SCALABLE VECTOR GRAPHICS

VECTOR GRAPHICS?

- Graphics are described using mathematical/geometrical primitives
  - 2D objects: Lines, curves, circles, rectangles, text
  - or 3D equivalent: meshes, nurbs, spheres, ...
  - Opposition to raster/bitmap images (pixel description)

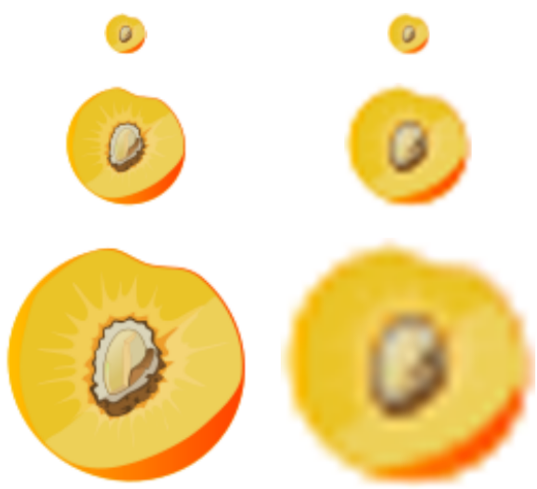
- Rendered into pixels given a resolution
  - Can be scaled without pixel artifacts
  - Client-side rendering vs. server-side rendering
  - Trade-off image quality vs. rendering cost

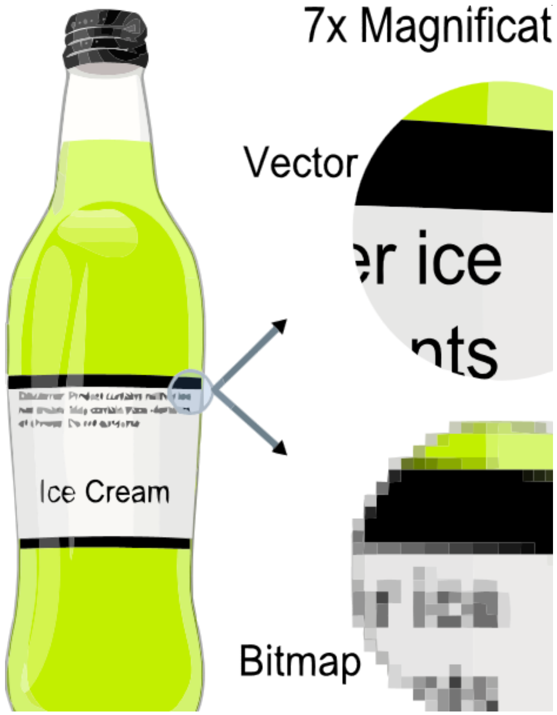
- Formats: SVG, VML, AI, PS, PDF, Flash…

VECTOR GRAPHICS

ZOOMABILITY

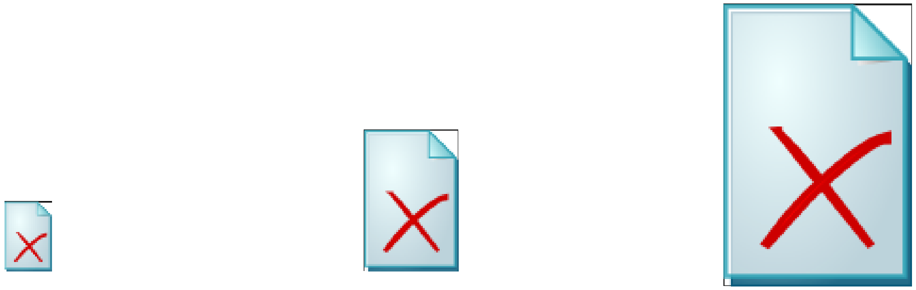
Source: wikipedia.org





VECTOR GRAPHICS

SCALABILITY



				Total
PNG	25x37 / 1,55 Ko	50x75 / 3,89 Ko	100x150 / 9,89 Ko	15,33 Ko
SVG	-	any resolution	-	5,93 Ko
SVGZ	-	any resolution	-	1,54 Ko

SVG

A BIT OF HISTORY

- Initial ecosystem:
  - HTML 4.01: 1999
  - CSS 1.0 (2nd ed.): 1996
  - XML 1.0 (2nd ed.): 1998

- Initial competing technologies: VML (Microsoft) and PGML (Adobe)
- Latest specifications
  - SVG 1.1 (recommendation): http://www.w3.org/TR/SVG

- New ecosystem: tight integration with
  - HTML 5
  - CSS 3
  - SVG 2.0 (draft): http://www.w3.org/TR/SVG2 (https://svgwg.org/svg2-draft/ editor’s draft)

WHAT IS SVG ?

- XML standard for
  - 2D Vector Graphics
    - Including text & fonts
    - With specific drawing, layout, positioning rules
  - With support for:
    - Styling (CSS),
    - Animations (SMIL or JavaScript),
    - Interactivity (DOM Events),
    - Scripting (DOM, JavaScript)
    - Raster images (PNG, JPG)
    - Multimedia (audio, video)
- http://svg-wow.org/

SVG VS. FLASH

- Textual vs. binary
  - Easier to hand write
  - Larger file size if not compressed
  - Easier to search, crawl, index
  - Better Accessibilty
- Native vs. Plugin
  - Ability to translate text in a page
  - Easier to style
  - Easier to script
  - Easier to integrate with HTML

SVG

BENEFITS/DRAWBACKS FROM XML

- SVG documents can be handled by generic XML tools
  - Syntax verification, validation
  - Modification using the DOM
    - More specific manipulations possible using SVG DOM or MicroDOM
  - Transformations using XSLT
  - ...
- Verbose
  - Some attributes were designed to cope with that
  - Compression

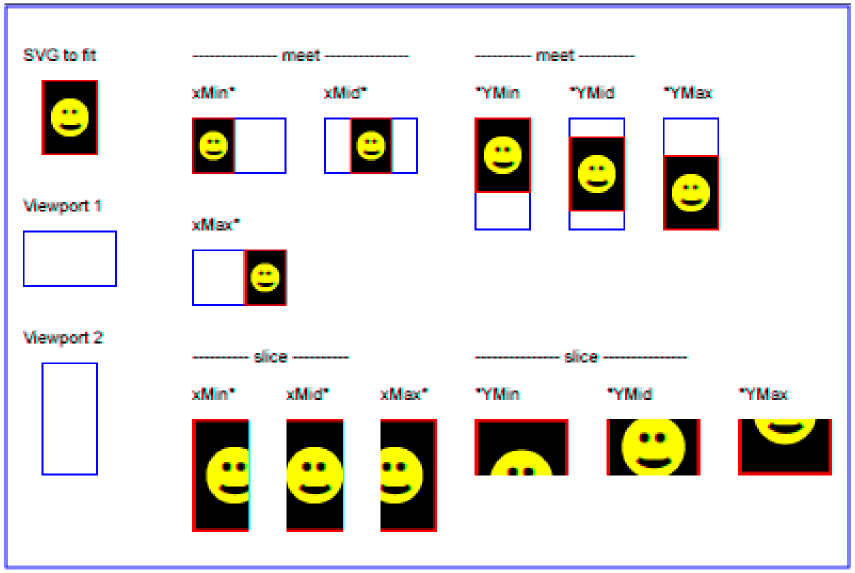
SVG DOM INTERFACES

- Can use generic DOM
- Many additional SVG DOM interfaces
  - Tricky animation value access
- MicroDOM
  - Simplified version of the DOM for SVG Tiny 1.2
  - Less string access, more typed access
  - Element navigation
- SVG 2.0
  - Towards a better DOM but compatible with HTML
  - Inspired from JavaScript libraries

BASICS OF AN SVG DOCUMENT STRUCTURE

- Root <svg> element
  - Defines the namespace http://www.w3.org/2000/svg
- SVG Document tree
  - Dictionary of elements using <defs>
  - Grouping of elements using <g>
- References
  - Across the tree=> graph
  - Across documents (with restrictions: image vs. script)

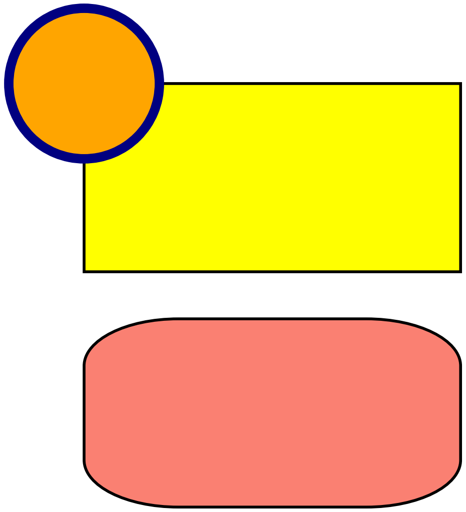
VIEWING SVG GRAPHICS: VOCABULARY


SVG to fit
Viewport 1
Viewport 2
--------------- meet ---------------
xMin*
xMid*
xMax*
---------- meet ----------
*YMin
*YMid
*YMax
---------- slice ----------
xMin*
xMid*
xMax*
--------------- slice ---------------
*YMin
*YMid
*YMax

SVG

BASIC EXAMPLE

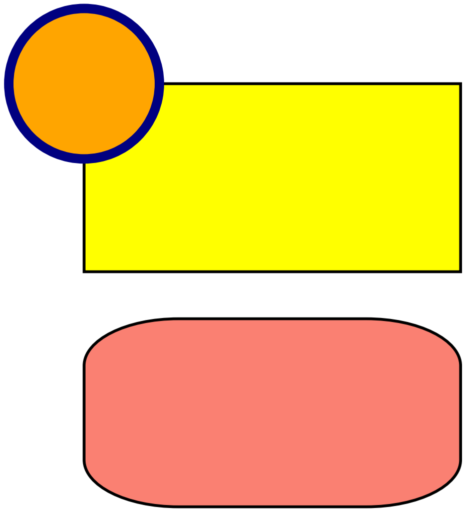
```
<svg xmlns="http://www.w3.org/2000/svg" viewBox="0 0 500 600" version="1.1">
 <rect x="100" y="100" width="400" height="200" fill="yellow" stroke="black" stroke
 <rect x="100" y="350" rx="100" ry="50" width="400" height="200" fill="salmon" stro
 <circle cx="100" cy="100" r="80" fill="orange" stroke="navy" stroke-width="10"/>
</svg>
```



SVG

EXAMPLE WITH GROUP

```
<svg xmlns="http://www.w3.org/2000/svg" viewBox="0 0 500 600" version="1.1">
 <rect x="100" y="100" width="400" height="200" fill="yellow" stroke="black" stroke
 <g>
  <rect x="100" y="350" rx="100" ry="50" width="400" height="200" fill="salmon" str
  <circle cx="100" cy="100" r="80" fill="orange" stroke="navy" stroke-width="10"/>
 </g>
</svg>
```



SVG

THE USE ELEMENT

```
<svg xmlns="http://www.w3.org/2000/svg"
        xmlns:xlink="http://www.w3.org/1999/xlink"
        viewBox="0 0 1000 1000" version="1.1">
 <defs>
  <!-- A circle of radius 200 -->
  <circle id="s1" cx="200" cy="200" r="200" fill="yellow" rx="200" ry="150">
  <ellipse id="s2" cx="200" cy="150" rx="200" ry="150" fill="salmon" stroke="black"
 </defs>
 <use x="100" y="100" xlink:href="#s1"/>
 <use x="100" y="650" xlink:href="#s2"/>
</svg>
```

SVG

STANDALONE VS. EMBEDDED VIEWING

- Standalone viewing
  - Width/height with fixed unit: the player creates a window of that size
  - Width/height relative units (e.g. 100%): the player allocates a size

- Embedded viewing
  - In HTML using CSS
  - The viewport is defined by the CSS Box Model

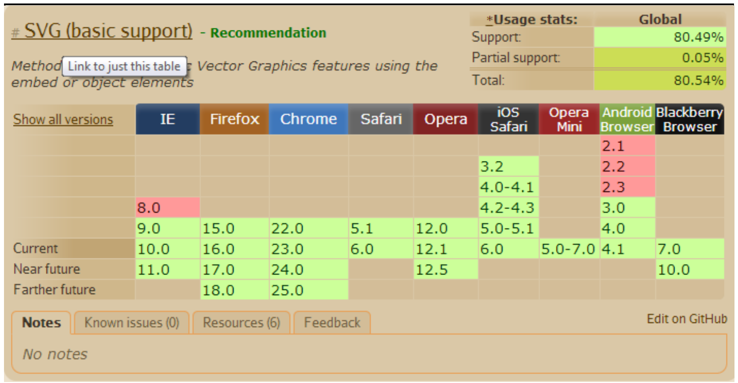
SVG FILES

- Internet Media Type (a.k.a. MIME Type)
  - image/svg+xml
- Extensions:
  - .svg
  - .svgz when compressed using GZIP
  - Possible compression using EXI

SVG

SUPPORT ON THE WEB

- Source: http://caniuse.com (nov. 2012)
- Source: http://mobilehtml5.org/ (nov. 2012)



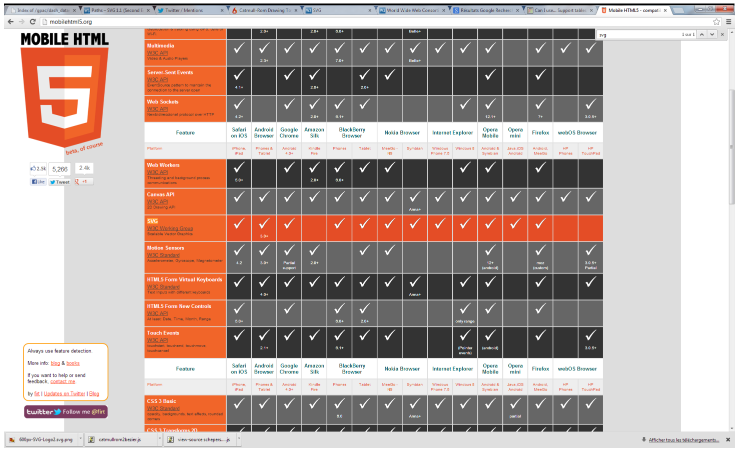
SVG (basic support) - **Recommendation**

Method Link to just this table *Vector Graphics features using the embed or object elements*

*Usage stats:	Global
Support:	80.49%
Partial support:	0.05%
Total:	80.54%

Show all versions	IE	Firefox	Chrome	Safari	Opera	iOS Safari	Opera Mini	Android Browser	Blackberry Browser
								2.1	
						3.2		2.2	
						4.0-4.1		2.3	
	8.0					4.2-4.3		3.0	
	9.0	15.0	22.0	5.1	12.0	5.0-5.1		4.0	
Current	10.0	16.0	23.0	6.0	12.1	6.0	5.0-7.0	4.1	7.0
Near future	11.0	17.0	24.0		12.5				10.0
Farther future		18.0	25.0						

No notes



Feature	Safari on iOS	Android Browser	Google Chrome	Amazon Silk	BlackBerry Browser		Nokia Browser		Internet Explorer		Opera Mobile	Opera mini	Firefox	webOS Browser	
Platform	iPhone, iPad	Phones & Tablet	Android 4.0+	Kindle Fire	Phones	Tablet	MeeGo - N9	Symbian	Windows Phone 7.5	Windows 8	Android & Symbian	Java, iOS Android	Android, MeeGo	HP Phones	HP TouchPad
Wi-Fi.		2.0+		2.0+	6.0+			Belle+							
Multimedia W3C API Video & Audio Players	✓	✓ 2.3+	✓	✓	✓ 7.0+	✓	✓	✓ Belle+	✓	✓	✓		✓	✓	✓
Server-Sent Events W3C API EventSource pattern to maintain the connection to the server open	✓ 4.1+		✓	✓ 2.0+		✓ 2.0+	✓				✓		✓		
Web Sockets W3C API Newbidireccional protocol over HTTP	✓ 4.2+		✓	✓ 2.0+	✓ 6.1+	✓				✓	✓ 12.1+		✓ 7+		✓ 3.0.5+
Feature	Safari on iOS	Android Browser	Google Chrome	Amazon Silk	BlackBerry Browser		Nokia Browser		Internet Explorer		Opera Mobile	Opera mini	Firefox	webOS Browser	
Platform	iPhone, iPad	Phones & Tablet	Android 4.0+	Kindle Fire	Phones	Tablet	MeeGo - N9	Symbian	Windows Phone 7.5	Windows 8	Android & Symbian	Java, iOS Android	Android, MeeGo	HP Phones	HP TouchPad
Web Workers W3C API Threading and background process communications	✓ 5.0+		✓	✓ 2.0+	✓ 6.0+	✓	✓			✓	✓		✓		
Canvas API W3C API 2D Drawing API	✓	✓	✓	✓	✓	✓	✓	✓ Anna+	✓	✓	✓	✓	✓	✓	✓
SVG W3C Working Group Scalable Vector Graphics	✓	✓ 3.0+	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓		
Motion Sensors W3C Standard Accelerometer, Gyroscope, Magnetometer	✓ 4.2	✓ 3.0+	✓ Partial support	✓ 2.0+		✓	✓				✓ 12+ (android)		✓ moz (custom)		✓ 3.0.5+ Partial
HTML5 Form Virtual Keyboards W3C Standard Text inputs with different keyboards	✓	✓ 4.0+	✓	✓	✓	✓	✓	✓ Anna+		✓	✓		✓		✓
HTML5 Form New Controls W3C API At least: Date, Time, Month, Range	✓ 5.0+		✓		✓ 6.0+	✓ 2.0+				✓ only range	✓		✓		
Touch Events W3C API touchstart, touchend, touchmove, touchcancel	✓	✓ 2.1+	✓	✓	✓ 6.1+	✓	✓			✓ (Pointer events)	✓ (android)		✓		✓ 3.0.5+
Feature	Safari on iOS	Android Browser	Google Chrome	Amazon Silk	BlackBerry Browser		Nokia Browser		Internet Explorer		Opera Mobile	Opera mini	Firefox	webOS Browser	
Platform	iPhone, iPad	Phones & Tablet	Android 4.0+	Kindle Fire	Phones	Tablet	MeeGo - N9	Symbian	Windows Phone 7.5	Windows 8	Android & Symbian	Java, iOS Android	Android, MeeGo	HP Phones	HP TouchPad
CSS 3 Basic W3C Standard opacity, backgrounds, text effects, rounded corners	✓	✓	✓	✓	✓ 6.0	✓	✓	✓ Anna+	✓	✓	✓	✓ partial	✓	✓	✓
CSS 3 Transforms 2D															

Always use feature detection.

More info: blog & books

If you want to help or send feedback, contact me.

by firt | Updates on Twitter | Blog

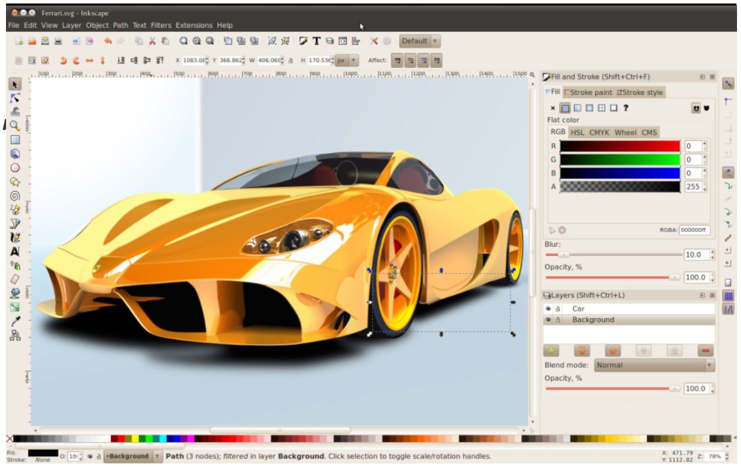
twitter Follow me @firt

OTHER RENDERING ENGINES

- Deprecated IE plugin from Adobe (ASV)
- The Batik SVG Toolkit (Java, Open Source)
- Anti Grain Geometry
- PageFire (Mobile)
- GPAC
- Ikivo ...

AUTHORING TOOLS

- Your favorite text editor!
- Commercial tools
  - Adobe: Illustrator, EdgeCode, Edge Animate, Dreamweaver
  - Microsoft: Visio
  - CorelDraw
- Open Source Software
  - Inkscape (GUI editor, Free, Open Source)
  - SVG Edit (editor in the browser)
- Flash to SVG/HTML5 Converters
  - Google Swiffy
  - Mozilla Shumway
- SVG Cleaners
  - Inkscape: Save as « Plain » or « Optimized » SVG
  - Scripts for cleaning: scour, …



X: 1083.08 Y: 366.862 W: 406.069 H: 170.536 px

R: 0, G: 0, B: 0, A: 255, RGBA: 000000ff

Blur: 10.0

Opacity, %: 100.0

Blend mode: Normal

Opacity, %: 100.0

Fill: Stroke: None O: 100

Path (3 nodes); *filtered* in layer **Background**. Click selection to toggle scale/rotation handles.

X: 471.79 Y: 1112.82 Z: 78%

HTML IN SVG

- Use of SVG `<foreignObject>` element

```
<svg xmlns="http://www.w3.org/2000/svg"
           width="800px" height="600px"
           viewBox="0 0 800 600">
 <foreignObject width="100" height="100">
  <body xmlns="http://www.w3.org/1999/xhtml">
   <p>
     …
   </p>
  </body>
 </foreignObject>
</svg>
```

SVG IN HTML

- Older versions of browsers: `<embed>`, `<object>` or `<iframe>`
- Current version:

```
<html xmlns="http://www.w3.org/1999/xhtml">
 <body>
  <div>
   <svg xmlns="http://www.w3.org/2000/svg"
           width="800px" height="600px" viewBox="0 0 800 600">
     …
   </svg>
   <img src="image.svg"</img>
  </div>
 </body>
</html>
```

- Future versions ?
  - Real mix between element from different namespaces

```
<html:p>some text <svg:circle …/><html:img /> …</html:p>
```

SVG IN CSS

STYLING WITH SVG

Background images

```
element { background-image: url(test.svg); }
```

CSS IN SVG

STYLING SVG

- using `<style>` elements
- using `style` attributes
- using `<?xml-stylesheet?>` PI
- Be careful with inheritance
  - Animations (SMIL sandwich model)
  - Inheritance path and the `<use>` element
    - Extensions in SVG 2.0

SVG INTERACTIVITY

- All versions of SVG support ECMAScript
  - But the associated API differ

- SVG 1.1 uses
  - Traditional DOM APIs: DOM Core, DOM Events, …
  - And a (complex) SVG DOM
  - Uses `onclick`, `onmouseover` …

- SVG Tiny 1.2 uses
  - Typed DOM interfaces called Micro DOM
    - Ex: `setFloatTrait` instead of `setAttribute`

  - XML events: `<listener>`, `<handler>`