

COMP 4021
Internet Computing

Images in Browsers

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Two Types

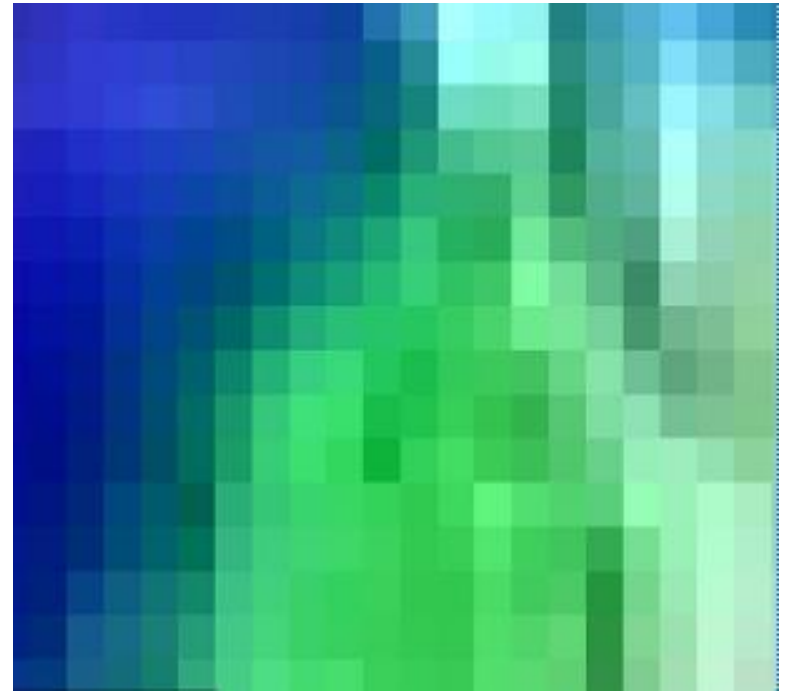
- If you want to display an image in a browser, there are two methods you can use:

1) Bitmap images

2) Vector graphics

Bitmap Images

- Bitmap images look 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



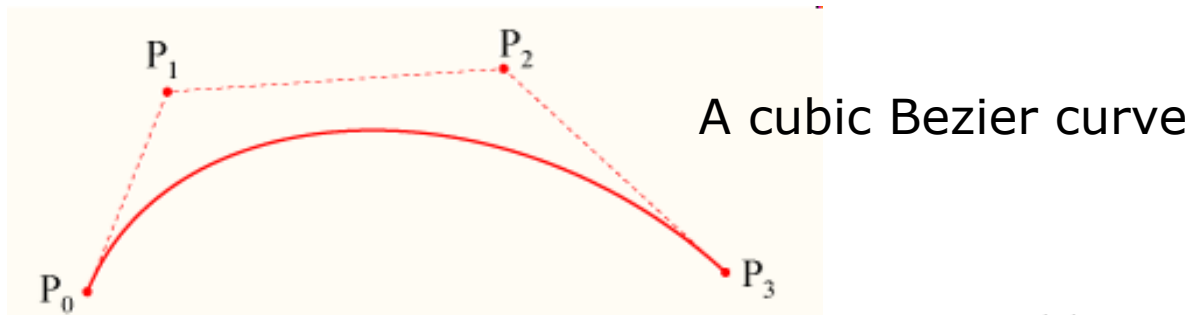
21x16 bitmap represented
as a 21x16 array

Bitmap Images

- The main bitmap image formats are:
 - GIF – **compressed**; old format for images with ≤ 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

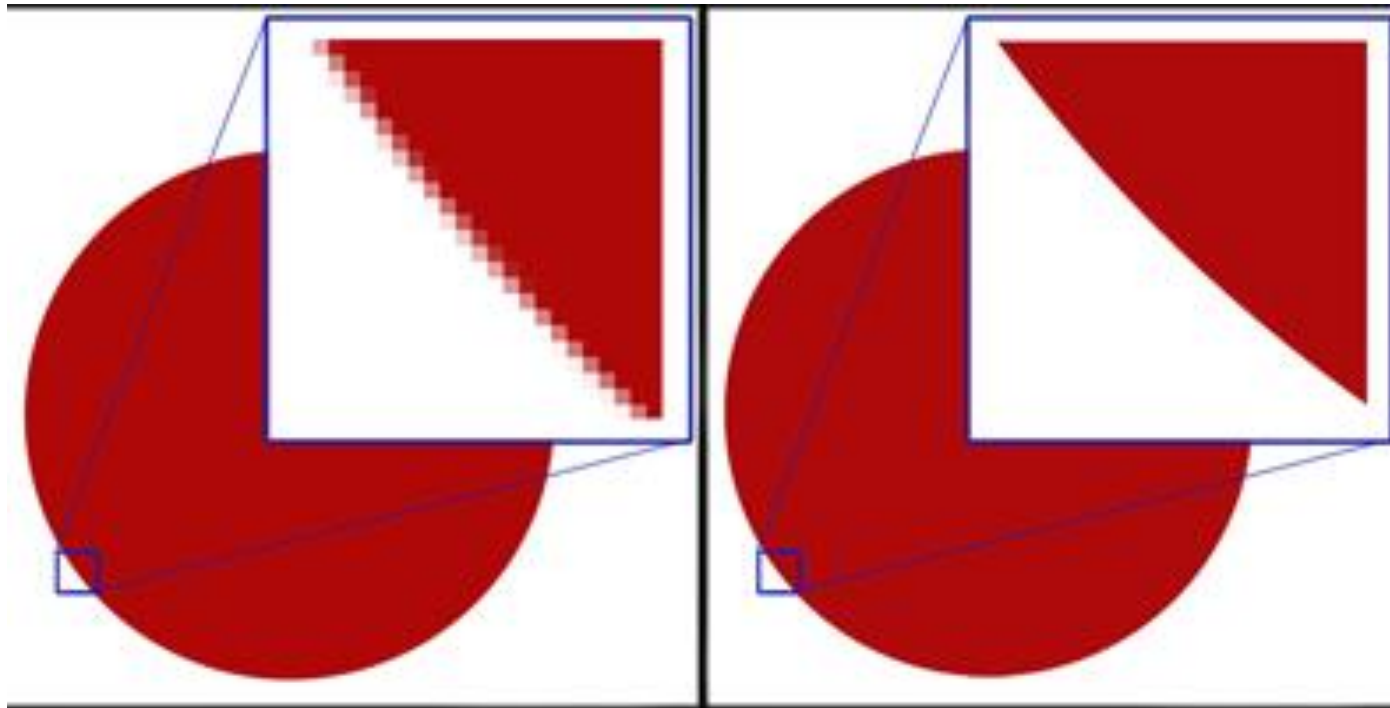
- Every object in vector graphics is mathematically represented
- Get perfect quality even when you zoom in/print
- Everything in the image is 'separated' into objects
 - Change can be applied to specific objects in the image
- Often much smaller file size than bitmap images, so less time to download



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

Comparison

- Bitmap image



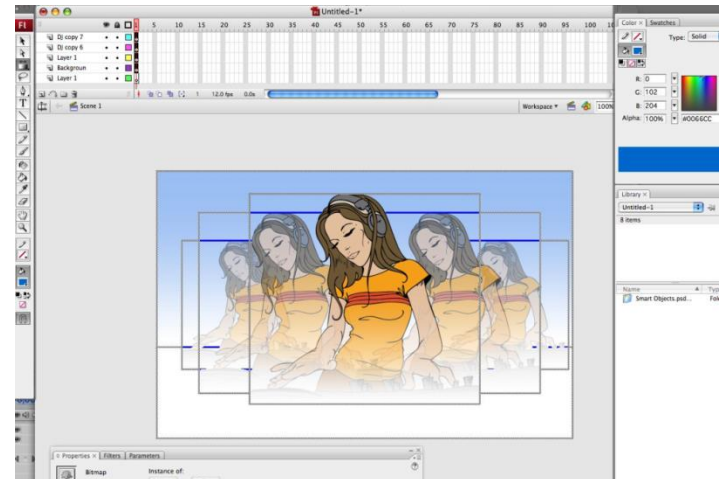
- Vector image

Web Vector Graphics Formats

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

Flash

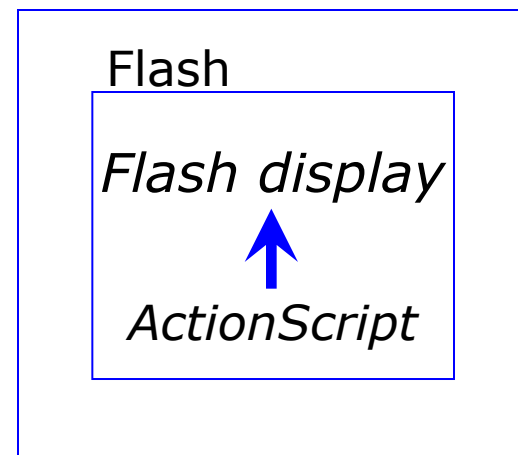
- Flash is a product of Adobe
- While Flash player is free, Flash editor is not
- Need to have a plug-in to play the files – but this is already included in all browsers (except Apple)
- Usually, it is impossible to search the content of a Flash file, because the content is 'hidden' in complex binary 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’ or ‘plugin’ in a web page
 - This is different from SVG and Canvas, which can be more ‘integrated’ with other parts of the web page

Web
page



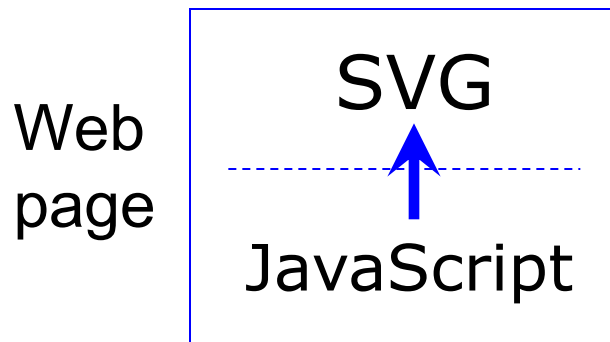
SVG (Scalable Vector Graphic)

- Made by the web open standards organization (W3C)
- Most browsers support SVG, e.g., Firefox, Opera, Chrome, IE, etc.
- SVG files are plain text files, so you can create, read and edit SVG with a plain text editor
 - SVG files can be indexed and searched by search engines
 - For any complex graphics, a rich-text-editor like Inkscape is preferred



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



Canvas

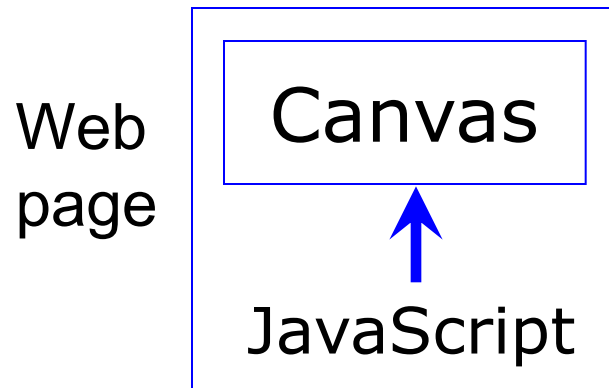
- Part of the HTML 5 standard
- Has the concept of a 2D bitmap area which you can draw things on
- Can change exact (x,y) pixels (cannot be done with SVG)
- However, not everything can be accessed through the DOM

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



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" />`

Take Home Message

- Graphics and images are important for the success and popularity of the web
- Bitmap cannot be easily manipulated (other than bit by bit)
- SVG is part of DOM (discussed later) and each object within an SVG picture can be manipulated (move, change color, etc.)
 - But each object must be manipulated as a whole; cannot change a part of a line to another color unless the 'line' consists of separately defined segments
- Canvas is new in HTML5 and is more efficient to process