

# **COMP 4021**

# **Internet Computing**

## **Images in Browsers**

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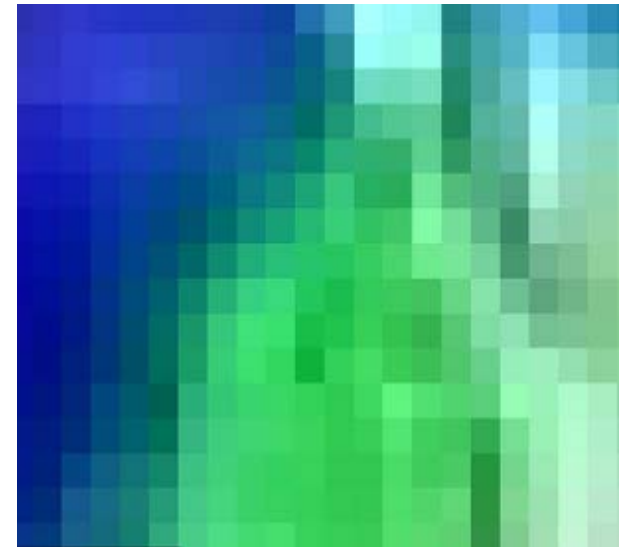
Slides created by Dr. David ROSSITER

# Two Types

- If you want to display an image in a browser, there are two methods you can use:
  - 1) Bitmap images
  - 2) Vector graphics

# Bitmap Images

- With bitmap images
  - Looks poor when you zoom in/print it (if not enough pixels)
  - They are static (=non-moving), or sometimes can do very simple animation by looping (such as animated GIF files)
  - File size can sometimes be large



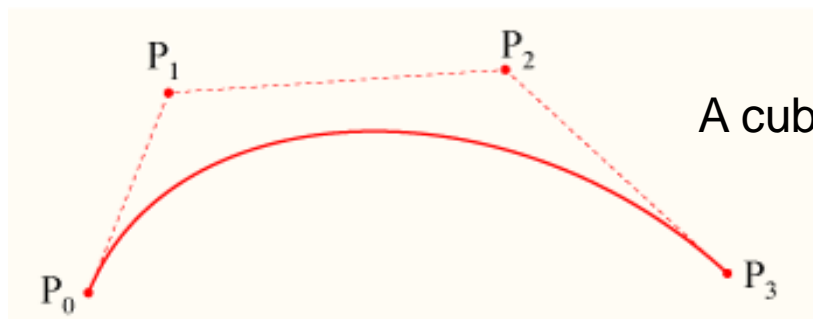
21x16 bitmap represented  
as a 21x16 array

# Bitmap Images

- The main bitmap image formats are:
  - GIF – **compressed**; old format for images with  $\leq 256$  colours
  - JPEG – **compressed**; best for images of ‘natural’ things  
(such as photographs of people, places)
  - PNG – **high** and **lossless** compression file format which does not change the pixels, use this instead of GIF

# Vector Graphics Formats

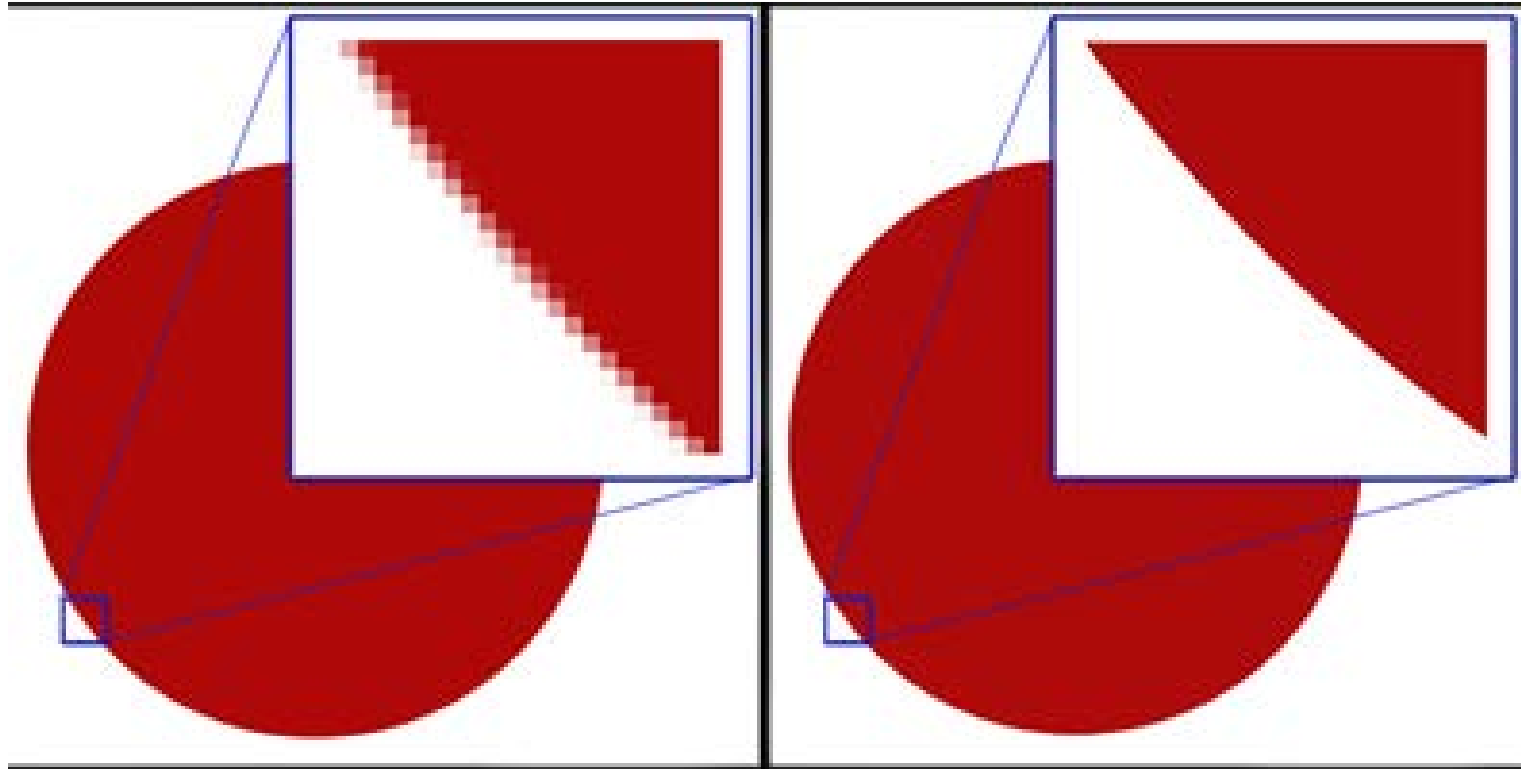
- Every object in vector graphics is mathematically represented
- Get perfect quality even when you zoom in/print
- Everything in the image is 'separated' into objects
  - Change can be applied to some specific objects in the image
- Often much smaller file size than bitmap images, so less disk space & less time needed for download



A cubic Bezier curve

$$B(t) = \sum_{i=0}^n \binom{n}{i} (1-t)^{n-i} t^i \mathbf{P}_i = (1-t)^n \mathbf{P}_0 + \binom{n}{1} (1-t)^{n-1} t \mathbf{P}_1 + \cdots + t^n \mathbf{P}_n, \quad t \in [0, 1]$$

# Comparison



- Bitmap image

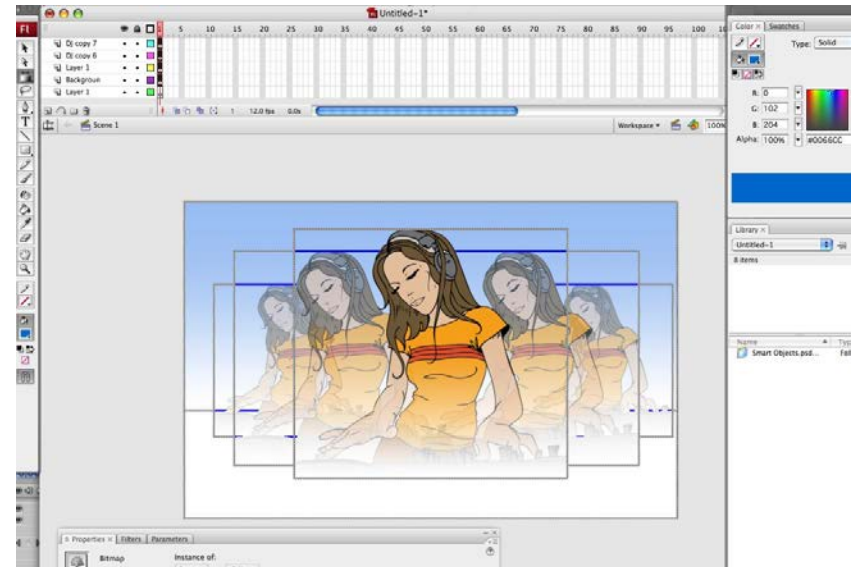
Vector image

# Web Vector Graphics Formats

- There are three main ways to display vector graphics in a browser:
  - Flash
  - SVG
  - Canvas

# Flash

- Adobe Flash Player is one of the most popular browser plug-ins
- Made by a company (Adobe)
- Have to use the Flash editor to create Flash files, must pay \$\$ for it
- Need to have a plug-in to play the files – but this is already included in most browsers (except Apple, no Flash support in Safari)
- Usually, it is impossible to search the content of a Flash file, because the content is 'hidden' in complex binary data (i.e., not recognizable characters)

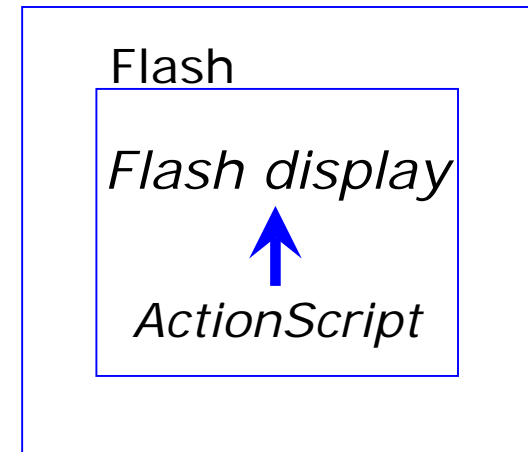




# Possible Uses of Flash

1. A picture where nothing moves
    - Create using simple clicking in the Flash editor
  2. A picture where some things move (animation)
    - Add animation by using timelines in the Flash editor
    - Can use ActionScript code for more control
- Flash is commonly used as a ‘black box’ in a web page
  - This is different to SVG and Canvas, which can be more ‘integrated’ with the web page

Web  
page



# SVG

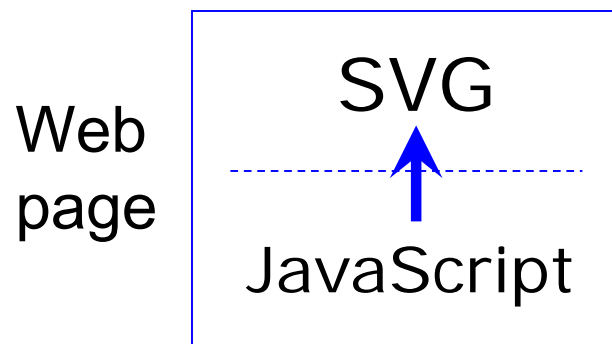
```
<?xml version="1.0" encoding="UTF-8" standalone="no" ?>
<svg version="1.0" xmlns="http://www.w3.org/2000/svg" >
  <defs>
    <linearGradient x1="99.7" y1="0" x2="100" y2="100" >
      <stop offset="0" stop-color="black" stop-opacity="1" />
    </linearGradient>
  </defs>
  <use xlink:href="#box_gr" />
  <use xlink:href="#circle" />
  <use xlink:href="#circle" />
  <line x1="100" y1="300" x2="100" y2="350" />
  <!--add more content here-->
  <circle cx="90" cy="300" r="10" />
</svg>
```



- SVG=Scalable Vector Graphics
- Made by the web open standards organization (W3C)
- Most browsers support SVG i.e. Firefox, Opera, Chrome, IE, etc.
- You don't need any special program to create SVG, simple text editors are OK
  - For any complex graphics, a rich-text-editor is needed
- SVG contains plain text, so it can be read and edit with a text editor, indexed and searched by a search engine

# Possible Uses of SVG

1. A picture where nothing moves
2. A picture where some things move (animation)
  - Animation commands are included in SVG
3. A picture which is controlled by JavaScript
  - JavaScript can change anything at any time
  - JavaScript controls things through the DOM



```
var example = document.getElementById('example');  
var context = example.getContext('2d');  
context.fillStyle = "rgb(255,0,0)";  
context.fillRect(30, 30, 50, 50);
```

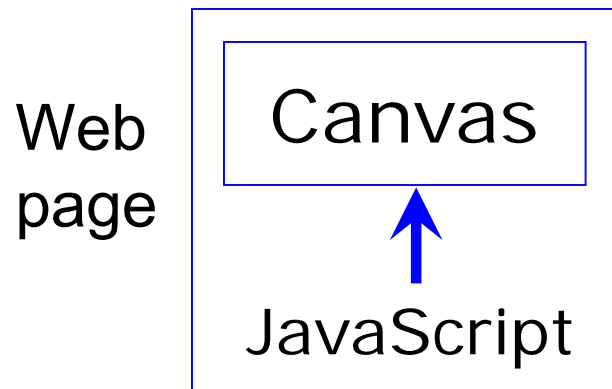
# Canvas



- Very new, just a few years old
- Part of the new HTML 5 standard - use a text editor
- Has the concept of a 2D bitmap area which you can draw things on
- Can change exact (x,y) pixels (can't do that with SVG)
- A bit troublesome in some ways – for example, cannot access everything through the DOM
- IE 9 or above supports Canvas natively (older version uses excanvas.js JavaScript library to simulate Canvas  
<!--[if IE]> <script src="excanvas.js"></script> <![endif]-->)

# Possible Uses of Canvas

1. A picture where nothing moves
2. A picture which is controlled by JavaScript
  - JavaScript can change anything at any time
  - JavaScript can control some Canvas things (but not everything) through the DOM



# SVG and Canvas Inherit XML Rules

- SVG and Canvas code is built using basic XML ideas (discussed later in the course)
- So the usual XML rules apply i.e.
  - End tags cannot be omitted  
e.g. every `<circle>` should have a `</circle>`  
or alternatively use `<circle ... />`
  - If nesting is used, tags must be correctly nested  
e.g. `<g><line>`  
This is bad SVG code `</g></line>`
  - Any attribute values must be enclosed in speech marks, for example: `<line width="1" />`