COMP 4021

Internet Computing

# Dynamic SVG

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# Approaches to Dynamic SVG

- SVG can be dynamically changed *while* it is being displayed

- There are two different approaches:
  1) Use SVG commands to make changes:
     - There are SVG commands to make changes (transformations)
     - There are SVG commands to animate changes
     - Works in Chrome, Safari, etc, and also IE
     - Older versions of IE and Firefox may not support SVG animation
  2) Use JavaScript to make change to DOM (SVG is just part of the DOM)
     - Should work in all browsers
     - To be discussed in later presentation

# Transformations (without JavaScript)

- All SVG graphic elements have a "transform" attribute to make changes to the graphic elements
- The transformation commands available are
  - translate
  - rotate
  - scale
  - matrix - can be used to do all of the above operations, individually or all at the same time

# Translate

- **translate( <tx> [<ty>] )** will move the element <tx> units along the x-axis and <ty> units along the y-axis.

```
<image xlink:href="ust.jpg" transform="translate(50,50)"
    x="0" y="0" width="300" height="200"/>
```

trans1_nothing.svg

trans2_translate.svg

# Scale

- **scale( <sx> [<sy>] )** will scale the element by multiplying <sx> and <sy> to the x and y coordinates
  - If <sy> is not given, it is assumed to be the same as <sx>
  - <sx> or <xy> is 0 it means the corresponding dimension has no change in scale
  - Scaling is relative to the origin (0,0)

# Scale

- Shrink the image to one half of its original size

```
<image xlink:href="ust.jpg" transform="scale(0.5 0.5)"
   x="0" y="0" width="300" height="200"/>
```

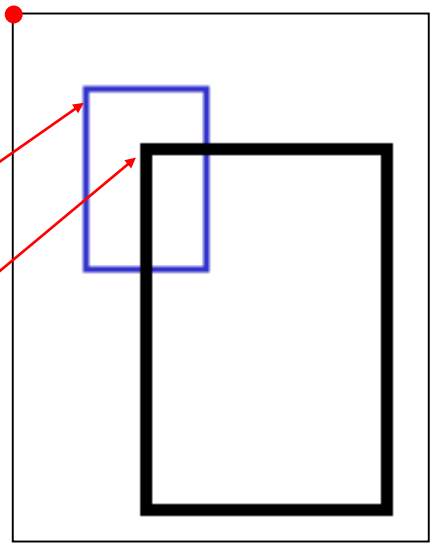
Demo – trans1_nothing.svg

Demo – trans3_scale.svg

# Scale (Cont.)

- Scaling is relative to the origin (0,0)

```
<rect x="10" y="10" width="20" height="30"
    transform="scale(2)" />
```




- To scale using a different center point, translate the element so that the center point becomes (0,0), perform scale, then translate the element back to its original location

# Rotate

- **rotate(<angle>, centre x, centre y)** rotates the element <angle> degrees around the point (centre x, centre y)

```
<image xlink:href="ust.jpg" transform="rotate(30,150,100)"
    x="0" y="0" width="300" height="200"/>
```

Rotate around the center of the photo

trans1_nothing.svg

trans4_combination.svg

# Rotate (Cont.)

- If rotation center is not given, assume the center is 0,0
- The following code has the same effect:

```
<image xlink:href="ust.jpg" transform="
    translate(150 100) rotate(30) translate(-150 -100) "
    x="0" y="0" width="300" height="200"/>
```

# Animation (Without JavaScript)

- So far we have looked at SVG commands to change an SVG element (once)
- But how can we continually apply a change over time, to get some kind of animation effect?
- SVG has commands for this also, called animate/ animateColor/ animateMotion/ animateTransform

# SVG Animation Commands

- animate - for animating any attribute
- animateColor - for animating color attributes only
  - The animate command can also do exactly the same thing that animateColor can do
- animateMotion - for animating any object in a motion path
- animateTransform - for animating any object by changing any transformation (I.e. animating translation/ scale/ rotation/ matrix parameters)

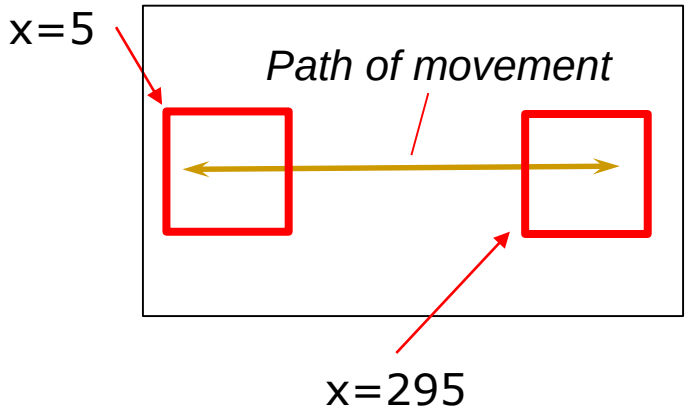
# animate

Anim01_animate.svg

```
<rect x="5" y="150" width="100" height="100" style="fill:none;
    stroke:red; stroke-width:5" >

        <animate attributeName="x" attributeType="XML"
                dur="5s" values="5; 295; 5"
                repeatCount="indefinite"/>

</rect>
```



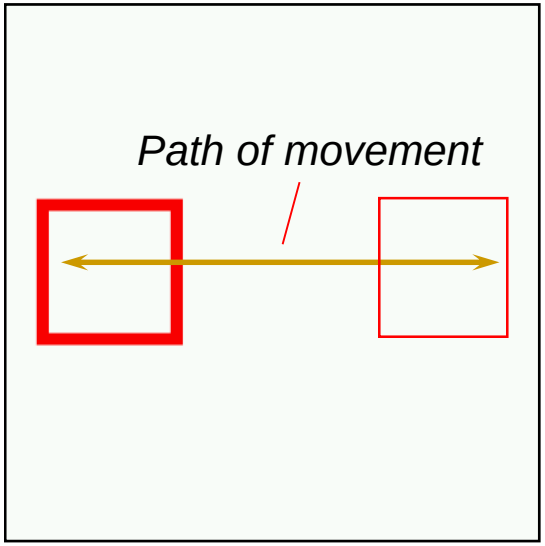

- The x position is changed over a period of five seconds, from x=5 to x=295, and then back to x=5
- Values are interpolated between the three key values : 5, 295, 5

# Animate Two Parameters

Anim02_animate.svg

```
<rect x="5" y="150" width="100" height="100" style="fill:none;
    stroke:red; stroke-width:5" >

    <animate attributeName="x" attributeType="XML"
          dur="5s" values="5; 295; 5“
          repeatCount="indefinite"/>
    <animate attributeName="stroke-width"
          attributeType="CSS" dur="5s"
          values="10; 1; 10"
          repeatCount="indefinite"/>
</rect>
```



# colorAnimate

Anim03_color.svg

```
<rect x="5" y="150" width="100" height="100"
    style="fill:none;stroke:red;stroke-width:5" >

  <animateColor attributeName="fill"
      attributeType="CSS" from="rgb(255,255,255)"
      to="rgb(255,0,0)" begin="0s" dur="5s"
      fill="freeze" />
</rect>
```

- The fill colour is interpolated from white (255,255,255) to red (255,0,0) over five seconds

# colorAnimate

Anim04_color.svg

```
<rect x="5" y="150" width="100" height="100"
    style="fill:none;stroke:red;stroke-width:5" >

  <animateColor attributeName="fill"
      attributeType="CSS"
    values="red;orange;yellow;green;blue;indigo;violet"
      begin="0s" dur="8s" repeatCount="indefinite"/>
</rect>
```

Colour is interpolated between these 7 key values

- The fill colour shows all the colours of the rainbow, in a cycle lasting 8 seconds

# attributeType

- Each node can have a variety of attributes
- Some are from style sheet parameters; there are others such as those added by the programmer (these are called XML attributes)
- So the *attributeType* can be one of
  - "CSS" (if the attribute being controlled is a CSS property)
  - "XML" (if the attribute being controlled is an XML property)
  - or "auto" (this is the best value if you're not sure – the browser will search through all the attributes and use the right one)

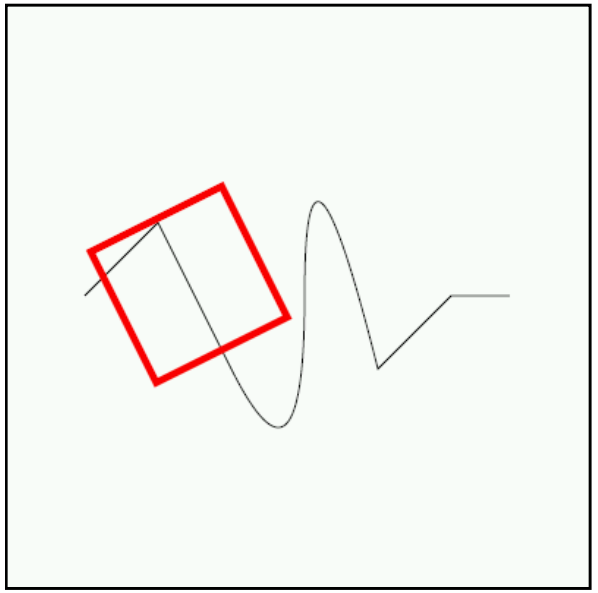
# animateMotion

Anim05_motion.svg

- SVG elements can be animated along a path specified by path data in the <animateMotion> element

```
<rect x="-50" y="-50" width="100" height="100"
    style="fill:none;stroke:red;stroke-width:5" >

    <animateMotion
            path="M55,200 l50,-50 t50,100
            t50,-50 t50,50 l50,-50 L345,200"
            dur="3s" fill="freeze" rotate="auto"/>
</rect>
```



# animateTransform

Anim06_transform.svg

- animateTransform is for animating translation/ rotation/ scaling

```
<g transform="translate(200, 200)">
<rect x="-50" y="-50" width="100" height="100"
    style="fill:none;stroke:red;stroke-width:10">
    <animateTransform type="scale"
    attributeName="transform" attributeType="XML" dur="5s"
    values="1;2;1" repeatCount="indefinite"/>
</rect>  </g>
```

- The rectangle is made larger and smaller in a 5 sec period

# animateTransform

Anim07_transform.svg

```
<g transform="translate(200, 200)">
<rect x="-50" y="-50" width="100" height="100"
    style="fill:none;stroke:red;stroke-width:10">
    <animateTransform type="rotate"
    attributeName="transform" attributeType="XML" dur="5s"
    from="0" to="360" repeatCount="indefinite"/>
</rect>   </g>
```

- The rectangle is constantly rotated

# Take Home Message

- SVG does not just display simple graphics; it can transform and animate graphics
- All of these are done with a markup language, without complex programming
- JavaScript is not an essential requirement although it can further enhance interactivity