15.03.21 21:32

CSCI 165
Introduction to the Internet and the World Wide Web
Lec 3: Graphics

Jetic Gū

Overview

- Focus: Web Development
- Architecture: Internet
- Core Ideas:
    1. Review on Bitmap Image Representation
    2. Vector graphics

P1
Bitmap Image

Image on Webpages

Quick review

Summary

Recall Your Basic HTML

- Displaying Images using `<img>`
  - User downloads the whole image file when loading the webpage
  - `src` attribute specifies the url to the image
  - Require image formats supported by the browser
    e.g. JPEG, these types of images are called **bitmap graphics**
  - Common formats: JPEG, GIF, PNG, etc.

Review

P1
Bitmap Image

Recall Your Basic HTML

- **Bitmap** Images
  - Images represented using **pixel**s
  - Each pixel is represented using 3 bytes[1] of values: **Red**, **Green**, **Blue**. Different combinations make up different colours
  - 3000 x 2000 image **without compression** will require:
    3000 x 2000 x 3 = 18MB storage

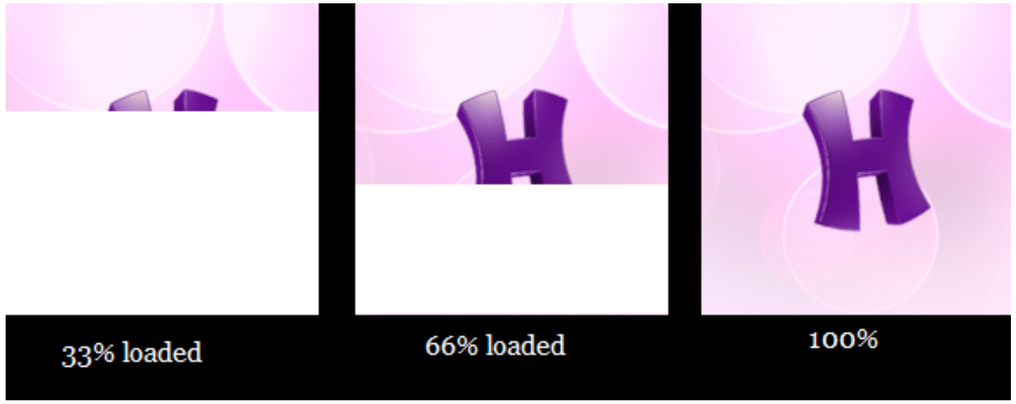
1. Image formats such as DNG and TIFF allow for higher number of bytes per colour channel, but JPEG is usually limited to 24bit per pixel (3 by

Review

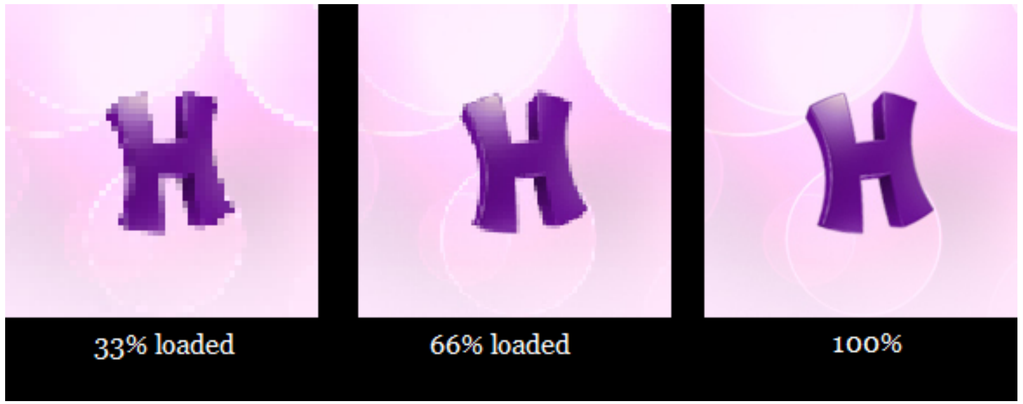
Recall Your Basic HTML

- Loading bitmap images

  1. Reused already downloaded image files on your machine (**caching**)
  2. Download entire image **before** loading the webpage
  3. Download entire image while loading the webpage
  4. Download JPEG **progressively** while loading the webpage[1]



Direct normal download



Progressive JPEG loading

Review

1. Require complex coding: progressive JPEG
2. Image credit: https://www.hostinger.com/tutorials/website/improving-website-performance-using-progressive-jpeg-images

P1
Bitmap Image

Problems with Bitmap Images

- **Computer monitors are getting higher resolutions**
  1080p -> 4K -> 6K, etc.

- **Higher resolution displays require higher resolution images**
  With bitmap, you need to keep updating your images until there's no higher resolution avail for them

- **Hi-Res Image -> Larger Image Files**
  The user has to download massive image files when using your webpage, this can slooooooow things down

  - 10% failure rate for 12MB webpage, about 30sec loading time[1]

  - Optimal: HTML + JS + CSS + Images <1MB size, how can we achieve this for our images?

Concept

1. Use the developer tool in your browser to check the speed and size

Vector Images

What is it, how to use it

Summary

P2
Vector Image

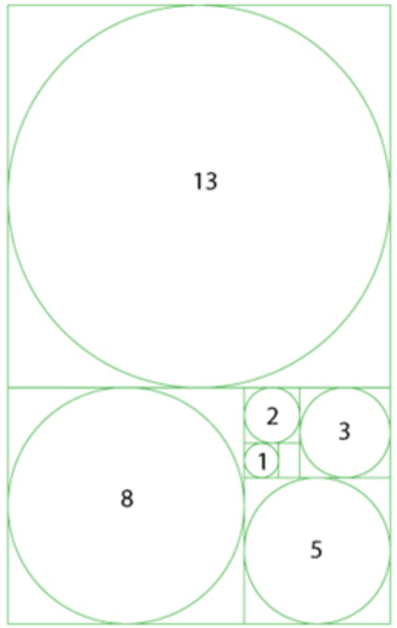
Image Representations in Web

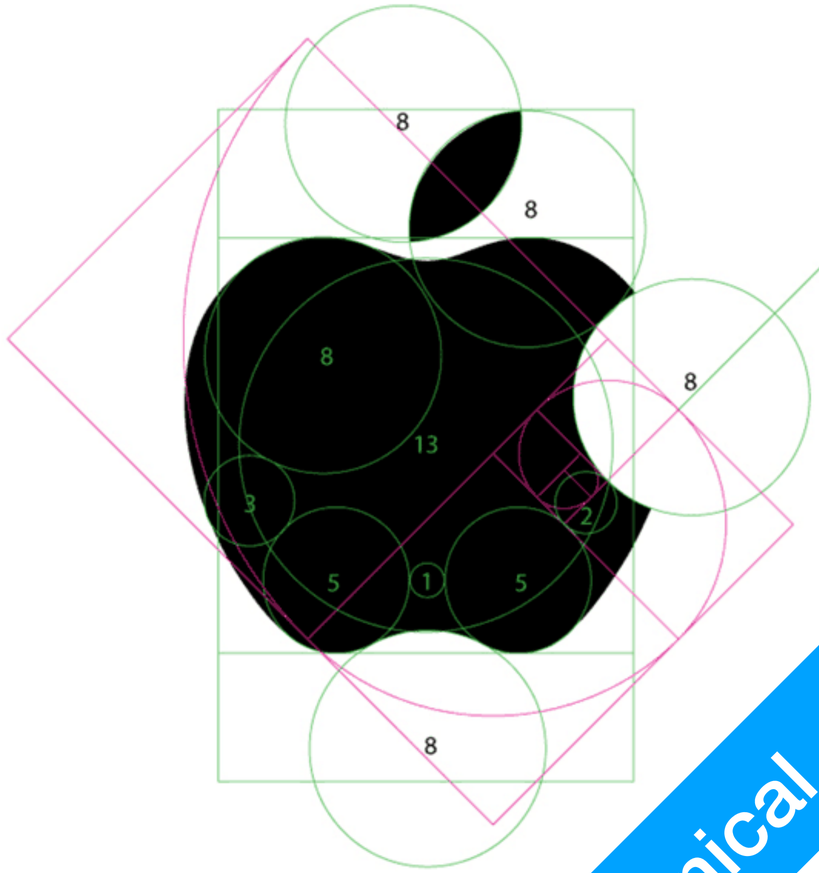
- **Bitmap Images**
  - Grids of pixels, usually come in JPEGs
  - Each pixel has its colour value stored as 3 bytes of binary
  - Fixed resolution
    cannot scale up, small images will look **blurry** on Hi-Res displays
- **Vector Images**
  - Images stored as collections of basic shapes

Concept

Vector Images

- Instead of Pixels, it stores
  - basic shapes
    Lines, Circles, Curves, etc.
  - relative sizes of shapes
  - coordinates of shapes
  - transparency of sections of shapes





Vector Images

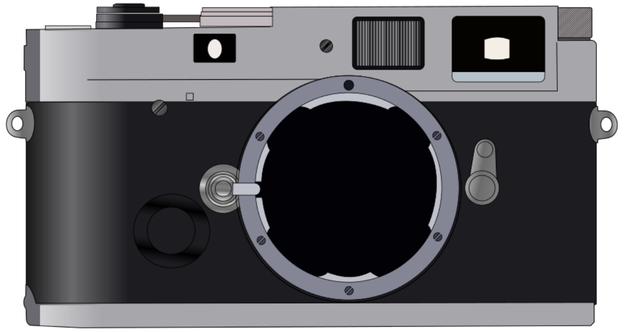
- Why Vector Images?
  - **Ability to upscale** unlimitedly
    don’t worry about resolutions, you are covered
  - **Smaller footprint**
    Images tend to be smaller in size than Hi-Res JPEGs
  - **Easy to edit**
    you can manipulate shapes separately in an editor
  - **Con: cannot represent all images**
    You won’t be able to make Mona Lisa into Vector Images

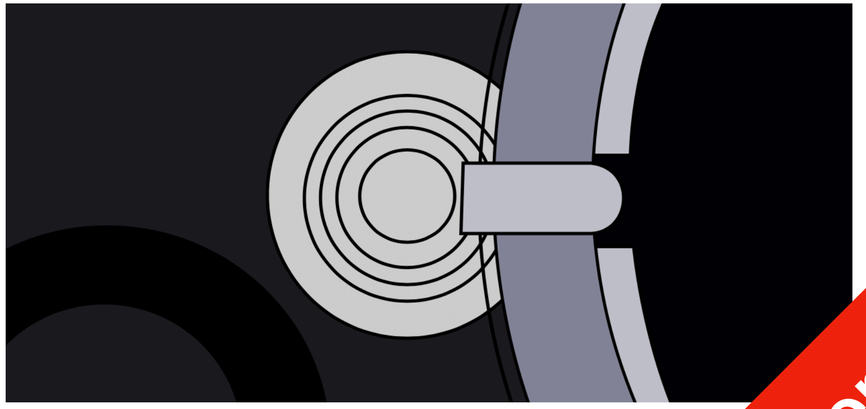
Concept

Common Formats

- **SVG: Scalable Vector Graphics**
  - Vector Image format designed for web use
  - Tons of editors on the internet
    You can use whatever you want, Greg Baker recommends inkscape.org
  - Right: leica-mp.svg from wikipedia, 56KB
- Other formats: PDF, CAD, Illustrator, etc.

Leica MP





P2
Vector Image

Design Your Logo

- Part of Assignment 3
  - Design a logo for yourself using inkscape.org
  - The logo must contain at least 10 different shapes, i.e. not too simple
  - Store the image as SVG
  - Store the image as 100x100 JPEG, 500x500 JPEG, 1000x1000 JPEG without compression, compare their differences in size

Exercise

Imaging Techniques

Colour Depth

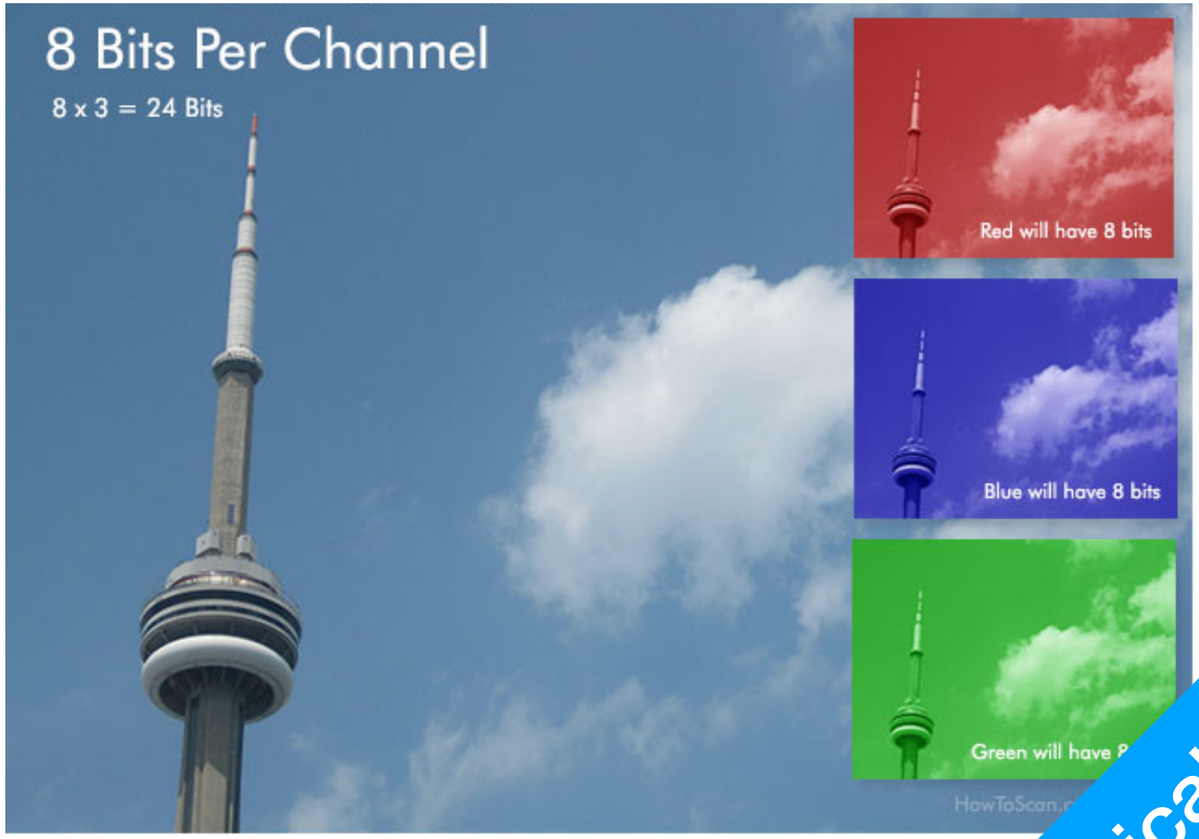
Summary

Colour Depth

- Recall
  - In JPEG, each image is represented by a grid of pixels
  - Each pixel is represented by 3 values, indicating Red Channel, Green Channel, Blue Channel (RGB)
    - Other colour representations do exist such as CMYK, but RGB is most common

Colour Depth

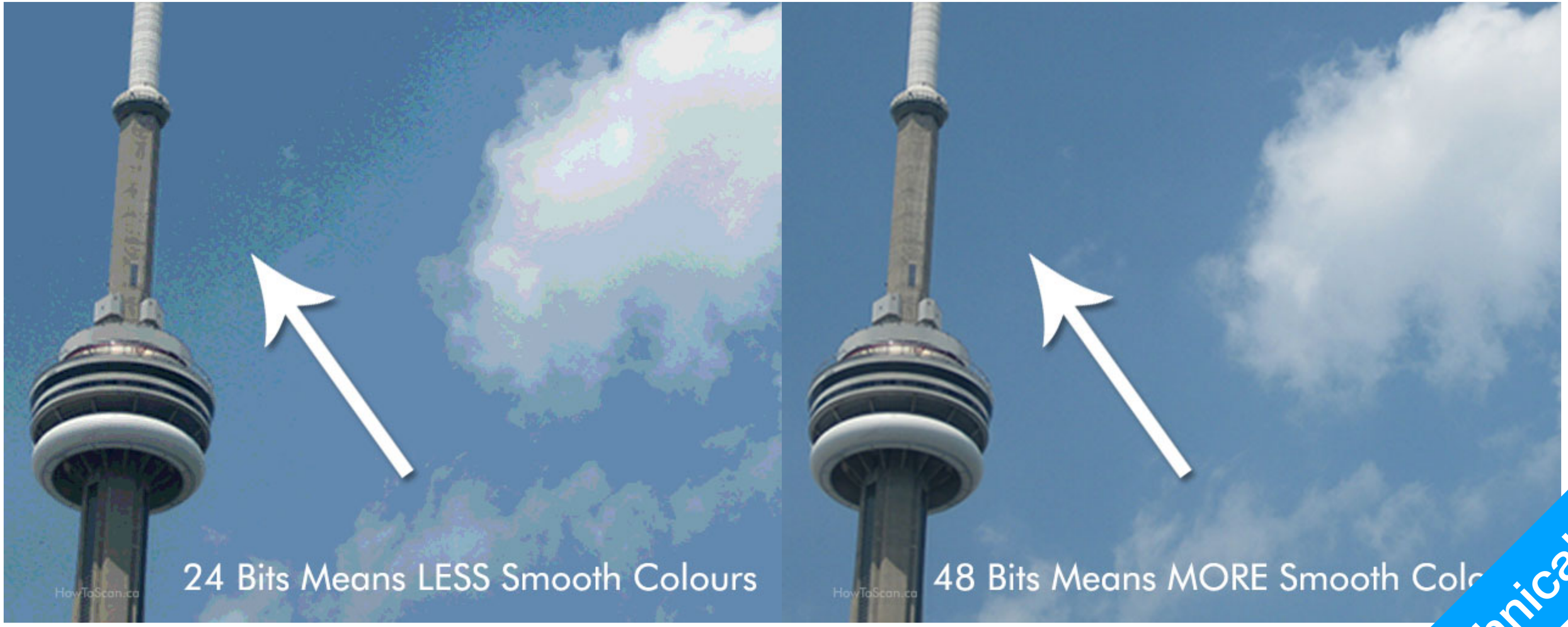
- Colour depth
  - 24-bit per pixel
    - 8-bit per colour channel
      that's 256 shades of Red/Green/Blue!
    - Is that a lot?



1. https://howtoscan.ca/scanning-tips/difference-between-24-bit-vs-48-bit-scans.php

Technical

Colour Depth



1. https://howtoscan.ca/scanning-tips/difference-between-24-bit-vs-48-bit-scans.php

Technical

Colour Depth

- How much colour depth do you need?
  - Photographic artwork: 48-bit, 16bit per channel per pixel, 100% size
  - Normal Web Images: 24-bit, 8bit per channel per pixel, 50% size
  - Simple stuff like logo: 8-bit, from a colour palette, 16.7% size

Colour Depth

- Bitmap Image Formats
  - JPEG: 24bit only
  - PNG: 8bit, 24bit, 32bit
  - GIF: 8bit