Scalable Vector Graphics

CST 205

SVG

- SVG stands for **scalable vector graphics**
    - Describe images in mathematical terms instead of pixels
    - Modern web browsers can natively display SVG
    - Crisp on any display (resolution independent)

Two ways to represent graphics

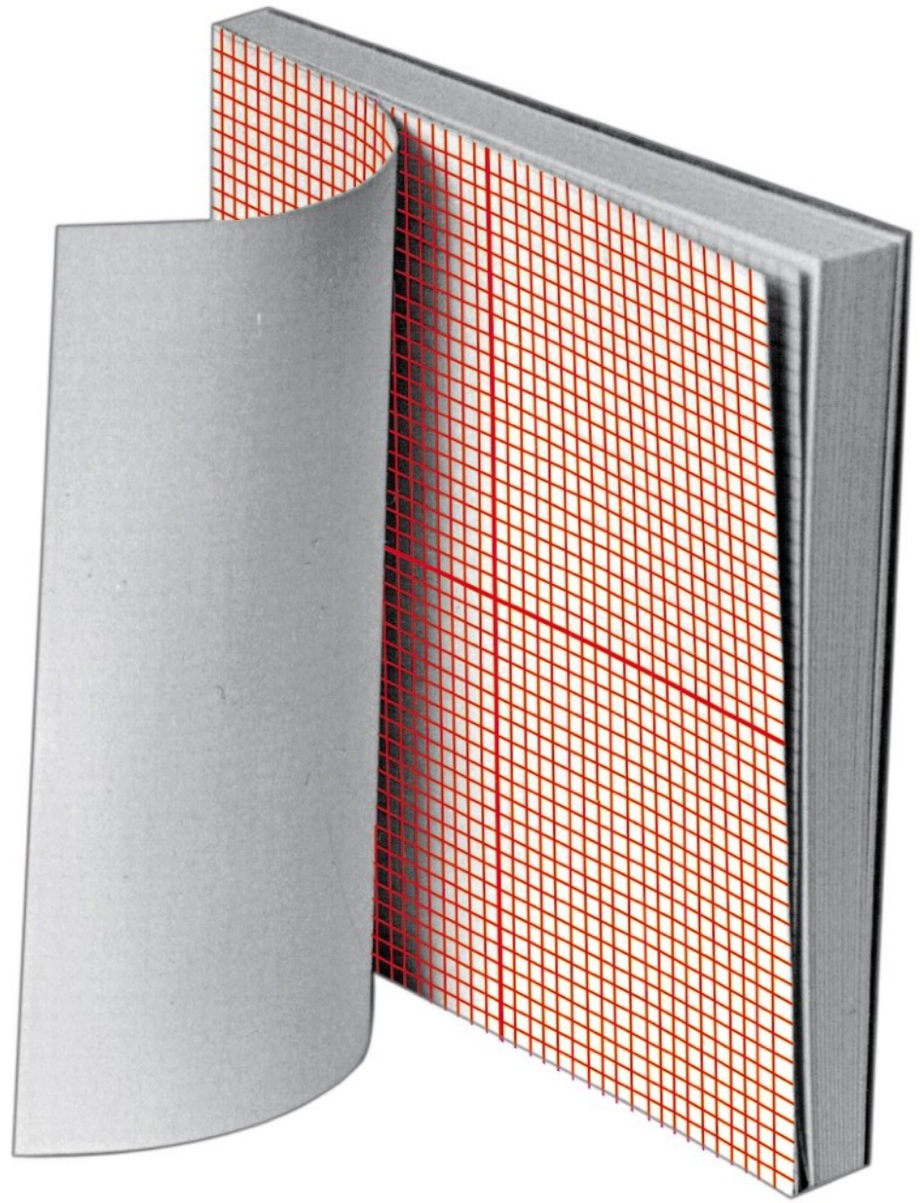
- **Raster** graphics: Rectangular array of pixels. Modern display devices are raster devices.

- **Vector** graphics: Series of geometric shapes. Commands to draw shapes at specified coordinates.

Think of a piece of graph paper

- **Raster** graphics describe which squares should be filled in.

- **Vector** graphics describe the grid points at which lines or curves are to be drawn.



Skeleton of SVG

```
<?xml version="1.0"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 1.1//EN"
  "http://www.w3.org/Graphics/SVG/1.1/DTD/svg11.dtd">

<svg width="140" height="170" version="1.1"
  xmlns="http://www.w3.org/2000/svg">
</svg>
```

Let’s draw a circle

```
<?xml version="1.0"?>
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 1.1//EN"
  "http://www.w3.org/Graphics/SVG/1.1/DTD/svg11.dtd">

<svg width="140" height="170" version="1.1"
  xmlns="http://www.w3.org/2000/svg">

  <title>Circle</title>
  <desc>Just a simple circle</desc>
  <circle cx="70" cy="95" r="50" style="stroke: black; fill: none" />
</svg>
```

The `<path>` element

- All basic shapes are shortcuts for the more general <path> element.
- Say we want to:
  - move to coordinate (75, 90)
  - draw a line to coordinate (65, 90)
  - draw an elliptical arc with x-radius 5 and y-radius 10, ending back at (75, 90)
- Using `<path>`:

```
<path d="M 75 90 L 65 90 A 5 10 0 0 0 75 90"
    style="stroke: black; fill: none" />
```

Bezier curves

- Graceful curves produced by graphic quadratic and cubic equations
- A single quadratic Bezier curve has exactly one peak or valley per curve segment.
- A *quadratic* curve in SVG specifies a beginning point, an end point, and a control point
    - Nice interactive example here
- *Cubic* Bezier curves can have both a peak and a valley in the same segment
    - Nice interactive example here

Lastly…

- Few people will write SVG from scratch
  - Inkscape, Adobe Illustrator
  - Bokeh and d3.js use SVG
- You can use SVG with PyQT5

Extra resources

- Watch a guy basically lose his mind while giving a talk about SVG (minor NSFW language in Russian accent)
    - The “guy” is actually Dmitry Baranovskiy, creator of the amazing Raphael and Snap.svg libraries
- Building Better Interfaces with SVG (link)
- Adobe article on SVG (link)
- Practical SVG book (link)
- Data Visualization with Python and JavaScript (link)