

Vektorový formát SVG

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Zobrazování grafiky v HTML5

SVG

- Scalable Vector Graphics
- také pod patronátem W3C

Grafické objekty (primitiva)

- rect, circle, line, ..
- snadno přístupné parametry formou XML atributů

```
<circle cx="250" cy="25" r="25"/>
```

Možnost použití **CSS** pro definici vzhledu (stylu)

```
<circle cx="25" cy="25" r="22" class="pumpkin"/>
```



Standardy – HTML5

HTML5

- mnoho zdrojů pro studium

Minimální platný HTML5 dokument

```
<!DOCTYPE html><title/>x
```

Stručný HTML dokument

```
<!DOCTYPE html>
<html>
  <head>
    <meta charset="utf-8">
    <title>Simple valid HTML5 page</title>
  </head>
  <body>
    <p>Paragraph..</p>
  </body>
</html>
```

Standardy – SVG



Scalable Vector Graphics

- W3C standard, založen na XML
- <http://www.w3.org/Graphics/SVG/>

Stručná HTML5 stránka se SVG grafikou

```
<!DOCTYPE html>
<meta charset="utf-8">
<title>SVG hello</title>
<svg width="800" height="400">
  <text y="12">
    Hello, world!
  </text>
</svg>
```



Standardy – CSS

Cascading Style Sheets

- W3C standard (CSS 2.2)
- <http://dev.w3.org/csswg/css2/>
- nepřidává obsah, pouze definuje styly zobrazení

Stručná HTML5 stránka s CSS stylem

```
<!DOCTYPE html>
<meta charset="utf-8">
<title>CSS hello</title>
<style>
body { background: steelblue; }
</style>
<body>
Hello, world!
</body>
```



SVG tvary

Rectangle <rect>

Circle <circle>, **ellipse** <ellipse>

Line <line>, **polygon** <polygon>, **polyline** <polyline>

Text <text>

Path

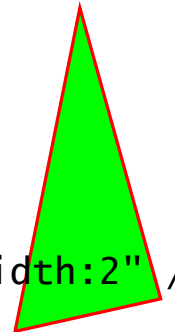
- komplikovanější popis tvaru
- vlastní jednoduchý jazyk
- lomené čáry, splines ...
- vyplnění uzavřené cesty a/nebo obkreslení čarou

SVG samples



```
<svg xmlns="http://www.w3.org/2000/svg" viewBox="0 0 100 100">
  <path d="M30,1h40l29,29v40l-29,29h-40l-29-29v-40z" stroke="#000" fill="none"/>
  <path d="M31,3h38l28,28v38l-28,28h-38l-28-28v-38z" fill="#a23"/>
  <text x="50" y="68" font-size="48" fill="#FFF" text-anchor="middle"><![CDATA[410]]>
</text>
</svg>
```

```
<svg xmlns="http://www.w3.org/2000/svg" height="210" width="500">
  <polygon points="200,10 250,190 160,210" style="fill:lime;stroke:red;stroke-width:2" />
</svg>
```



```
<svg xmlns="http://www.w3.org/2000/svg" height="150" width="500">
  <ellipse cx="240" cy="100" rx="220" ry="30" style="fill:purple" />
  <ellipse cx="220" cy="70" rx="190" ry="20" style="fill:lime" />
  <ellipse cx="210" cy="45" rx="170" ry="15" style="fill:yellow" />
</svg>
```



Rendering model

SVG grafika se kreslí **odzadu-dopředu**

- postupné vykreslování přes sebe
- „malířův algoritmus“

Možnost **poloprůhledné kresby** (alpha-channel)

- attribute **opacity** ('opacity="0.5"')

Vyplňování („fill“) a/nebo **obkreslení („stroke“)**

- style="fill:<color>"
- style="stroke:<color>;stroke-width:<number>"
- ...



SVG shapes I

<rect>

- x, y, width, height, rx, ry

<circle>

- cx, cy, r

<ellipse>

- cx, cy, rx, ry

<line>

- x1, y1, x2, y2



SVG shapes II

<polygon>

- points="100,100 50,100 55,80 ..."

<polyline>

- points

<path>

- d="M 10 10 L 100 100" (MoveTo, LineTo – absolute)
- d="M 10 10 l 90 90" (LineTo – relative)
- d="M 10 10 l 90 90 l -40 10 l -10 -70 z" (ClosePath)

Relative positioning: **lower case letters**



SVG path details

All path elements

- **M** (moveto 'x y'), **L** (lineto 'x y'), **H** (horizontal lineto 'x'), **V** (vertical lineto 'y')
- **C** (curveto 'x1 y1 x2 y2 x y'), **S** (smooth curveto 'x2 y2 x y')
- **Q** (quadratic Bèzier curve 'x1 y1 x y'), **T** (smooth quadratic Bèzier curveto 'x y')
- **A** (elliptical arc 'rx ry x-rot large? sweep? x y'), **Z** (closepath)

Simplifications

- white-space can be omitted, ',' can be used instead of ''
- command letter can be omitted if equal to previous one

`d="M30,1h40l29,29v40l-29,29h-40l-29-29v-40z"`



Grouping <g>

Common attributes

- style, fill, stroke ...

Coordinate transformations

- `<g transform="translate(50,0)"> ... </g>`
- `scale(s)`, `scale(sx,sy)`
- `rotate(angle)`, `rotate(angle,x,y)` [all angles in **degrees**]
- `skewX(angle)` ... `"x += y*tan(angle)"`
- `skewY(angle)`
- `matrix(a,b,c,d,e,f)`
- `transform="scale(1.5),rotate(45),translate(10,0)"`

$$\begin{bmatrix} a & c & e \\ b & d & f \\ 0 & 0 & 1 \end{bmatrix}$$



Links <use>

Shared components, shapes

- define once, use multiple times..

'id' attribute = label

- `<g id="tree" ...> ... </g>`
- `<path id="arrow" d="M0,0l-30-10 ..." ...>`

<use> element = reference

- `<use xlink:href="#tree" transform="translate(20,0)"/>`
- `<use xlink:html="#arrow" opacity="0.8"/>`



Clipping

<clipPath> element

„clip-path“ attribute

... not yet



Text <text>

„font-family“

„font-style“

- normal, italic, oblique

„font-variant“

- normal, small-caps

„font-weight“

- normal, bold, bolder, lighter, 100, 200, 300, 400, 500, 600, 700, 800, 900

```
<text x="50" y="68" font-family="Verdana" font-size="48"
  fill="#FFF" text-anchor="middle">The answer is 42</text>
```



Animation

<animate>

- animation of an attribute value during defined time-interval

<set>

- sets an attribute value at a specific time

Specific subclasses: **<animateTransform>**, **<animateColor>**

Repetitions, animation curves ...

```
<rect x="20" y="10" width="120" height="40" fill="#501080">  
  <animate attributeName="width" from="120" to="40" begin="0s" dur="8s" fill="freeze"/>  
  <animate attributeName="height" from="40" to="82" begin="6s" dur="7s" fill="freeze"/>  
</rect>
```




Resources

SVG homepage

- <https://www.w3.org/Graphics/SVG/>

SVG 2 recommendation

- <https://www.w3.org/TR/SVG/>

David Duce et al.: *SVG Tutorial*

- <https://www.w3.org/2002/Talks/www2002-svgtut-ih/hwtut.pdf>

W3schools: *SVG tutorial*

- https://www.w3schools.com/graphics/svg_intro.asp

Local example page

- <https://cgg.mff.cuni.cz/~pepca/lectures/examples/SVG/>