Visualization on the Web

SVG
SCALABLE VECTOR GRAPHICS

Introducing SVG

- Descriptive tags for images
- Based on vector graphics
- D3.js can manage the creation and modification of tags

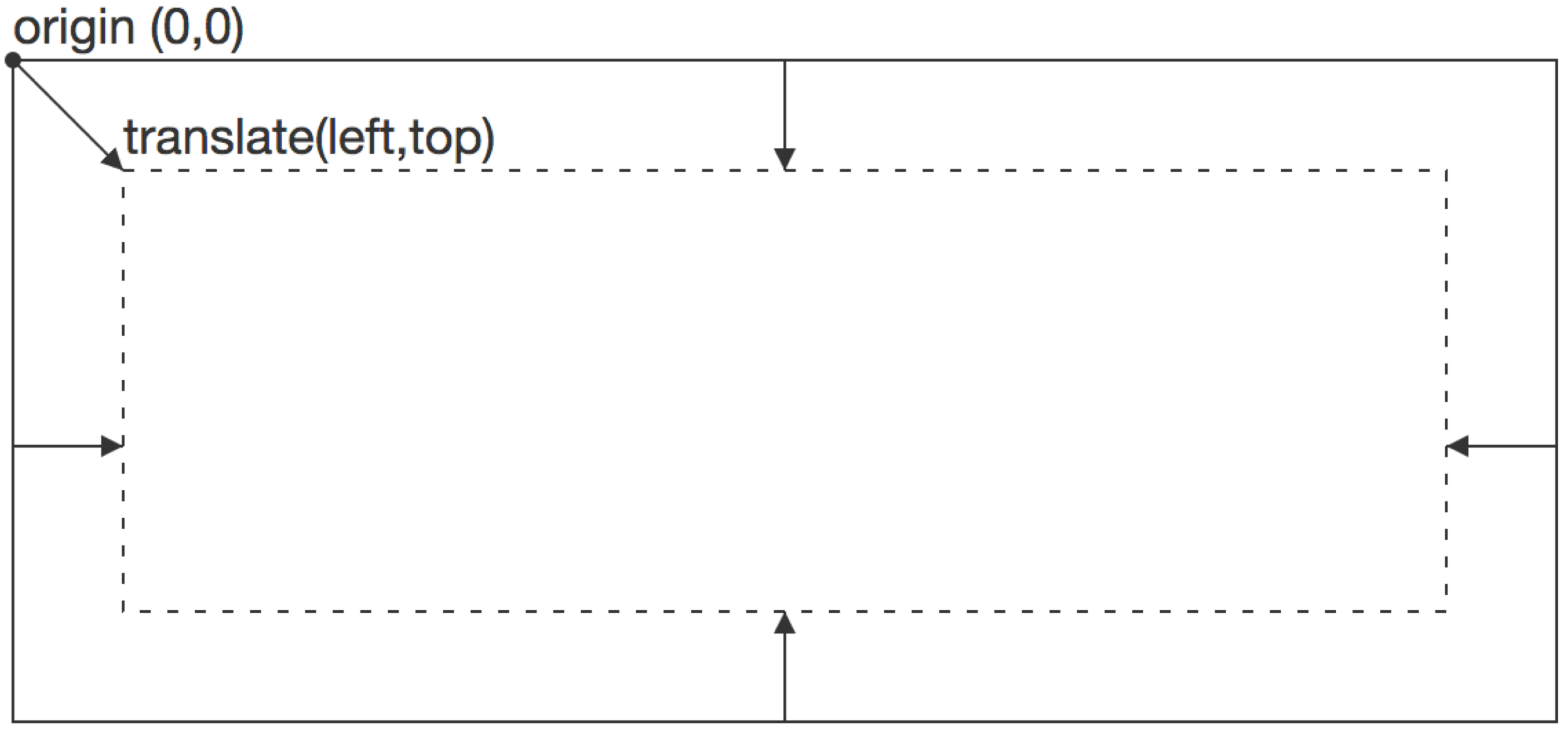
SVG External Resources

- SVG Specification
  - http://www.w3.org/TR/SVG/
- Mozilla Developer Network
  - https://developer.mozilla.org/en/SVG
- D3.js API Reference
  - https://github.com/mbostock/d3/wiki/SVG-Shapes

Hello World Example

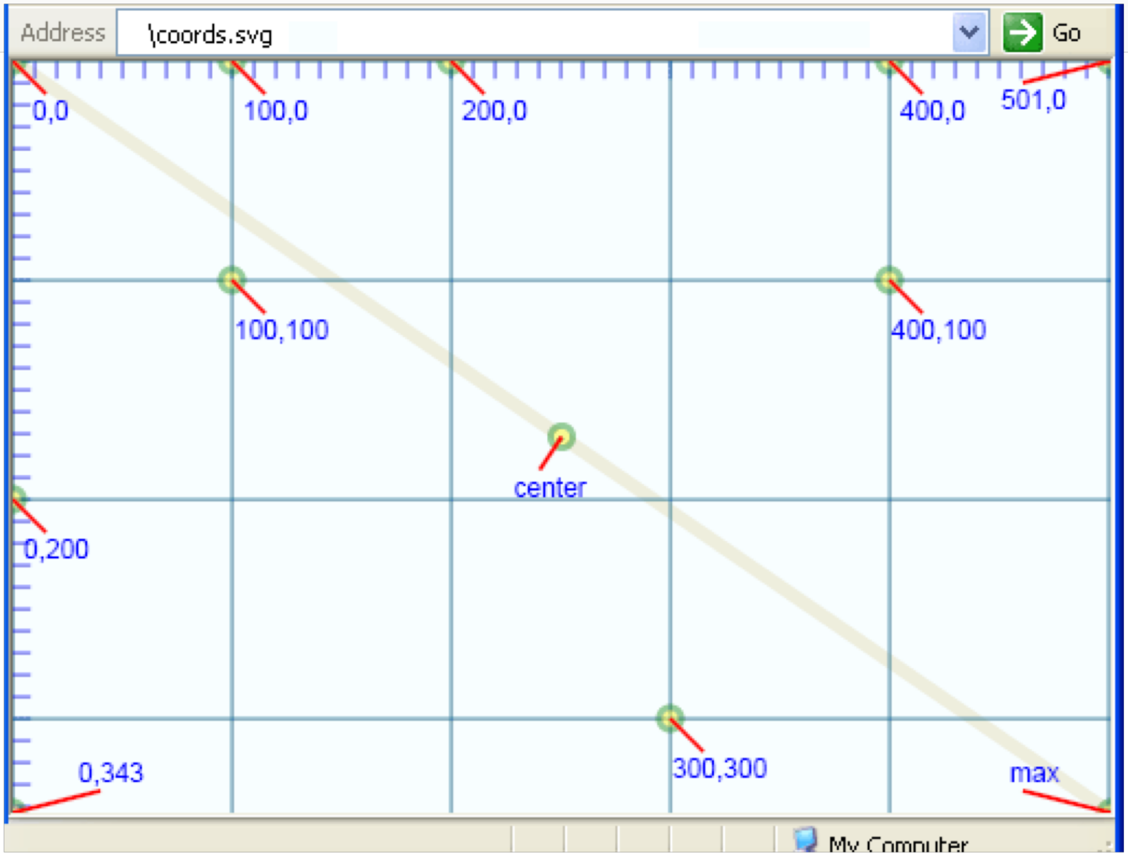
```
<!DOCTYPE html>
<meta charset="utf-8">
<svg width="960" height="500">
  <text y="12">
    Hello, world!
  </text>
</svg>
```

Coordinate System



SVG Viewport

```
<svg width="500" height="300">
    <circle cx="250" cy="150" r="30" fill="red" stroke="black" stroke-width="4px"/>
    <g transform="translate(50,50)">
        <circle r="50px" stroke="red" fill="pink"/>
        <text text-anchor="middle">Label</text>
    </g>
</svg>
```



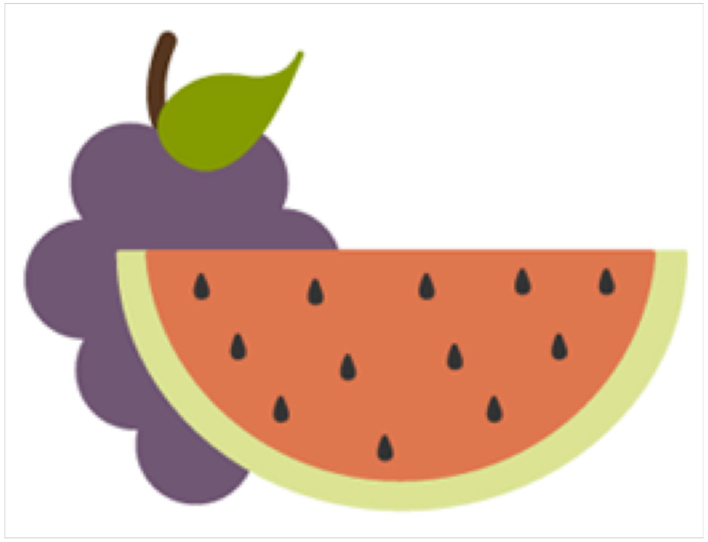
SVG – Construction and Margins

```
var width = 960;
var height = 600;
var margins = {left:10, right:10, top:10,
bottom:10}
var svg = d3.select("body").append("svg")
    .attr("width", width)
    .attr("height", height);

var g = svg.append("g")
    .attr("transform", "translate("
      + margins.left + ","
      + margins.top + ")");
```

Stacking ordering

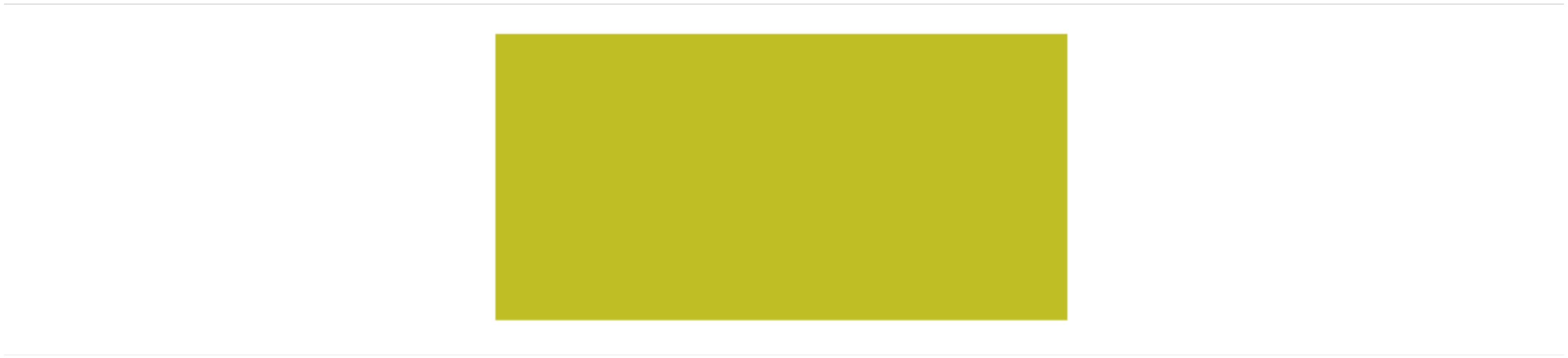
```
<svg>
  <g class="grapes">
    <!--<path <stem path> />-->
    <!--<path <grapes path> />-->
    <!--<path <leaf path> />-->
  </g>
  <g class="watermelon">
    <!--<path <outside path> />-->
    <!--<path <inside path> />-->
    <!--<path <seeds path> />-->
  </g>
</svg>
```



SVG – BASIC SHAPES

Rectangle

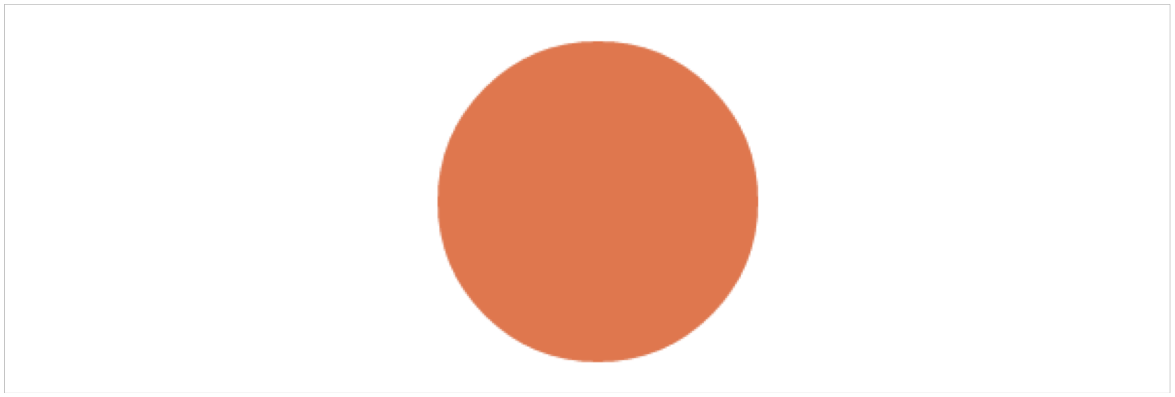
```
<svg>
    <rect width="200" height="100" fill="#BBC42A" />
</svg>
```



http://codepen.io/jonitrythall/pen/525df2422b0ebc54c71a48d27534ea5e

Circle

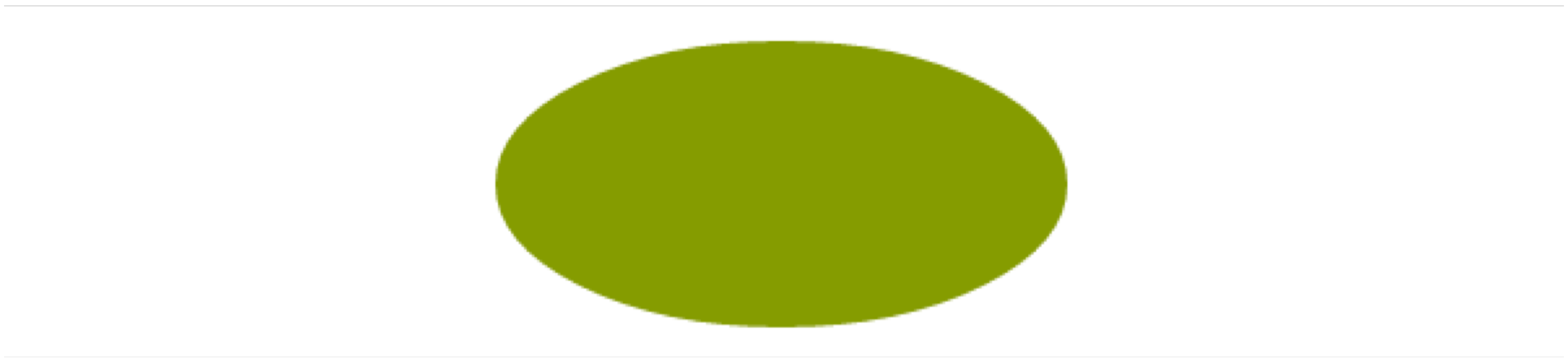
```
<svg>
    <circle cx="75" cy="75" r="75" fill="#ED6E46" />
</svg>
```



http://codepen.io/jonitrythall/pen/088bbada7eed6739d09715666b945141

Ellipse

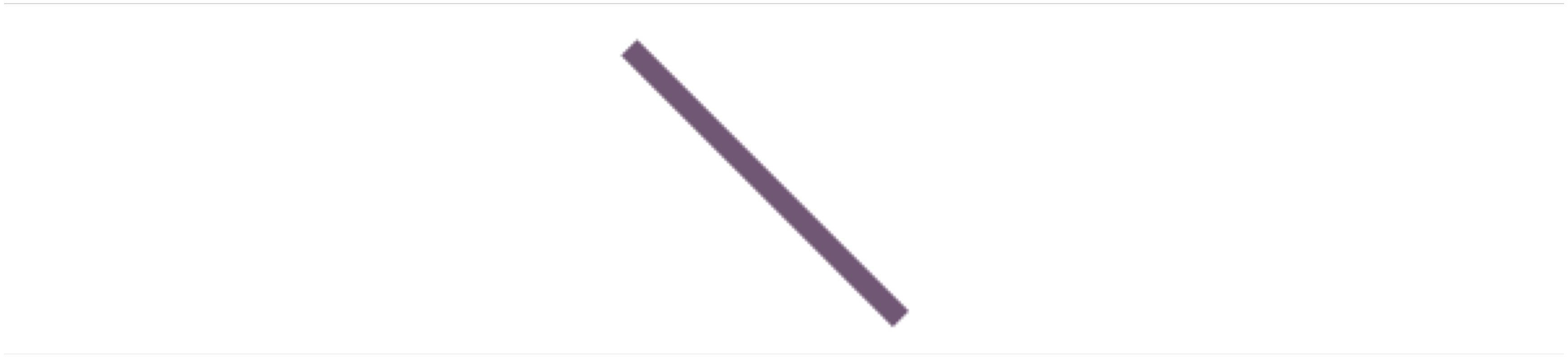
```
<svg>
    <ellipse cx="100" cy="100" rx="100" ry="50"
fill="#7AA20D" />
</svg>
```



http://codepen.io/jonitrythall/pen/8ec26dac6d5b64bc663c03f01c5d60e0

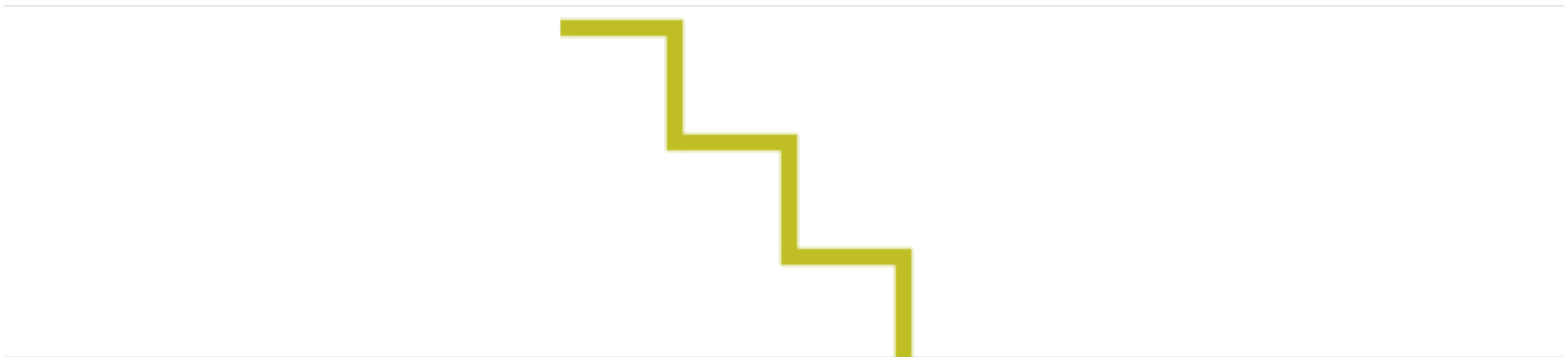
Line

```
<svg>
    <line x1="5" y1="5" x2="100" y2="100"
stroke="#765373" stroke-width="8"/>
</svg>
```



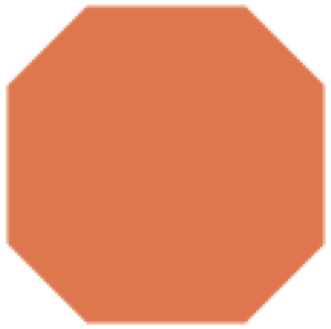
Polyline

```
<svg>
    <polyline points="0,40 40,40 40,80 80,80 80,120 120,120 120,160"
fill="white" stroke="#BBC42A" stroke-width="6" />
</svg>
```



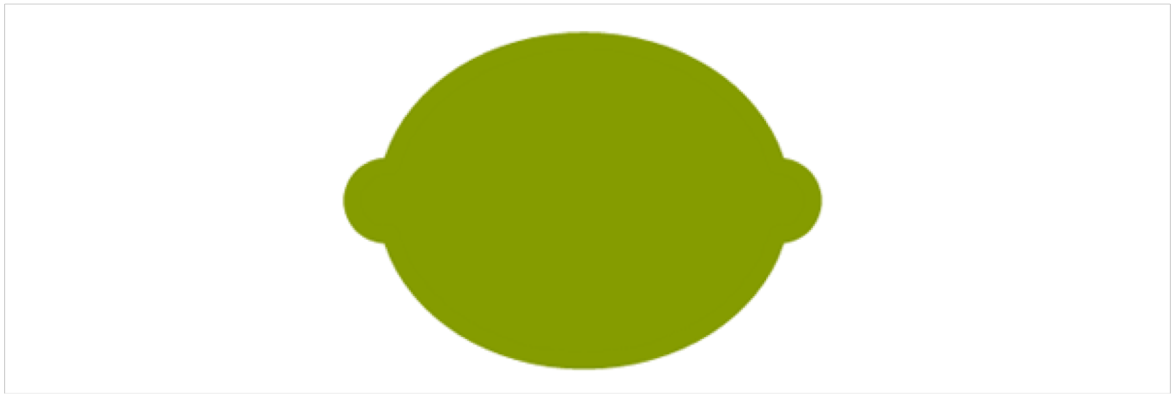
Polygon

```
<svg>
    <polygon points="50,5 100,5 125,30 125,80 100,105
50,105 25,80 25,30" fill="#ED6E46" />
</svg>
```



Path

```
<svg width="258px" height="184px">
    <path fill="#7AA20D" stroke="#7AA20D" stroke-width="9" stroke-
linejoin="round" d="M248.761,92c0,9.801-7.93,17.731-17.71,17.731c-
0.319,0-0.617,0-0.935-0.021c-10.035,37.291-51.174,65.206-100.414,65.206
c-49.261,0-90.443-27.979-100.435-65.334c-0.765,0.106-1.531,0.149-
2.317,0.149c-9.78,0-17.71-7.93-17.71-17.731 c0-9.78,7.93-17.71,17.71-
17.71c0.787,0,1.552,0.042,2.317,0.149C39.238,37.084,80.419,9.083,129.702
,9.083    c49.24,0,90.379,27.937,100.414,65.228h0.021c0.298-0.021,0.617-
0.021,0.914-0.021C240.831,74.29,248.761,82.22,248.761,92z" />
</svg>
```



Path specifications

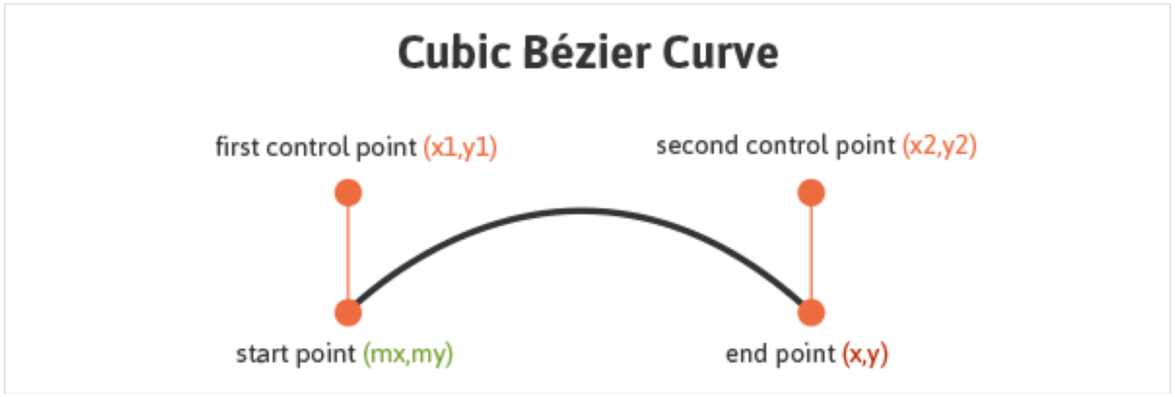
- Definition of a path is done within a path element
  - <path d="{specifics of the path}" />
- The specifics of path are instructions to move a virtual pen over the graphics
  - Move to (M or m). Go to coordinates lifting the pen, without a trace
  - Line to (L or l). Draw a line from the last point to the new coordinates
  - Vertical or Horizontal lines (H or h, V or v). Draw a line parallel to one of the axis
  - Close path (Z or z)

Path commands – Uppercase vs lowercase commands

- An uppercase letter indicates absolute coordinates will follow
- A lowercase letter indicates a relative coordinate

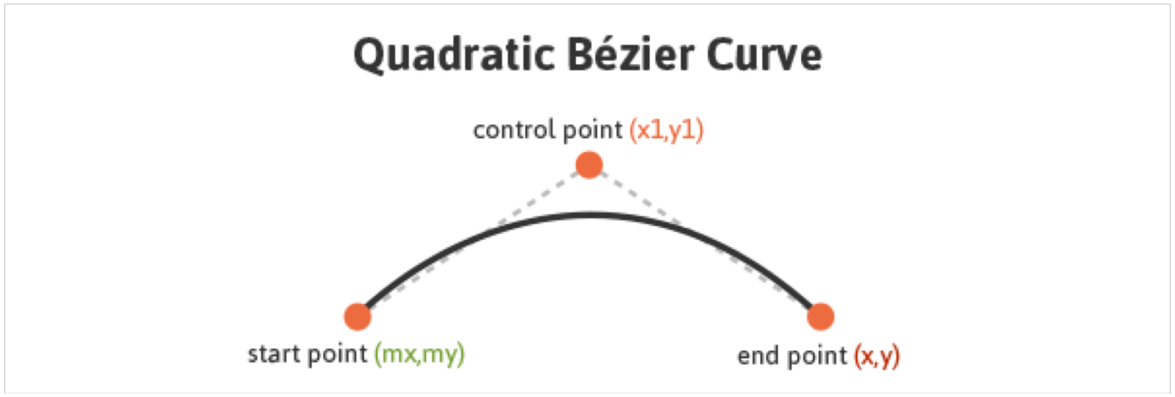
Path – Cubic Bezier

```
<svg>
    <path fill="none" stroke="#333333" stroke-width="3"
d="M10,55 C10,5 100,5 100,55" />
</svg>
```



Path – Quadratic bezier Curve

```
<svg>
    <path fill="none" stroke="#333333" stroke-width="3"
d="M20,50 Q40,5 100,50" />
</svg>
```



Example - Stairways with path

```
<!--
  Stairways example using path
  -->
  <svg width="200" height="200">
    <path d="M0,40 L40,40 L40,80 L80,80 L80,120 L120,120
L120,160" fill="white" stroke="#BBC42A" stroke-width="6" />
  </svg>
```

- Live example at:
- http://jsbin.com/xazajaw/2/edit?html,output

Example - Stairways with path

```
<!--
  Stairways example using path with H and V commands
  -->
  <svg width="200" height="200">
    <path d="M0,40 H40 V80 H80 V120 H120 V160"
fill="white" stroke="#BBC42A" stroke-width="6" />
  </svg>
```

- Live example at:
- http://jsbin.com/xazajaw/2/edit?html,output

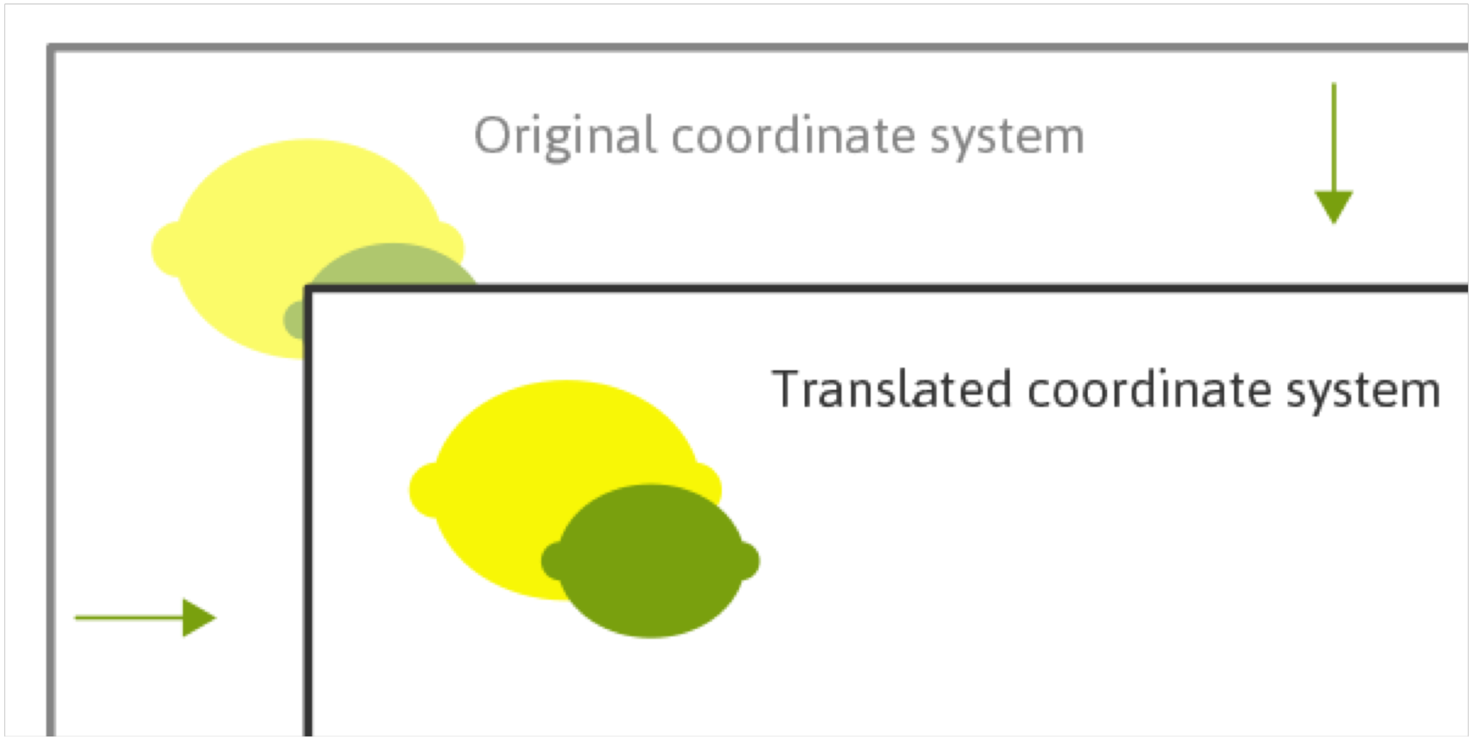
Example - Stairways with path

```
<!--
    Stairways example using path with relative coordinates
(h and v)
  -->
  <svg width="200" height="200">
    <path d="M0,40 h40 v40 h40 v40 h40 v40" fill="white"
stroke="#BBC42A" stroke-width="6" />
  </svg>
```

- Live example at:
- http://jsbin.com/xazajaw/2/edit?html,output

Coordinate System Transform

```
transform="translate(<tx>,<ty>) rotate(<rotation angle>)
```



Transformations

- Translate
  - `transform="translate(<tx>,<ty>)"`
- Rotate
  - `transform="rotate(<rotation angle>)"`
  - `transform=rotate(<rotation angle> [<cx>,<cy>])"`
- Scale
  - `transform="scale(<sx> [<sy>])"`
- Skew
  - `transform="skewX(20)"`

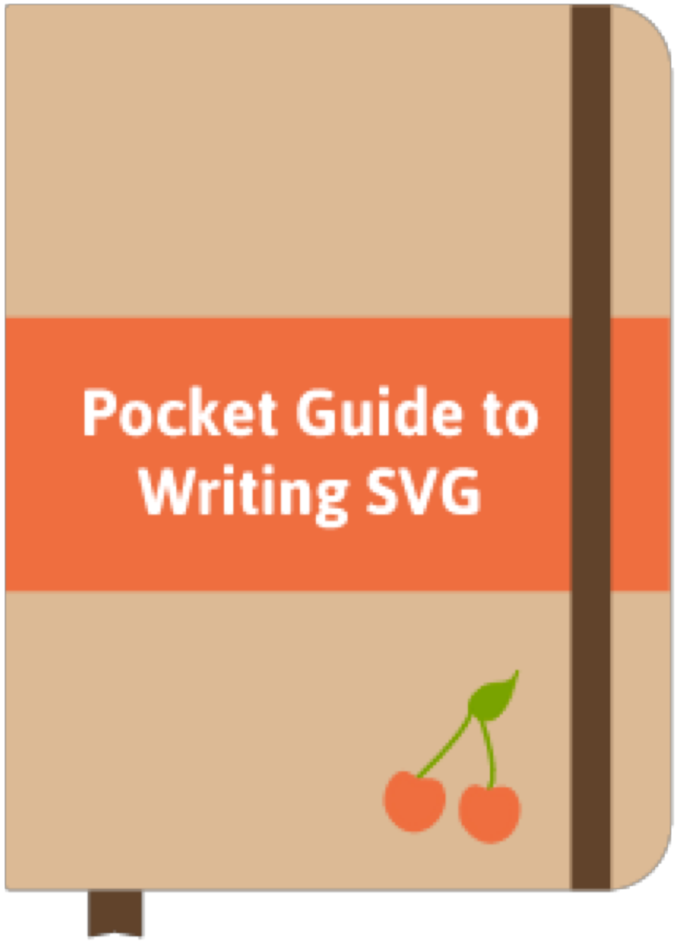
Circle example with translation

```
<!--
    Draw a circle in the center of the element
    using relative coordinates after a translation
  -->
  <svg width="200" height="100">
    <g transform="translate(100,50)">
      <circle r="50"/>
      <circle r="20" style="fill:#fdbb84"/>
    </g>
  </svg>
```

- Live example at:
- http://jsbin.com/kiwukat/2/edit?html,output

Pocket Guide to Writing SVG

http://svgpocketguide.com/book/



CANVAS ELEMENT

Canvas

- A canvas element is a container for raster graphics
- Within the canvas, a context provide the functions to draw visual elements
- Two different context types:
  - “2d”
  - “webgl”

Canvas - Example

```
<p>Before canvas.</p>
<canvas width="120" height="60"></canvas>
<p>After canvas.</p>
<script>
  var canvas =
document.querySelector("canvas");
  var context = canvas.getContext("2d");
  context.fillStyle = "red";
  context.fillRect(10, 10, 100, 50);
</script>
```

Canvas - Path

```
<canvas></canvas>
<script>
  var cx =
document.querySelector("canvas").getContext("2d");
  cx.beginPath();
  for (var y = 10; y < 100; y += 10) {
    cx.moveTo(10, y);
    cx.lineTo(90, y);
  }
  cx.stroke();
</script>
```

Canvas - Curves

```
<canvas></canvas>
<script>
  var cx =
document.querySelector("canvas").getContext("2d");
  cx.beginPath();
  cx.moveTo(10, 90);
  // control=(60,10) goal=(90,90)
  cx.quadraticCurveTo(60, 10, 90, 90);
  cx.lineTo(60, 10);
  cx.closePath();
  cx.stroke();
</script>
```

Canvas - Curves

```
<canvas></canvas>
<script>
  var cx =
document.querySelector("canvas").getContext("2d");
  cx.beginPath();
  cx.moveTo(10, 90);
  // control1=(10,10) control2=(90,10) goal=(50,90)
  cx.bezierCurveTo(10, 10, 90, 10, 50, 90);
  cx.lineTo(90, 10);
  cx.lineTo(10, 10);
  cx.closePath();
  cx.stroke();
</script>
```