

## IMAGE FILES

### Two main ways to create graphics

- Bitmapped
- Vector Graphics

### Bitmapped graphics – image is modeled as an array of pixel values

- Render by direct mapping of logical pixels to physical pixels of screen
- May need scaling and clipping

### Vector graphics – image is modeled as mathematical description of curves, shapes

- Render by computing pixels from description (classic Computer Graphics)

### Memory Requirements

**Bitmapped** – any picture of  $W \times H$  pixels, using  $c$  bytes per pixel occupies  $W \times H \times c$  bytes

**Vector** – space required depends on complexity of picture

(how many shapes, segments of path, etc)

- Usually vector graphics smaller than bitmapped

### Image Editing

**Vectors** – drawing programs

- Select individual graphic objects (shapes, paths, &c)
- Transform size, position, angle, &c
- Change attributes: stroke and fill &c

**Bitmaps** – painting programs

- Select areas of pixels
- Apply effects and filters

### Scaling

**Vectors**

- Simple mathematical operation on stored description (before rendering)
- Curves and lines remain smooth at all sizes

**Bitmaps**

- Interpolate pixel values
- More or less sophisticated algorithm
- Usually produces loss of quality, blurring, jaggedness &c

### Combining Vectors & Bitmaps

**Rasterize vectors** - Lose all their vector properties

**Trace bitmaps** - Difficult and can only produce an approximation (parameterized)

- Import bitmaps into vector drawing programs - Treated as indivisible objects
- Apply complex strokes to vectors to approximate bitmapped appearance

## **File Formats**

- Many different graphics file formats in existence
- Different ways of encoding image data
- Different amounts/form of supplementary data
- (Bitmaps) Different compression methods

## **Most used Bitmapped Formats**

- **GIF (CompuServe Graphics Interchange Format)**
  - Lossless, 256 colors (indexed), transparency
- **JPEG (Joint Photographic Experts Group)**
  - Lossy (variable quality), millions of colors
- **PNG (Portable Network Graphics)**
  - Lossless, variable number of colors, W3C standard

## **24 bit color**

- This format supports 256x256x256 possible combined colors, or a total of 16,777,216 possible colors.
- This flexibility results in a storage penalty: A 640x480 24-bit color image requires 921.6kB of storage without compression
- Many 24-bit color images are actually stored as 32-bit images, with the extra byte of data for each pixel used to store an alpha value representing special effect information (e.g., transparency).

## **Popular File Formats**

**GIF** Graphic Image Format  
Graphics Interchange Format  
Graphical Interchange Format

- Developed by CompuServe to pass an image from dial-up customers across different platforms
- Designed to handle a palette of 256 colors (8 bit color), and a single image
- When developed, this was near state of the art for most personal computers

## **Uses LZW algorithm to compress the data**

- 1984, while working for Sperry Corporation (now Unisys),
- Terry Welch modified the Lempel-Ziv 78 (LZ78) compression algorithm for greater efficiency for implementation in high-performance disk controllers

- The result was the LZW algorithm - Run Length Encoding
- Uses an 8 bit Color Look Up Table (CLUT) to identify its color values

If the original image is an 8 bit, gray-scale photo,

- then a compressed lossless image file

If 24 bit color graphic image

- map to an 8 bit CLUT
- Compress
- Loss would be in the remapping of the original 24 bit (16.7 million) colors to the limited 8 bit (256 colors)

**CLUT**

The compression is lossless to the remapped 8 bit image, not to the original 24 bit image.

- LZW not efficient for compressing images with many changes in the coloration across lines of pixels.
- Very efficient when there are rows of pixels with the same color or when a very limited number of colors is used.
- A controllable parameter in SAVING GIF files is the palette size.

**Transparency**

- One color in a lookup table can be identified as TRANSPARENT
- Any pixel mapped to the TRANSPARENT color will pass the background color of the page through.
- Animation without requiring your viewers to have any special browser plugin
- Animation is achieved by a series of frames
- The ability to animate is part of the GIF89a standard.

For the standard specification, the general file format of a GIF87

Sections of information

GIF signature  
Screen descriptor  
Global color map

Image descriptor (These 3 repeated 1 to n times)