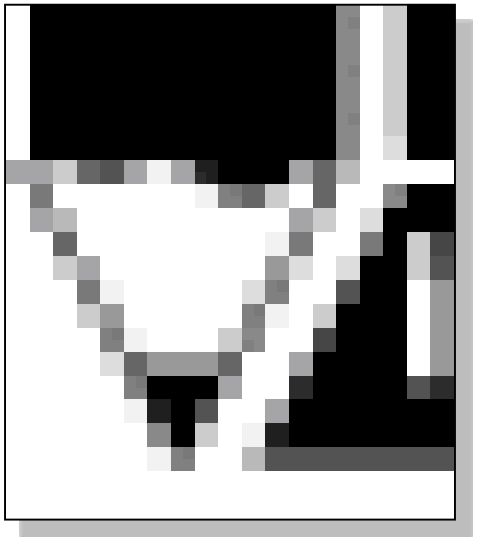
- Bitmap images are easily converted to different formats.
- Bitmap images are easier to import into different software applications.
- Bitmap images produce a variety of continuous tone images.
- Bitmap images are better suited for most high quality renderings and web page graphics.



Lecture Three

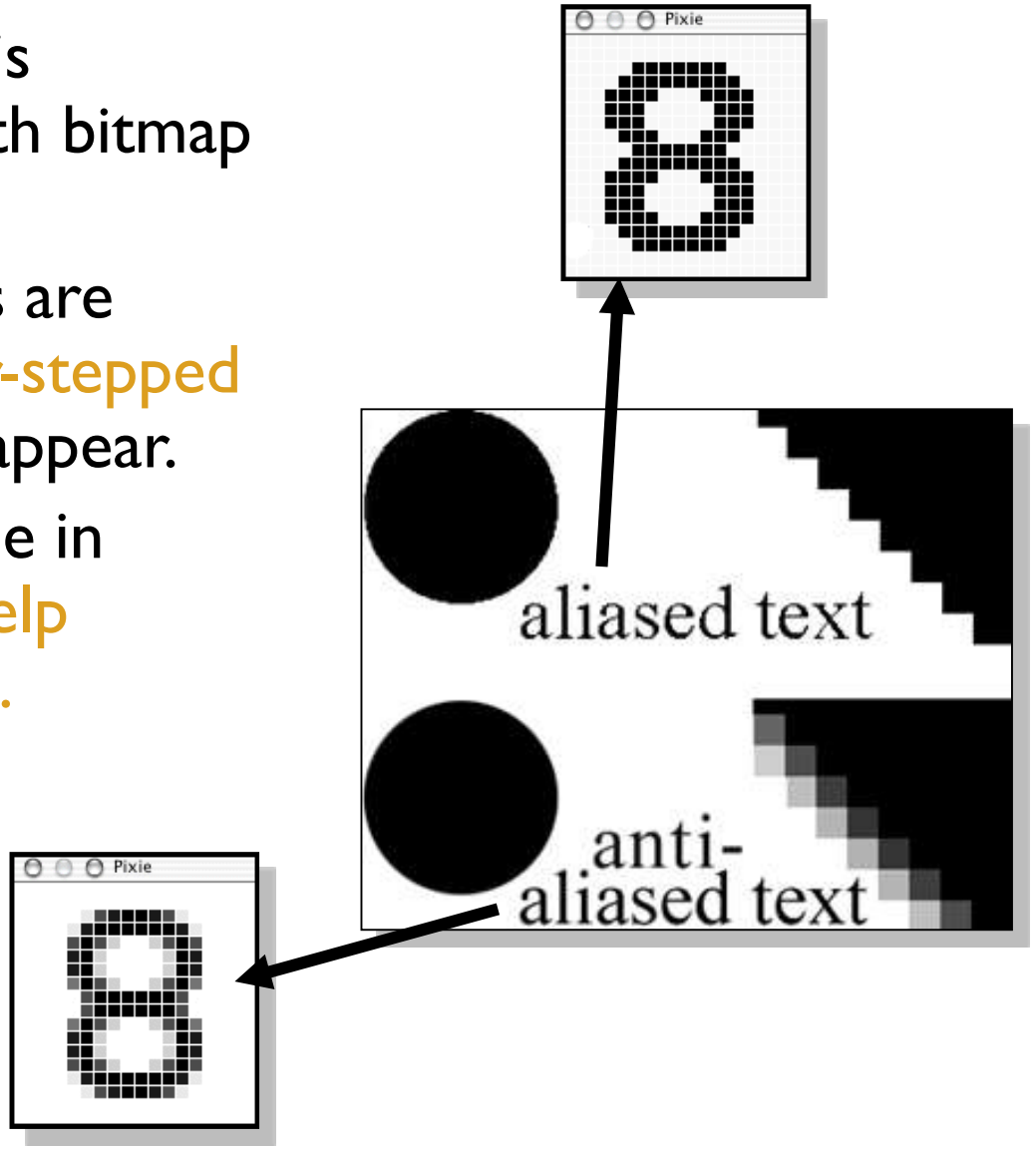
Disadvantages of Bitmap Images.

- Bitmap images produce larger files sizes.
- Bitmap images have restrictions in regards to alterations and modifications such as scale, image distortion, and format conversion.
- There is a common appearance of blocked or jagged edges and blurriness in the image, which must be compensated for with sharpness filters.



Disadvantages of Bitmap Images

- Substantial memory is required to work with bitmap images.
- When bitmap images are enlarged, jagged, stair-stepped edges called *aliasing* appear.
- *Anti-aliasing* is available in some programs to help smooth jagged edges.



Resolution

- There are three types of resolution measuring different aspects of the quality, detail and size of an image:
  - **Image Resolution:**
    - The term **resolution** often associated with an **image's degree of detail or quality**.
  - **Display Resolution:**
    - Resolution can also refer to **quality capability of graphic output (monitor).**
  - **Colour Resolution / Colour Depth:**
    - Colour depth describe the **number of bits** used to **represent the colour** of a single pixel.

Bitmap Images Resolution

- Image resolution measures the pixel dimension of an overall image or how many pixel the image has.
  - It is the number of pixels in an image and is referred to as dpi or dots per inch.
- Resolution is based on the number of pixels, which is determined, by its width and height of the pixels.
- Example:

  Image size = width in pixels x height in pixels

Display resolution

- Display resolution is also measured in pixels in terms of height and width.
- It simply means how many pixels can be displayed on the computer screen.
- Display resolution normally uses a setting of 640x480(VGA), 800x600 (SVGA), 1024x768, etc.
- You can change the display resolution under Display Properties in Control panel.
- If your image resolution is bigger than the display resolution, the result would be part of the image will be out of the display area.

Colour Resolution/Colour Depth

- Color depth refers to the number of "colors" available and/or the amount of computer memory that will be required to store pixel values of an image.
- The higher the bit number, the more colors you have available, but the more computer memory required to store the image.
- File size should be considered when saving, creating, and scanning an image.

Color Depth (bit depth)

- Each pixel can represent at least 2 possible colours or more.
- Colour resolution or Colour depth/channel depth is measured in bits.

Colour Depth	Calculation	Number of Colours
1 bit	$2^1 = 2$	2 colours
4 bits	$2^4 = 16$	16 colours
8 bits (1 byte)	$2^8 = 256$	256 colours
16 bits (2 bytes)	$2^{16} = 65,536$	65,536 colours
24 bits (3 bytes)	$2^{24} = 16,777,216$	16,777,216 colours

Memory/Storage requirement

- Factors to consider:
  - The height of the image
  - The width of the image
  - The colour depth or bit depth

- The file size of a bitmap image (in bytes):

Height X Width X (Colour depth / 8)

Basic Types of Bitmap Images

- **Black and white images** called line art are simple 1-bit images.
- **Grayscale images** contain various shades of gray as well as black and white.
- **Full color images** use color information that can be described using a number of color spaces such as RGB, CMYK or Lab colors.

Binary (Bitonal) Image

- These images have two possible values of pixel intensities: black and white.
- Also called 1-bit monochrome image, since it contains only black and white. Binary 1 represents a black pixel Binary 0 represents a white pixel.

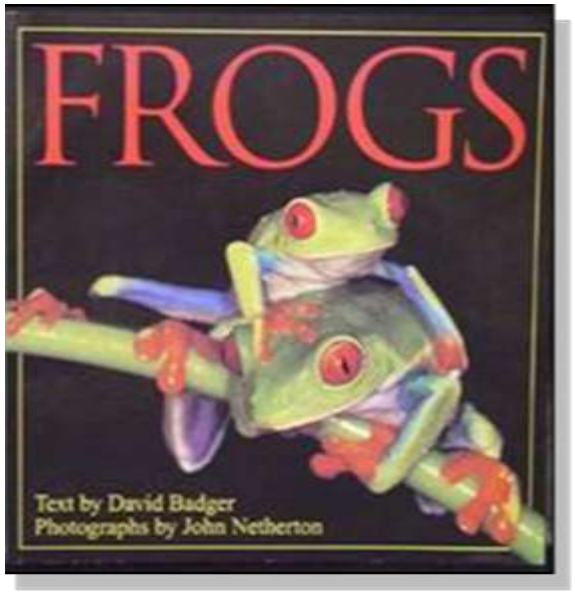
- Typical applications of bitonal images include office/business documents, handwritten text, line graphics, engineering graphics etc.

Grayscale Image

- They contain several shades of grey.
- Typical applications of grayscale images include newspaper photographs , magnetic resonance images, and CAT-scans.
- A grayscale image can be represented by n bits per pixel, so the number of gray levels supported will be 2^n.
- 8-bit Grayscale Image. It consists of 256 gray levels.
- A dark pixel might have a pixel value of 0, a bright one might be 255.

Colour Image

- They are characterized by the intensity of three primary colours (RGB).
- For example, 24-bit image or 24 bits per pixel. There are 16,777,216 (2^{24}) possible colours. In other words, 8 bits for R(Red), 8 bits for G(Green), 8 bits for B(Blue).
- Since each value is in the range 0-255, this format supports 256 x 256 x 256 or 16,777,216 different colours.



Examples of Pixel Depth

Monochrome

- Monochrome graphics have one-bit pixel depth. (pure black or pure white)

Examples of Pixel Depth

Gray-Scale

- Gray-Scale graphics have more bit-depth (No colours besides black, white and grey)

Examples of Pixel Depth

8 Bit Colour

- 8 bits per pixel provides 256 colour choices (Typical of the web - that's why web graphics need some skilful preparation)

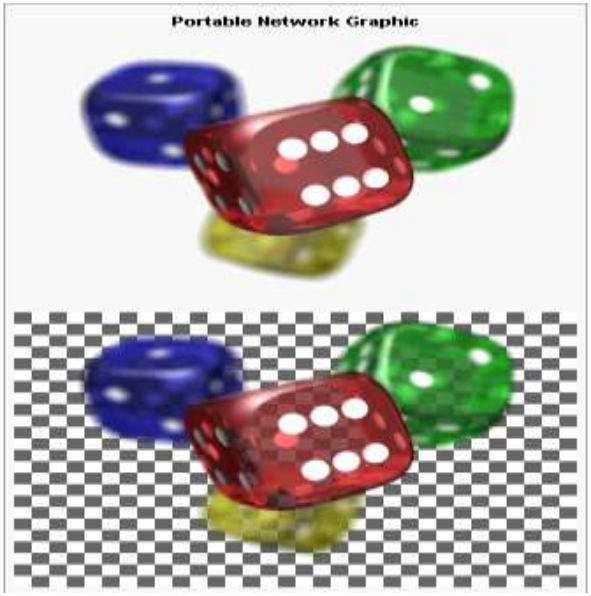
Examples of Pixel Depth

24 or 32 bits per pixel

- 24 or 32 bits per pixel provides thousands or millions of colour choices. (Typical of graphics and games software)

RGBA / 32-bit images

- An important point: many 24-bit colour images are actually stored as 32-bit images, with the extra byte of data for each.
- Allows RGBA colour scheme; Red, Green, Blue, Alpha.
- Pixel used to store an *alpha* value representing the degree of "transparency".



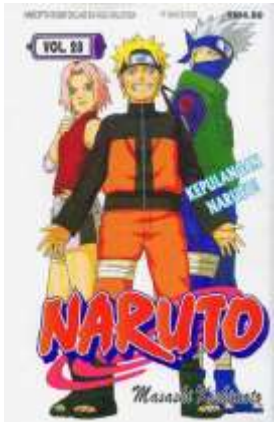
Bitmaps

Bitmaps can be inserted by:

- Using clip art galleries.
- Using bitmap software.
- Capturing and editing images.
- Scanning images.

Clip Art

Drawn



Scan

Capture

Using Clip Art Galleries

- A clip art gallery is an assortment of graphics, photographs, sound, and video.
- Clip arts are a popular alternative for users who do not want to create their own images.
- Clip arts are available on CD-ROMs and on the Internet.

Using Bitmap Software

The industry standard for bitmap painting and editing programs are:

- Adobe's Photoshop. 

- Adobe Fireworks. 

- Corel's Painter. 

- CorelDraw. 

- Quark Express. 

Capturing Images From Screen

- Capturing and storing images directly from the screen is another way to assemble images for multimedia.
- The PRINT SCREEN button in Windows and COMMAND-CONTROL-SHIFT-4 keystroke on the Macintosh copies the screen image to the clipboard.

Programs For Editing Images

Image editing programs enable the user to:

- Enhance and make composite images.
- Alter and distort images.
- Add and delete elements.
- Morph (manipulate still images to create animated transformations).

Capturing Images From Digital Cameras

Types of Digital Cameras

	Image Quality	Features	Price	Use
Basic	Low 640x 480 3 x 5 inch prints	PHD	$100-350	Snaps, Web, email
Deluxe Point and Shoot	Good 1 mega pixel 4 x 6 prints	Some control	400-800	Manuals, education, Web
Prosumer	Better 2 megapixel 8 x 10 prints	More control	$900-2000	Newsletters, documentation
Professional	Best 3+ megap's	Many	$3000-50,000	Advertising, news, fashion

Types of Cameras

Basic Point and Shoot	Deluxe Point and Shoot (1 megapixel)	Prosumer (2-3 megapixels)	Professional (3+ megapixels)
Olympus D-360	Olympus D-450 zoom	Olympus D-2500 L	Canon EOS D2000
			
HP Photosmart D200	Kodak DC265	Nikon Coolpix 950	Kodak DCS 660
			

Basic Camera elements

- Lens
  - Viewfinder / SLR; Optical / Digital Zoom
- Image sensor
  - CMOS/ CCD
- Camera features
  - Exposure/ Focus Lock, LCD, Burst shooting/recovery time
- Connection to PC
  - Serial, Parrallel, USB, SCSI
- Downloading options
  - To PC, Printer, Video
- Batteries
  - Nickel Metal Hydride rechargables

Digital Cameras: Storage Options

- Internal Memory Only - RAM (Basic models)
- Removable memory cards
  - Compact Flash- Kodak, Nikon, Canon
  - Smart Media - Olympus, Fuji, Agfa (smaller, not as high capacity)
  - Sony Memory Stick
- Direct Cable connection (Professional Models)
- File formats JPEG or TIF
- Resolution
  - 640 x 480, 1024 x 768, 1280 X 960…

Downloading Options From Camera

- Camera to PC Cable
  - Serial, USB common, SCSI, Firewire more expensive
  - Serial ~ 1 minute per megabyte; USB 50x faster
- Storage media to PC via Card reader drive directly attached to PC
- Printer, TV for direct output

Basic Image Editing

- Cropping
- Selecting
- Copy/Pasting
- Retouching
- Colorizing
- Filters
- Sharpening
- Special Effects

Printing

- Even for images that will eventually be printed, there is little point scanning beyond 150 dpi unless you are producing a very high quality glossy colour magazine (in which case you would use 300dpi.)
- If you want to enlarge an image then you would scan at correspondingly higher resolution.
- If necessary, a low resolution image can be reduced in print size to effectively give a higher resolution image on paper
  - e.g. if you halve the size of a 150 dpi image you have a 300 dpi image.
  - Laser printers rated as 600 dpi only use 100 dpi in a graphic.

File extensions

- As you know, files are usually stored as
  - Name of file
  - A dot (or period)
  - An extension that indicates the general category of the file.

Some common extensions

- .txt Plain text
- .doc Microsoft word document
- .docx Microsoft Word Open XML Document
- .pdf Portable Document Format File
- .msg Outlook mail message
- .ppt Powerpoint presentation
- .xls Excel spreadsheet
- .bmp Bitmap image file
- .jpg JPEG image file
- .mp3 Mp3 audio file
- .wav Wave audio file

Some common extensions (cont.)

- .log Log file
- .mov Apple QuickTime movie
- .mpg MPEG video file
- .exe Executable file
- .html Hypertext Markup Language file
- .zip Zipped file
- .java Java source file
- .py Python source file

Image File Types used in Multimedia

- Macintosh formats.
- Windows formats.
- Cross-platform formats.

Macintosh Formats

- On the Macintosh, the most commonly used format is PICT.
- PICT is a complicated and versatile format developed by Apple.
- Almost every image application on the Macintosh can import or export PICT files.
- In a PICT file, both vector-drawn objects and bitmaps can reside side-by-side.

Windows Formats

- The most commonly used image file format on Windows is DIB.
- DIB stands for Device-independent bitmaps.
- The preferred file type for multimedia developers in Windows is Resource Interchange File Format (RIFF).

Windows Formats

Bitmap formats used most often by Windows developers are:

- BMP - A Windows bitmap file.
  - Native bitmap file format of the Microsoft Windows environment
- TIFF - Extensively used in DTP packages.
  - Used to exchange documents between different applications and platforms
- PCX - Used by MS-DOS paint software.
  - One of the oldest bitmapped formats

Cross-Platform Formats

The image file formats that are compatible across platforms are:

- **DXF** - Used by CAD applications.
- Initial Graphics Exchange Standard (IGS or IGES) - Standard for transferring CAD drawings.
- **JPEG and GIF** - Most commonly used formats on the Web.

Most Popular Image File Formats

- **JPEG** (Joint-Photographic Experts Group)
- **GIF** (Graphical Interchange Format)
- **PNG** (Portable Network Graphic)
- Other formats:
  - **BMP, PSD, TIFF/TIF, TGA, EPS, PCX, ICO**

GIF – Graphics Interchange Format

- **Animation** – Standard format for animation on the Internet.
- **Transparency** – yes
- **Lossless compression**
- **Colors** = 256 (8-bit)

Animated Gif

- Most common format for:
  - Text
  - Clip art, animations, icons, logos
  - Simple diagrams, line drawings
  - Graphics with large blocks of a single color
  - Graphics with transparent areas
  - Images displayed on computer screens and on websites.

Most Popular Image File Formats

- **GIF**
  - For **large areas of the same color** and a **moderate level** of **detail**.
  - Supports up to **256** colors
  - Allows **transparency** and **interlacing**
  - Uses **lossless** compression

JPEG – Joint Photographic Experts Group

- **Animation** – No
- **Transparency** – No
- **Lossy** compression
- **Colors –** 16.7 M (24-bit)
- High quality but larger file size than a GIF

- Commonly Used For:
  - Desktop publishing photographs
  - Photographs and natural artwork
  - Scanned photographs
  - Emailing photographs
  - Digital camera photographs

Most Popular Image File Formats

- **JPEG**
  - For continuous tone images, such as full-color photographs
  - Supports more than **16 millions** of color (**24-bit**)
  - Uses **lossy** compression (averaging may lose information)

BMP - Bitmap

- **Animation** – No
- **Transparency** – No
- Uncompressed
- 256 **colors**
- Large file size - not well suited for transfer across the Internet or for print publications

- Commonly Used For:
  - Editing raster graphics
  - Creating **icons** and **wallpaper**
  - On-screen display

Icons

PNG – Portable Network Graphics

- ✗ **Animation** – no
- ✓ **Transparency** – yes
- **Lossless** compression
- 256 **colors**
- **Not** suited for photographs
- Biggest Disadvantage: Not widely supported by web browsers and image viewers/editors without plug-ins.

- Commonly Used For:
  - Replacing GIF and TIFF images
  - Online viewing of images

Most Popular Image File Formats

PNG

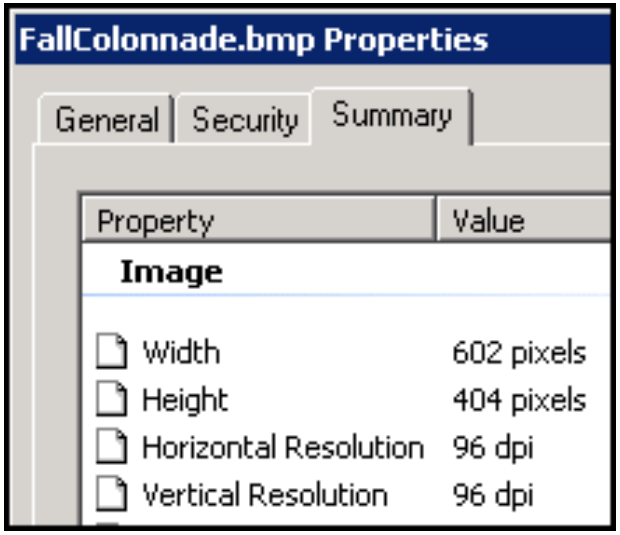
- **lossless**, **portable**, **well-compressed** storage of raster images
- patent-free replacement for GIF
- also replace many common uses of TIFF
- Support indexed-color, grayscale, and true color images + an optional alpha channel for transparency

TIFF – Tagged Image File Format

- Available in compressed and un-compressed formats
- Compressed is advised
- Commonly Used For:
  - Storage container for faxes and other digital images
  - To store raw bitmap data by some programs and devices such as scanners
  - High resolution printing
  - Desktop Publishing images

Extension is not enough

- Often the software needs more information than is conveyed by the extension.
- A .bmp file stores the RGB values for each pixel, thus 24 bits in 3 bytes for each pixel.



- Suppose there is RGB information for 100 pixels. Is the picture a 10 by 10, 25 by 4, 5 by 20 or what? Many other such questions.

File headers

- Many file formats specify how some needed information is to be stored in the beginning of the file.
- The extension tells the type of format being used; the file header encodes additional information needed by the software accessing the file.
- File has
  - Header information
  - File data