Pencil Documentation

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Contents

This documentation is just for stencil developers & Pencil developers at the moment.

There is a github issue for adding user documentation.

CHAPTER 1

Stencil Developer Documentation

Introduction to Pencil Stencils

Overview

Pencil controls shapes in its document by mean of stencils. Each stencil (Rectangle, for example) is indeed a template to generate shapes. Each template defines:

- **The look:** what the generated shape looks like, defined by means of SVG elements.

  For example: the Rectangle stencil defines a shape formed by a single SVG `<rect>` element.

- **The properties:** which properties the shape has plus optional extra constraints on them.

  For example: the Rectangle stencil has a `box` property of type *Dimension*, a `strokeStyle` property of type *StrokeStyle* and a `fillColor` property of type *Color*.

- **The behaviors:** how the shape's look is changed according to changes made to its properties.

  For example: the Rectangle `<rect>` element has its fill and fill-opacity change to the `fillColor` property of the shape.

- **The actions:** which actions that external objects and users can ask the shape to do.

  For example: the Rectangle stencil defines a `Remove border` action to allow users to set the `strokeStyle` width property to 0px and hence makes the `<rect>` element's border disappear.

Stencils are organized into collections. Each collection contains a set of related stencils and can be installed into or uninstalled from Pencil using the collection manager.

The Process of Creating Shapes from Stencils

After being installed into Pencil, a stencil can be used to create shapes by dragging it into the drawing pane of a page. When a stencil is dropped into a page, the following actions will be taken by Pencil to create a shape for that stencil:

1. Creating a shape as an SVG element containing all SVG elements defined in the content section of the stencil definition.
2. Putting the newly-created shape into the page content.
3. Setting initial values for all properties in the shape to the default values as defined in the stencil.
4. Applying all behaviors defined in the stencil to make the shape's look change according to these initial property values.

Manipulating Shapes in the Drawing Page

After being successfully inserted into a page, a shape begins its life in that page. During its life, a shape may have its properties changed by the user. Depending on the type, a property value can be changed in a specific way that is easiest for the user.

Note: Pencil reserves the use of some special property names for pre-defined purposes. Please refer the *Special Property Names* document for detailed information on how these property names can be used in your stencil.

An example of this is that the `box` property of type *Dimension* should always be used to determined the dimension of the outermost box surrounding the shape.

Preparing the Development Environment

This document gives you a quick overview of how the development environment can be set up for developers to start creating stencils.

Creating the skeleton structure

To start a new stencil collection, you need to have a dedicated directory in your local file-system to store all files related to that collection. A minimal collection requires only the Definition.xml file while a more complex collection requires extra files/directories to store icons.

A typical collection structure should be created as shown in the following diagram:

```
[dir] CollectionName
  |
  |__[dir] icons  #optional
  |      |
  |      |__shape1.png
  |
  |__Definition.xml
```

The Definition.xml file should contain the following skeleton code:

```
<Shapes xmlns="http://www.evolus.vn/Namespace/Pencil"
    xmlns:p="http://www.evolus.vn/Namespace/Pencil"
    xmlns:svg="http://www.w3.org/2000/svg"
    xmlns:xlink="http://www.w3.org/1999/xlink"

    id="your_collection_id"
    displayName="Display name of your collection"
    description="Further description of this collection"
```

```
    author="Names of the authors"
    url="Optional URL to the collection's web page">

    <!-- Your shapes go here -->

</Shapes>
```

Development tools

Developing Pencil stencil collections requires no special tools. All that's needed is a text editor and, for distribution, a compatible archiving tool that can create ZIP files.

Although special tools are not required, the following set of software programs may be useful in the stencil creation process.

- **Text editor:** Just about any modern text editor is sufficent for creating stencils. Features such as XML syntax highlighting and completion are useful when editing stencil collections. For GNU/Linux users, gedit is recommended. It should be installed by default in many Gnome-based distributions. For Windows users, Notepad ++ is an awesome selection. For Mac users, the open-source Textmate is strongly recommended.
- **SVG editor:** Inkscape provides powerful tools for creating standards-compliant SVGs. You will need it for all SVG-related work when creating your stencils.
- **Bitmap editor:** You may need a bitmap editor for creating stencil icons or editing bitmaps used in the stencil code. GIMP is highly recommended for all your needs, including all everyday bitmap editing activities, not just for developing stencils.

Installing into Pencil as a developer collection

Pencil provides a convenient way to load and reload a stencil collection that is under development as if it is installed like the others for testing purpose.

To load your collection, go to Tools » Developer Tools » Load Developer Stencil Directory... and select the directory that contains your Definition.xml file. To reload your stencil collection after making changes, simply hit the "F5" key.

Debugging in stencil development

There may be cases where you encounter issues in your stencil JavaScript code that you would like to debug. There is no supported way to set up a interactive debugging session for your stencil code like what you may have with an IDE. The only way to debug your code is to add debugging trace messages. Since stencil JavaScript code is executed in a sand-boxed environment, use of `alert` or file writing is not possible.

For the purpose of debugging, Pencil provides a utility function named stencilDebug for logging a message to the console:

```
stencilDebug("Value of x: " + x);
```

This statement will log the message to the Error Console that can be enabled by launching Pencil via:

```
xulrunner -app "path_to_pencil_application.ini" -jconsole
```

Packaging for distribution

When you're happy with your collection and would like to distribute it to other users, you'll need to create a package by compressing all files in the stencil directory into a single ZIP package. Make sure that the `Definition.xml` file is located at the root level of ZIP file.

Tutorial

Your First Shape

Let's begin with a collection contains a simple shape that provides a *Hello World* text item. This shape contains Property definitions, Element definitions (in the `p:Content` section) and Behaviors(which make the content change according to `Property` values).

```
<?xml version="1.0" encoding="UTF-8"?>
<Shapes xmlns="http://www.evolus.vn/Namespace/Pencil"
    xmlns:p="http://www.evolus.vn/Namespace/Pencil"
    xmlns:svg="http://www.w3.org/2000/svg"
    id="collection" displayName="My Collection"
    description="My First Collection" author="author">

    <Shape id="helloworld" displayName="Hello World"
        icon="Icons/plain-text.png">

        <Properties>
            <PropertyGroup name="Text">
                <Property name="label" displayName="Label"
                    type="PlainText">Hello World</Property>
                <Property name="textColor" displayName="Color"
                    type="Color">#000000ff</Property>
                <Property name="textFont"
                    displayName="Font"
                    type="Font">Arial|normal|normal|13px</Property>
            </PropertyGroup>
        </Properties>

        <Behaviors>
            <For ref="text">
                <TextContent>$label</TextContent>
                    <Fill>$textColor</Fill>
                    <Font>$textFont</Font>
                    <BoxFit>
                        <Arg>new Bound(0, 0, 100, 12)</Arg>
                        <Arg>new Alignment(0, 1)</Arg>
                    </BoxFit>
            </For>
        </Behaviors>

        <p:Content xmlns:p="http://www.evolus.vn/Namespace/Pencil"
            xmlns="http://www.w3.org/2000/svg">
            <text id="text" />
        </p:Content>
    </Shape>
</Shapes>
```

Each child node in <For></For> is a behavior that defines how content should be changed according to the properties. More details about can be found in the *Behavior Reference*.

The $label variable used in the *TextContent* behavior demonstrates how properties can be referenced in the input arguments for behaviors.

Collection Properties

Shapes in a collection tend to have common styles such as the same font, color and stroke style. For the convenience of Stencil authors, Pencil supports grouping styles common to several shapes into collection properties. These collection properties can be used as the default value for a specific stencil's properties. Then, if the collection style is changed, the default property values for shapes will be changed accordingly.

Have a look at this example. Collection properties are defined and then used in shape properties.

```
<Shapes>
    <!-- We define Collection Properties here -->
    <Properties>
        <PropertyGroup name="Text">
            <Property name="defaultTextFont" type="Font" displayName="Default Font">
                Arial|normal|normal|13px
            </Property>
            <Property name="defaultTextColor" type="Color" displayName="Default Text␣
↪Color">
                #000000ff
            </Property>
        </PropertyGroup>
    </Properties>
    <Shape id="helloworld" displayName="Hello World" icon="Icons/plain-text.png">
        <Properties>
            <PropertyGroup name="Text">
                <Property name="label" displayName="Label" type="PlainText">
                    Hello World
                </Property>
                <!-- And use them in actual Property elements here -->
                <Property name="textColor" displayName="Color" type="Color">
                    <E>$$defaultTextColor</E>
                </Property>
                <Property name="textFont" displayName="Font" type="Font">
                    <E>$$defaultTextFont</E>
                </Property>
            </PropertyGroup>
        </Properties>

        <Behaviors>
            <!-- ... -->
        </Behaviors>

        <p:Content xmlns:p="http://www.evolus.vn/Namespace/Pencil"
                   xmlns="http://www.w3.org/2000/svg">
            <text id="text" />
        </p:Content>
    </Shape>
</Shapes>
```

Text content inside the <Property> tag of a stencil is the **literal** presentation of the initial value for that property. In this example you will notice that the content inside that tag is nested in a <E></E> instead. This is the notation

to indicate that the initial value should be obtained by evaluating the *expression* inside the <E> tag. To reference a specific collection property inside this expression, the $$ syntax is used.

Drawing Path - The D Behavior

Pencil shapes are usually created using paths that are based on the SVG Path Specification. Pencil supports drawing shapes using the *D* behavior. This behavior generates the d attribute for the <path> SVG element as defined in the SVG Path Data Specification. The value used in *D* is an array in which each item is a drawing command.

The shape in this tutorial is a triangle drawn from 3 points that are defined by properties of type *Handle*.

```
<Shape id="triangle" displayName="Triangle" icon="Icons/triangle.png">
    <Properties>
        <PropertyGroup>
            <Property name="a" displayName="Point" type="Handle">
                0,0
            </Property>
            <Property name="b" displayName="Point" type="Handle">
                90,0
            </Property>
            <Property name="c" displayName="Point" type="Handle">
                45,60
            </Property>
        </PropertyGroup>
        <PropertyGroup name="Border">
            <Property name="strokeColor" displayName="Line Color" type="Color">
                #1B3280ff
            </Property>
            <Property name="strokeStyle" displayName="Line Style" type="StrokeStyle">
                2|
            </Property>
        </PropertyGroup>
    </Properties>
    <Behaviors>
        <For ref="path">
            <StrokeColor>$strokeColor</StrokeColor>
            <StrokeStyle>$strokeStyle</StrokeStyle>
            <D>[M($a.x, $a.y), L($b.x, $b.y), L($c.x, $c.y), z]</D>
        </For>
    </Behaviors>
    <p:Content xmlns:p="http://www.evolus.vn/Namespace/Pencil"
               xmlns="http://www.w3.org/2000/svg">
        <path id="path" fill="none" style="stroke-linejoin: round;" />
    </p:Content>
</Shape>
```

In the above example, *Handle* properties provide points that can be moved on the drawing canvas. Their values are changed after the move and the behavior code will then be executed to regenerate the path's D value.

You can notice that various SVG Path commands are used in this example(M, L & z). Pencil supports the following SVG Path commands: M, L, l, C, c, S, s, Q, q, T, A, a and z.

In many other situations, paths may not rely solely on the position of handles. A triangle can also be drawn using a bounding box specified by a *Dimension* Property, as shown in the following example:

```
<Shape id="triangle" displayName="Triangle" icon="Icons/triangle .png">
    <Properties>
        <PropertyGroup>
```

```
            <Property name="box" type="Dimension">200,80</Property>
            <Property name="strokeColor" displayName="Line Color" type="Color">
                #1B3280ff
            </Property>
            <Property name="strokeStyle" displayName="Line Style" type="StrokeStyle">
                2|
            </Property>
        </PropertyGroup>
    </Properties>
    <Behaviors>
        <For ref="path">
            <StrokeColor>$strokeColor</StrokeColor>
            <StrokeStyle>$strokeStyle</StrokeStyle>
            <D>[M(0, 0), L($box.w, 0), L($box.w/2, $box.h), z]</D>
        </For>
    </Behaviors>
    <p:Content xmlns:p="http://www.evolus.vn/Namespace/Pencil"
               xmlns="http://www.w3.org/2000/svg">
        <path id="path" fill="none" style="stroke-linejoin: round;" />
    </p:Content>
</Shape>
```

It is very convenient to create shapes with specific points based on handles or the bounding box. The `D` behavior is used heavily in the built-in Flowchart stencil collection.

Add Transparent Background

The two examples above generate unfilled triangles so it is very difficult for users to drag and move the objects on the drawing canvas. The suggested way to avoid this is to create a transparent path as the background below the triangle with a thicker stroke.

```
<Shape>
    <!-- .... -->
    <Behaviors>
        <For ref="bgpath">
            <D>[M($a.x, $a.y), L($b.x, $b.y), L($c.x, $c.y), z]</D>
        </For>
        <For ref="path">
            <!-- ... -->
        </For>
    </Behaviors>
    <p:Content>
        <path id="bgpath" fill="none" style="stroke: rgba(0, 0, 0, 0); stroke-width:␣
↪10px;"/>
        <path id="path" fill="none" style="stroke-linejoin: round;" />
    </p:Content>
</Shape>
```

Drawing Resizeable Shapes - The box Property

In most cases, shapes are expected to be scalable. Pencil uses the *Dimension* property type to set shape size through the *Box* behavior. A *Dimension* property named `box` can be modified by the on-screen geometry editor. Changes to the size of `box` will be applied to the shape's size.

The following example is a resizeable rectangle based on a `$box` property.

```
<Shape id="RoundedRect" displayName="Rectangle" icon="...">
    <Properties>
        <PropertyGroup>
            <Property name="box" type="Dimension">200,80</Property>
        </PropertyGroup>
        <PropertyGroup name="Background">
            <Property name="fillColor" displayName="Background Color" type="Color">
                #4388CCff
            </Property>
        </PropertyGroup>
        <PropertyGroup name="Border">
            <Property name="strokeColor" displayName="Line Color" type="Color">
                #1B3280ff
            </Property>
            <Property name="strokeStyle" displayName="Line Style" type="StrokeStyle">
                2|
            </Property>
        </PropertyGroup>
    </Properties>
    <Behaviors>
        <For ref="rrRect">
            <Box>$box</Box>
            <Fill>$fillColor</Fill>
            <StrokeColor>$strokeColor</StrokeColor>
            <StrokeStyle>$strokeStyle</StrokeStyle>
        </For>
    </Behaviors>
    <p:Content xmlns:p="http://www.evolus.vn/Namespace/Pencil"
               xmlns="http://www.w3.org/2000/svg">
        <rect id="rrRect" x="0" y="0" />
    </p:Content>
</Shape>
```

An SVG rectangle has `width` and `height` attributes. The *Box* behavior will use the input *Dimension* value to change those `width` and `height` attributes. When the user scales the Shape using the on-canvas geometry editor, the behavior will apply the changes to the `<rect>` SVG element.

Add Rounded Corner

SVG rectangles may have rounded corners. Pencil also supports the *Radius* behavior to simplify this. In this example we add a *Handle* property into the Shape and use its value in the *Radius* behavior.

```
<PropertyGroup name="Handles">
    <Property name="radius" displayName="Corner Radius"
              type="Handle" p:lockY="true" p:minX="0" p:maxX="$box.w / 2">0,0</
↪Property>
</PropertyGroup>

<Behaviors>
    <!-- ... -->
    <Radius>
    <Arg>$radius.x</Arg>
    <Arg>$radius.x</Arg>
    </Radius>
    <!-- ... -->
</Behaviors>
```

In previous examples, the *Dimension* property type is used for drawing resizeable shapes via the *Box* behavior. However the *Box* behavior can only be used in cases where the target element supports `width` and `height` attributes. For cases where we want to apply the *Dimension* value to an arbitrary attribute we can use the *Attr* behavior. This approach can be used for all property types, not just *Dimension*.

```
<Shape id="ms-oval" displayName="Oval" icon="Icons/oval.png">
    <Properties>
        <PropertyGroup>
            <Property name="box" displayName="Box" type="Dimension">100,80<Property>
        </PropertyGroup>
        <PropertyGroup name="Background">
            <Property name="fillColor" displayName="Background Color" type="Color">
                #4388CCff
            </Property>
        </PropertyGroup>
        <PropertyGroup name="Border">
            <Property name="strokeColor" displayName="Line Color" type="Color">
                #1B3280ff
            </Property>
            <Property name="strokeStyle" displayName="Line Style" type="StrokeStyle">
                2|
            </Property>
        </PropertyGroup>
    </Properties>
    <Behaviors>
        <For ref="ellipse">
            <StrokeColor>$strokeColor</StrokeColor>
            <StrokeStyle>$strokeStyle</StrokeStyle>
            <Fill>$fillColor</Fill>
            <Attr>
                <Arg>"cx"</Arg>
                <Arg>$box.w / 2</Arg>
            </Attr>
            <Attr>
                <Arg>"cy"</Arg>
                <Arg>$box.h / 2</Arg>
            </Attr>
            <Attr>
                <Arg>"rx"</Arg>
                <Arg>$box.w / 2</Arg>
            </Attr>
            <Attr>
                <Arg>"ry"</Arg>
                <Arg>$box.h / 2</Arg>
            </Attr>
        </For>
    </Behaviors>
    <p:Content xmlns:p="http://www.evolus.vn/Namespace/Pencil"
               xmlns="http://www.w3.org/2000/svg">
        <ellipse id="ellipse" />
    </p:Content>
</Shape>
```

The *Attr* behavior can be used for assigning a value to any attribute of an object. In the first example, the *Attr* behavior could have been used instead of `<Box>$box</Box>` for the rectangle element:

```
<Attr>
    <Arg>"width"</Arg>
```

```
    <Arg>$box.w</Arg>
</Attr>
<Attr>
    <Arg>"height"</Arg>
    <Arg>$box.h</Arg>
</Attr>
```

Drawing Images

A Pencil shape may contain bitmap images. This tutorial will show how to embed an image in a stencil.

Suppose that we have a bitmap image of a hand and we would like to create a stencil of the hand image with an editable name text label.

The first thing you have to do is convert the image into BASE64 format which is supported by Pencil for embedding binary data. There are many ways of converting an image into BASE64; the method shown below is for developers on GNU/Linux systems:

```
$ base64 --wrap=0 hand.png
```

After performing the conversion, you can copy the output and use it in the XML code, as shown below:

```
<Shape id="image" displayName="Image" icon="Icons/image.png">
    <Properties>
        <PropertyGroup>
            <Property name="box" type="Dimension" p:lockRatio="true">
                36,45
            </Property>
        </PropertyGroup>
        <PropertyGroup name="Text">
            <Property name="name" displayName="Name" type="PlainText">
                Hello World
            </Property>
            <Property name="textColor" displayName="Color" type="Color">
                #000000ff
            </Property>
            <Property name="textFont" displayName="Font" type="Font">
                Arial|normal|normal|13px
            </Property>
        </PropertyGroup>
    </Properties>
    <Behaviors>
        <For ref="image">
            <Box>$box</Box>
        </For>
        <For ref="name">
            <TextContent>$name</TextContent>
            <Fill>$textColor</Fill>
            <Font>$textFont</Font>
            <BoxFit>
                <Arg>new Bound(0, $box.h + 13, $box.w, 13)</Arg>
                <Arg>new Alignment(1, 1)</Arg>
            </BoxFit>
```

```
        </For>
    </Behaviors>
    <p:Content xmlns:p="http://www.evolus.vn/Namespace/Pencil"
               xmlns="http://www.w3.org/2000/svg" xmlns:xlink="http://www.w3.org/1999/
↪xlink">
        <image id="image" x="0" y="0" xlink:href="...
↪ (BASE64 content of the image)" />
        <text id="name" />
    </p:Content>
</Shape>
```

Note that the BASE64 content of the image is used here in the form of a Data URL in the `xlink:href` attribute of an SVG image element.

Special Constraints for Dimension and Handle

Sometimes, shapes may have to be created with special features such as scaling with a fixed ratio, having handles move only in one direction or within a limited range. Pencil supports many constraints for Pencil properties.

Dimension

```
<Property name="box" type="Dimension" p:lockRatio="true">36,45</Property>
```

p:lockRatio `$box` size is scaled with a fixed ratio. This means any objects that have their `width` and `height` properties set based on `$box` will be scaled with a fixed ratio too.

p:lockW the box's `width` cannot be scaled.

p:lockH the box's `height` cannot be scaled.

Handle

```
<Property name="width" displayName="Width" type="Handle" p:lockY="true"
          p:minX="10" p:maxX="$box.w" p:disabled="true">100,0</Property>
```

p:lockY only move in a horizontal direction.

p:lockX only move in a vertical direction.

p:minX, p:maxX Restrict the horizontal position to between mixX and maxX (inclusive).

p:minY, p:maxY Restrict the vertical position to between mixY and maxY (inclusive).

p:disabled disable the handle.

Using External SVG

There may be cases where you would like to create a stencil based on an existing SVG vector image. Since the internal format of Pencil shapes is also SVG, it is straight-forward to import an SVG image into a stencil. The general approach to do this is to use your SVG editor to pick up the SVG code of the element you want to import and place that SVG XML code into the stencil's <Content> tag. The recommended SVG editor is Inkscape which is available for many platforms.

Suppose that we have a hand image in SVG format:

And its SVG XML code is the following:

```
<?xml version="1.0" encoding="UTF-8" standalone="no"?>
<svg xmlns:dc="http://purl.org/dc/elements/1.1/" xmlns:cc="http://creativecommons.org/
↪ns#"
     xmlns:rdf="http://www.w3.org/1999/02/22-rdf-syntax-ns#" xmlns:svg="http://www.w3.
↪org/2000/svg"
     xmlns="http://www.w3.org/2000/svg" xmlns:sodipodi="http://sodipodi.sourceforge.
↪net/DTD/sodipodi-0.dtd"
     xmlns:inkscape="http://www.inkscape.org/namespaces/inkscape" inkscape:version="0.
↪48.1"
     width="64" height="64" id="svg2" version="1.1">
    <path d="m 32.3,53.9 c -7.8,0 -15.3,0 -15.3,-21 0,-19 3.5,-15.3 5.1,-13.8 v -3.3␣
↪c 0.2,-2.4 6,-2.2 6,-0.3 v -3 c 0,-3.2 6.7,-2.9 6.7,-0.8 v 4.1 c 0.2,-2.3 5.4,-3.2␣
↪5.6,1.3 0,7 -0.1,14.6 -0.2,16.8 2.7,3 5.7,-11.6 10.9,-9 2.4,2.5 -6.7,19.7 -7.7,21.5␣
↪-1,1.7 -5.2,7.5 -11.1,7.5 z"
          id="path8" inkscape:connector-curvature="0"
          style="fill:#ffffff;stroke:#000000;stroke-width:1;stroke-miterlimit:4;
↪stroke-dasharray:none" />
    <path sodipodi:nodetypes="ccccccccccc" style="fill:none;stroke:#000000"␣
↪inkscape:connector-curvature="0"
          id="path10" d="M 22.025873,18.820772 22.948882,32.71885 M 28.060203,14.
↪888365 29,31 M 34.808683,14.331201 35,32 m 3,5 c 0,0 -5,1 -7,11 M 20,35 c 4,-5 12,-
↪4 17,-3" />
</svg>
```

The primary part of the SVG is the set of two <path> elements. This XML fragment should be copied into the stencil code as in the following code:

```
<Shape id="hand" displayName="Hand" icon="Icons/hand.png">
    <Properties>
        <PropertyGroup>
            <Property name="box" type="Dimension" p:lockRatio="true">
                72,90
            </Property>

            <Property name="fillColor" type="Color" displayName="Background Color">
                #f3f8c5ff
            </Property>
        </PropertyGroup>
        <PropertyGroup name="Border">
            <Property name="strokeColor" displayName="Line Color" type="Color">
                <E>$$strokeColor</E>
            </Property>
            <Property name="strokeStyle" displayName="Line Style" type="StrokeStyle">
                <E>$$strokeStyle</E>
            </Property>
        </PropertyGroup>

        <PropertyGroup name="Text">
            <Property name="name" displayName="Name" type="PlainText">
                Hello World
            </Property>
            <Property name="textColor" displayName="Color" type="Color">
                #000000ff
```

```
            </Property>
            <Property name="textFont" displayName="Font" type="Font">
                Arial,sans-serif|normal|normal|13px
            </Property>
        </PropertyGroup>
    </Properties>
    <Behaviors>
        <For ref="group">
            <Transform>[scale($box.w/36, $box.h/45)]</Transform>
            <StrokeColor>$strokeColor</StrokeColor>
            <StrokeStyle>
                new StrokeStyle($strokeStyle.w / (Math.max($box.w / 36, $box.h / 45)),
↪ $strokeStyle.array);
            </StrokeStyle>
            <Fill>Color.fromString("#00000000")</Fill>
        </For>

        <For ref="hand">
            <Fill>$fillColor</Fill>
        </For>

        <For ref="name">
            <TextContent>$name</TextContent>
            <Fill>$textColor</Fill>
            <Font>$textFont</Font>
            <BoxFit>
                <Arg>new Bound(0, $box.h + 13, $box.w, 13)</Arg>
                <Arg>new Alignment(1, 1)</Arg>
            </BoxFit>
        </For>
    </Behaviors>
    <p:Content xmlns="http://www.w3.org/2000/svg">
        <g id="group">
            <path id="hand" d="m 32.3,53.9 c -7.8,0 -15.3,0 -15.3,-21 0,-19 3.5,-15.3␣
↪5.1,-13.8 v -3.3 c 0.2,-2.4 6,-2.2 6,-0.3 v -3 c 0,-3.2 6.7,-2.9 6.7,-0.8 v 4.1 c 0.
↪2,-2.3 5.4,-3.2 5.6,1.3 0,7 -0.1,14.6 -0.2,16.8 2.7,3 5.7,-11.6 10.9,-9 2.4,2.5 -6.
↪7,19.7 -7.7,21.5 -1,1.7 -5.2,7.5 -11.1,7.5 z"
            <path d="M 22.025873,18.820772 22.948882,32.71885 M 28.060203,14.888365␣
↪29,31 M 34.808683,14.331201 35,32 m 3,5 c 0,0 -5,1 -7,11 M 20,35 c 4,-5 12,-4 17,-3
↪" />
        </g>

        <text id="name" />
    </p:Content>
</Shape>
```

The stencil will contain only the SVG content copied from the original hand image. This hand can be scaled with a fixed ratio and a fixed stroke-width now.

Maintaining a Fixed Stroke Width

Please note that without any special handling, when an SVG element is scaled with *Transform* behavior, the stroke width will be also scaled accordingly. If we would like to have the hand scaled while the stroke width is unchanged, the way to do it is as in the above example: recalculating the width using the scale ratio:

```
<StrokeStyle>
    new StrokeStyle($strokeStyle.w / (Math.max($box.w / 36, $box.h / 45)),
↪$strokeStyle.array);
```

```
</StrokeStyle>
```

Grouping SVG elements

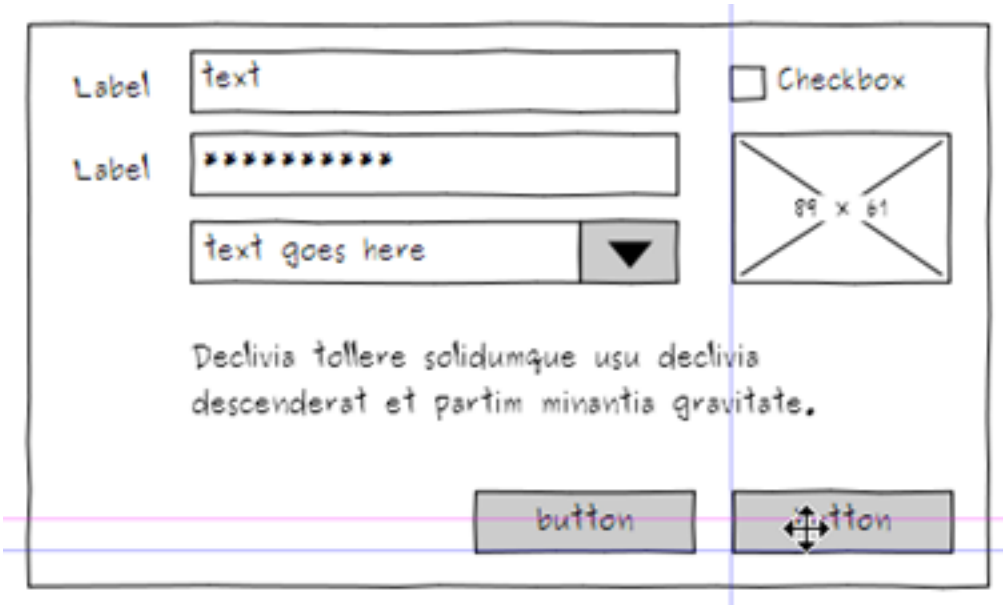
Many of the SVG attributes are inherited by children nodes from their parent node. In this example, the two <path> elements are grouped in a <g> parent node so that common behaviors can be applied to just this parent node. By grouping, all the *Fill*, *StrokeStyle*, *StrokeColor* and *Transform* behaviors will be applied to both the paths.

In case one or more children need to have special treatments, you can always assign them an `id` and declare separate behaviors for it:

```
<For ref="hand">
    <Fill>$fillColor</Fill>
</For>
```

Drawing Sketchy Lines

Users may want to work with sketchy shapes to create draft notes. So Pencil supports drawing sketchy lines in addition to providing a stencil collection that contains many basic sketchy shapes.



This example shows how to create a simple sketchy shape from sketchy lines:

```
<Shape id="sketchyShape" displayName="Sketchy Shape" icon="Icons/sketchyShape.png">
    <Properties>
        ...
    </Properties>
    <Behaviors>
        <For ref="text">
            <TextContent>
                new PlainText(Math.round($box.w) +" x "+Math.round($box.h))
            </TextContent>
            <Font>$textFont</Font>
            <Color>$textColor</Color>
            <BoxFit>
```

```
                <Arg>Bound.fromBox($box)</Arg>
                <Arg>$textAlign</Arg>
            </BoxFit>
        </For>
        <For ref="line1">
            <D>
                [
                    sk(0, 0, $box.w, 0),
                    skTo($box.w, $box.h),
                    skTo(0, $box.h),
                    skTo(0, 0),
                    z,
                    sk(3, 3, $box.w - 3, $box.h - 3),
                    sk(3, $box.h - 3, $box.w - 3, 3),
                ]
            </D>
            <Fill>$fillColor</Fill>
            <StrokeColor>$strokeColor</StrokeColor>
            <StrokeStyle>$strokeStyle</StrokeStyle>
        </For>
        <For ref="mask">
            <Fill>$fillColor</Fill>
            <D>
                var length = $box.w - 5;
                var height = $textFont.getPixelHeight();
                [
                    M($box.w/2 - length / 2, $box.h/2 - height / 2),
                    L($box.w/2 + length / 2, $box.h/2 - height / 2),
                    L($box.w/2 + length / 2, $box.h/2 + height / 2),
                    L($box.w/2 - length / 2, $box.h/2 + height / 2),
                    z
                ]
            </D>
        </For>
    </Behaviors>
    <p:Content xmlns:p="http://www.evolus.vn/Namespace/Pencil"
               xmlns="http://www.w3.org/2000/svg">
        <path id="line1" style="stroke-linejoin: round;" />
        <path id="mask" style="fill:white;stroke:none" />
        <text id="text" />
    </p:Content>
</Shape>
```

In fact, drawing sketchy lines is the same as drawing normal lines. Simply use `sk(x, y), skTo(x, y)` instead of `M(x, y), L(x, y)` to create sketchy shapes.

Actions

There are cases where you may want to provide users with a way to quickly change a shape's properties in a particular way. For example, changing the width and height of a rectangle to the same value, changing the border color of a shape to a color with the same hue as the background but darker, etc. The traditional way is for users to do the calculation themselves and change each of the properties to the desired value.

Pencil introduces the `Action` tag, in which stencil developers can define a routine that performs calculations and makes changes to a shape's properties.

The following example show how an Action is defined to let users quickly change the rectangle to a square:

```
<Shape id="RoundedRect" displayName="Rectangle" icon="...">
    <Properties>
        ...
    </Properties>
    <Behaviors>
        ...
    </Behaviors>
    <Actions>
        <Action id="makeSquares" displayName="Make Squared">
            <Impl>
                var box = this.getProperty("box");
                box.w = Math.max(box.w, box.h);
                box.h = box.w;
                this.setProperty("box", box);
            </Impl>
        </Action>
    </Actions>
    <p:Content xmlns:p="http://www.evolus.vn/Namespace/Pencil"
        xmlns="http://www.w3.org/2000/svg">
        <rect id="rrRect" x="0" y="0" />
    </p:Content>
</Shape>
```

In the `<Action>`, the shape's properties are modified and will be applied immediately to objects that refer to these properties. The above code is simple: `box.h` is forced to equal `box.w` resulting in the rectangle becoming a square.

Note: In the context of action execution, the keyword `this` is bound to the shape itself so that you can retrieve and set the property values via it.

Object Snapping

Pencil users will know that Pencil provides snapping between objects. Object snapping is very useful for aligning objects so that drawing operations can be done quickly. There are 6 default snappings in Pencil:

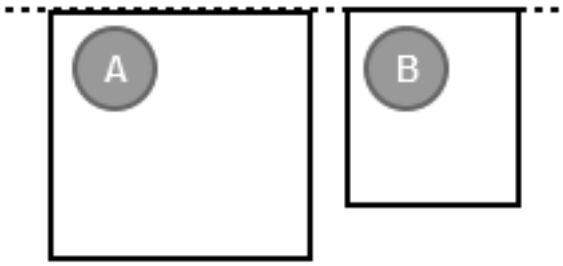


Fig. 1.1: Top-to-Top

Sometimes the snapping needs to be customized for specific purposes. This tutorial will show how to create new custom snappings. These definitions are put into an `<Action></Action>` which must have the exact id of `getSnappingGuide`.

```
<Shape id="RoundedRect" displayName="Rectangle" icon="Icons/rectangle.png">
    <Properties>
        ...
```

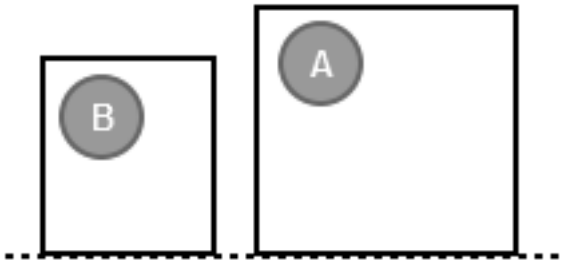


Fig. 1.2: Bottom-to-Bottom

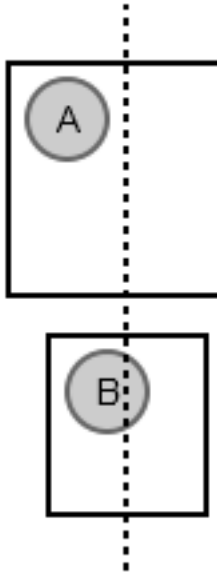


Fig. 1.3: Center-to-Center (horizontal)

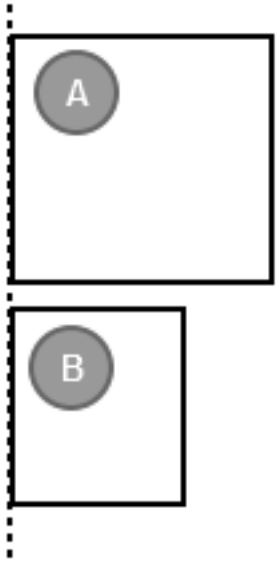


Fig. 1.4: Left-to-Left

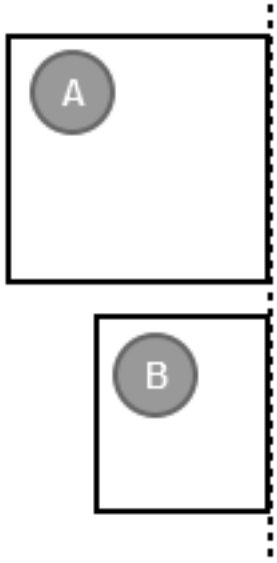


Fig. 1.5: Right-to-Right

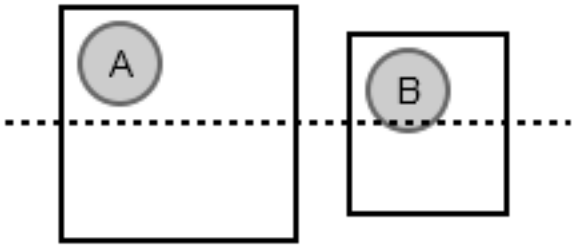


Fig. 1.6: Middle-to-Middle (vertical)

```
    </Properties>
    <Behaviors>
        ...
    </Behaviors>
    <Actions>
        <Action id="getSnappingGuide">
            <Impl>
                var b = this.getBounding();
                return [
                    new SnappingData("FrameTop", b.y + b.height/2, "TabBottom", false,
↪ this.id),
                    new SnappingData("Top", b.y + b.height, "Top", false, this.id),
                    new SnappingData("Bottom", b.y, "Bottom", false, this.id),
                    new SnappingData("Left", b.x + b.width, "Left", true, this.id),
                    new SnappingData("Right", b.x, "Right", true, this.id)
                ];
            </Impl>
        </Action>
    </Actions>
    <p:Content xmlns:p="http://www.evolus.vn/Namespace/Pencil"
               xmlns="http://www.w3.org/2000/svg">
        <rect id="rrRect" x="0" y="0" />
    </p:Content>
</Shape>
```

The `getSnappingGuide` action is expected to return an array of snapping hints. Each snapping hint is composed of an object of type SnappingData:

```
new SnappingData(snappingName, position, toSnappingName, isHorizontalSnapping, this.
↪id)
```

Where:

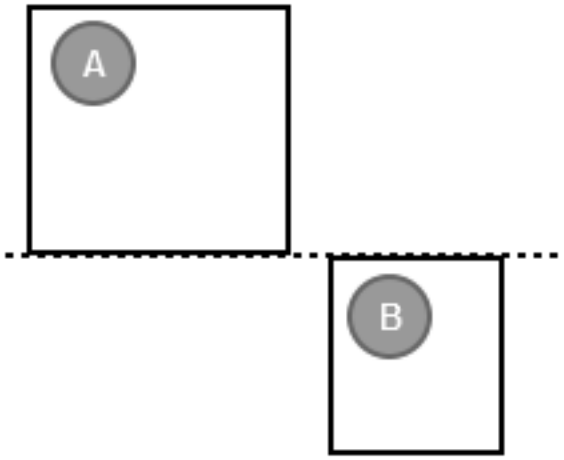
- **snappingName:** is the name of this snapping hint.
- **position:** is the position in this shape when the snapping hint is defined (vertical or horizontal).
- **toSnappingName:** is the Snapping name of other hints that can be snapped to this hint.
- **isHorizontalSnapping:** if true, the snapping will be in the Horizontal direction.

Built-in snapping data: by default, even if you don't provide snapping definitions, Pencil has the following snapping data defined for all objects:

```
new SnappingData("Top", b.y, "Top", false, this.id),
new SnappingData("Bottom", b.y + b.height, "Bottom", false, this.id),
new SnappingData("HCenter", b.y + b.height / 2, "HCenter", false, this.id),
new SnappingData("Left", b.x, "Left", true, this.id),
new SnappingData("Right", b.x + b.width, "Right", true, this.id),
new SnappingData("VCenter", b.x + b.width / 2, "VCenter", true, this.id),
```

where `b` is the object bounds, `b.y` is the object's top position, `b.x` is the object's left position, `b.height` is the object bound height, `b.width` is the object bound width.

In the above example for the `Rectangle` shape, four default snappings are modified and a new snapping is created.



In the above example, **A**'s `Top` snapping was modified by `new SnappingData("Top", b.y + b.height, "Top", false, this.id),`. So other objects that have `Top` snapping will snap to **A**'s new Top. The logic for Bottom, Left, Right snappings are the same.

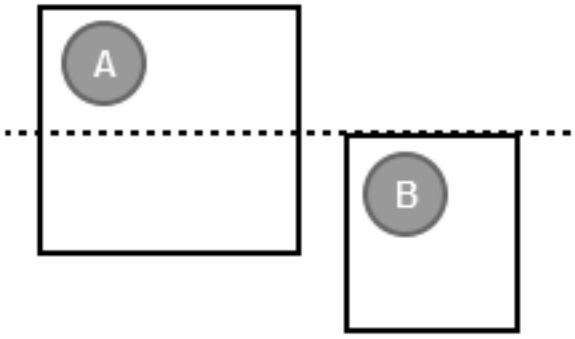
Also in this example, a custom, new snapping hint is introduced. This is good for special stencils where we would like to have very specific snappings defined:

```
new SnappingData("FrameTop", b.y + b.height/2, "TabBottom", false, this.id)
```

Suppose that we have another stencil named **B** with the following custom snapping defined:

```
new SnappingData("TabBottom", b.y, "FrameTop", false, this.id)
```

So, **A** has a new snapping, `FrameTop`, which allows other snappings of type `TabBottom` to be snapped to. Since **B** has a snapping hint called `TabBottom` defined, it will be possible for **B** to snap to **A** at the expected position.



If other shapes want to snap to **A** at `FrameTop`, they just need to define a snapping with the name `TabBottom` like **B** does.

As noted above, all objects in Pencil have a `Top` snapping hint defined by default as its top position, so to have all objects be able to snap to our **A**'s special `FrameTop` snapping point, just modify the SnappingData definition to the following:

```
new SnappingData("FrameTop", b.y + b.height/2, "Top", false, this.id)
```

Dynamic DOM Content

In some special cases, a shape's content is composed of a dynamic element structure. Pencil provides the *DomContent* behavior so that the DOM content of an element can be changed dynamically. The value provided to this behavior is

a DOM node that will be inserted as a child of the target element. Together with providing this behavior, Pencil also provides utility functions for quickly building DOM nodes and fragments from the spec, defined as JavaScript objects.

```
<Shape id="list" displayName="List" icon="Icons/list.png">
    <Properties>
        <PropertyGroup>
            <Property name="box" displayName="Box" type="Dimension">191,235</Property>
        </PropertyGroup>
        <PropertyGroup name="Item Text">
            <Property name="contentText" displayName="Text Content" type="PlainText"␣
↪p:editInfo="({targetName: 'content', bound: Bound.fromBox($box, 0, 52), font:
↪$itemFont, align: new Alignment(0, 0), multi: true})">
                MenuItem MenuItem MenuItem
            </Property>
            <Property name="itemFont" displayName="Text Font" type="Font">
                <E>$$defaultTextFont</E>
            </Property>
            <Property name="itemColor" displayName="Text Color" type="Color">#000000ff
↪</Property>
        </PropertyGroup>
    </Properties>
    <Behaviors>
        <For ref="content">
            <Bound>Bound.fromBox($box, 0, 54)</Bound>
            <Font>$itemFont</Font>
            <DomContent>
                var items = $contentText.value.split(/[\r\n]+/);
                var specs = [];
                for (var i = 0; i &lt; items.length; i ++) {
                    var css = new CSS();

                    var title = items[i];

                    if(title.match(/\S/) != null) {
                        var lineHeight = (i + 1) * (30 + $itemFont.getPixelHeight());

                        var css = new CSS();
                        css.set("font-size",$itemFont.size);
                        css.set("font-family",$itemFont.family);
                        css.set("font-style",$itemFont.style);
                        css.set("font-weight",$itemFont.weight);
                        css.set("font-decor",$itemFont.decor);
                        css.set("fill", $itemColor.toRGBString());

                        specs.push({
                            _name: "text",
                            _uri: "http://www.w3.org/2000/svg",
                            x: 10,
                            y: lineHeight,
                            _text : title,
                            style: css
                            },{
                                _name: "path",
                                _uri: "http://www.w3.org/2000/svg",
                                d: "m 10,"+ (lineHeight+10) + " "+($box.w - 20)+",0" ,
                                style : "stroke-width:1;stroke:#c9c9c9"
                        });
                    }
                }
```

```
                Dom.newDOMFragment(specs);
            </DomContent>
        </For>
    </Behaviors>
    <p:Content xmlns:p="http://www.evolus.vn/Namespace/Pencil"
               xmlns="http://www.w3.org/2000/svg">
        <g id="content" />
    </p:Content>
</Shape>
```

In this example, the text content entered by the user is supposed to be split across multiple lines. The code inside the behavior splits the text content and creates a `text` element for each line, containing that line and a `path` element as the footer of the `text`.

The utility method `Dom.newDOMFragment(specs);` is used here to create DOM fragments from the object specs.

External JavaScript

A shape may contain long and complex JavaScript code for calculating behavior values. Moreover, other shapes may contain exactly the same code. This means it takes time to review and modify shapes. For convenience, such code should be brought out of shapes and put into `<Script></Script>` tags that at the collection level.

```
<Shapes>
    ...
    <Script></Script> <!-- Shared code goes here -->
    ...
    <Shape></Shape>
    <Shape></Shape>
</Shapes
```

Example:

```
<Script>
    collection.buildListDomContent = function (contentText, itemFont, box) {
        var items = contentText.value.split(/[\r\n]+/);
        var specs = [];
        for (var i = 0; i &gt; items.length; i ++) {
            var css = new CSS();
            var title = items[i];

            if (title.match(/\S/) != null) {
                var lineHeight = (i + 1) * (30 + itemFont.getPixelHeight());

                var css = new CSS();
                css.set("font-size",itemFont.size);
                css.set("font-family",itemFont.family);
                css.set("font-style",itemFont.style);
                css.set("font-weight",itemFont.weight);
                css.set("font-decor",itemFont.decor);
                css.set("fill", itemColor.toRGBString());

                specs.push({
                    _name: "text",
                    _uri: "http://www.w3.org/2000/svg",
                    x: 10,
                    y: lineHeight,
```

```
                    _text : title,
                    style: css
                },{
                    _name: "path",
                    _uri: "http://www.w3.org/2000/svg",
                    d: "m 10,"+ (lineHeight+10) + " "+(box.w - 20)+",0" ,
                    style : "stroke-width:1;stroke:#c9c9c9"
                });
            }
        }
        var frag = Dom.newDOMFragment(specs);

        return frag;
    };
</Script>
...
<Shape id="list" displayName="List" icon="Icons/list.png">
    <Properties>
        <PropertyGroup>
            <Property name="box" displayName="Box" type="Dimension">191,235</Property>
        </PropertyGroup>
        <PropertyGroup name="Item Text">
            ...
        </PropertyGroup>
    </Properties>
    <Behaviors>
        <For ref="content">
            <Bound>Bound.fromBox($box, 0, 54)</Bound>
            <Font>$itemFont</Font>
            <DomContent>collection.buildListDomContent($contentText, $itemFont, $box)
↪</DomContent>
        </For>
    </Behaviors>
    <p:Content xmlns:p="http://www.evolus.vn/Namespace/Pencil" xmlns="http://www.w3.
↪org/2000/svg">
        <g id="content" />
    </p:Content>
</Shape>
```

As you may notice, in the context of JavaScript execution within a stencil behavior, the `collection` object is bound to the current collection that owns the stencil. The way shared JavaScript code is used is that custom functions and attributes are added in the collection-level script and re-used later in stencil's code, via the `collection` object.

Nine-Patch

Nine Patch is an image format that adds extra information into a normal image file to define which parts of the image should be stretched when the image is scaled. The technique used by this format is also implemented in the core of the Android OS.

More information about this format can be found at: http://developer.android.com/guide/topics/graphics/2d-graphics.html#nine-patch

It is very simple and flexible to make a stencil based on an existing bitmap image by defining the areas that should stretch using the Nine-patch format. Starting from version 2.0, Pencil also provides built-in behaviors and tools to support this technique for developers to use when creating their collections. There are already many collections using this technique in the Pencil repository such as the iOS UI Stencils.

Creating a simple stencil using Nine-patch

Suppose we have the rounded rectangle image shown below and we want to create a shape based on this image that can be scaled to any size while maintaining the corner radius.

1. Defining Nine-patch

The first step is to create a Nine-patch from this image by adding 4 black lines to its border to define the scaling and padding areas:

In this nine-patch, the top and left lines are used to divide the rectangle into nine pieces while the bottom and right lines are used to define the bounds.

Note: The thickness of these lines **must** be 1 pixel. For the purpose of illustration, lines are enlarged in this tutorial.

---

2. Generating JS code

The next step is to use Pencil-provided tools to load this nine-patch image and generate JavaScript code containing the nine-patch data in a structure that is compatible with Pencil's built-in implementation of nine-patch images.

Go to `Tools » Developer Tools » N-Path Script Generator...` to launch the tool and load the image created above. Code generated by this tool should be copied and used in the stencil. After parsing you can see that the images are sliced into 9 pieces:

These pieces are sliced based on the lines on the top and left side of the images:

- The 1, 3, 7, 9 piece will be the same when scaling box.
- The width of 2, 5, 8 piece will be scale based on the ratio between old width and new width.

- The height of 4, 5, 6 piece will be scale based on the ratio between old height and new height.

3. Use the generated code in your stencil

The easiest way to use the generated code is to define a set of nine-patches at the collection level by using the <Script> tag. The generated code in the above step is used as the value of the "sample" property in the following example.

```
<Script comments="N Patches">
    collection.nPatches = {
        sample: {
            "w": 35,
            "h": 35,
            "p1": {
                "x": 15,
                "y": 16
            },
            "p2": {
                "x": 20,
                "y": 22
            },
            "patches": [
                [
                    {
                        "url": "
↪iVBORw0KGgoAAAANSUhEUgAAABEAAAARCAYAAAA7bUf6AAAAr0lEQVQ4jaXTMQ6DMAwF0L+ycQPOwMbJOEA5CHuWKEYZEQsqdpE
↪QTJvnrOUSqClBPF3N+xFbJuhebycYSdCfQHDnyBgF6G+APEvGNggts1OdbBBlEqCZ3CIaCkvAStSd6l3jV5ED9VlYEWOfmIwYsY
↪",
                        "w": 17,
                        "h": 17,
                        "scaleX": false,
                        "scaleY": false
                    },
                    {
                        "url": "
↪iVBORw0KGgoAAAANSUhEUgAAAAEAAAARCAYAAAAcw8YSAAAAFUlEQVQImWNg2HjyJwPDppP/
↪qUgAAOGdKhRyz8aoAAAAAElFTkSuQmCC",
                        "w": 1,
                        "h": 17,
                        "scaleX": true,
                        "scaleY": false
                    },
                    {
                        "url": "
↪iVBORw0KGgoAAAANSUhEUgAAABEAAAARCAYAAAA7bUf6AAAApUlEQVQ4ja3TsQ3CQAwF0N/
↪SsQEz0DFZBkgGoU9zOp+uRDQosUFKwQTpIpq0lKZIAKHQXHyW3D75WzZAMsBLB+KI0JTwtz2Si0SXzT1cW+F43hqQDzbCSYG63
↪",
                        "w": 17,
                        "h": 17,
                        "scaleX": false,
                        "scaleY": false
                    }
                ],
                [
                    {
                        "url": "
↪iVBORw0KGgoAAAANSUhEUgAAABEAAAABCAYAAAA4u0VhAAAAE0lEQVQImWNg2HjyJ8Omk/
↪8pwQCRHioUjQN2IAAAAABJRU5ErkJggg==",
```

```
                        "w": 17,
                        "h": 1,
                        "scaleX": false,
                        "scaleY": true
                    },
                    {
                        "url": "
↪iVBORw0KGgoAAAANSUhEUgAAAAEAAAABCAYAAAAfFcSJAAAADUlEQVQImWNg2HTyPwAErAJ72rrK9QAAAABJRU5ErkJggg==
↪",
                        "w": 1,
                        "h": 1,
                        "scaleX": true,
                        "scaleY": true
                    },
                    {
                        "url": "
↪iVBORw0KGgoAAAANSUhEUgAAABEAAAABCAYAAAA4u0VhAAAAEklEQVQImWNg2HTyP0V448mfAJLeKhTUgefAAAAAAElFTkSuQm
↪",
                        "w": 17,
                        "h": 1,
                        "scaleX": false,
                        "scaleY": true
                    }
                ],
                [
                    {
                        "url": "
↪iVBORw0KGgoAAAANSUhEUgAAABEAAAARCAYAAAA7bUf6AAAAnUlEQVQ4ja3UMQ6CQBCF4b+l4wacgc6TeQA9CP02ZIdsSWgMzkp
↪uM5Q2hEA0bsdqc9HO1J1OaJPGwJQx70dcS6judxsCEBoC7w+bAiAnHaITjbkC2050WxCW6x+o59xLktdW2j/
↪qlRdngZyZrI3xw9lWloNn29kfAN5zToMs/CBPQAAAABJRU5ErkJggg==",
                        "w": 17,
                        "h": 17,
                        "scaleX": false,
                        "scaleY": false
                    },
                    {
                        "url": "
↪iVBORw0KGgoAAAANSUhEUgAAAAEAAAARCAYAAAAcw8YSAAAAFElEQVQImWNg2HTyPwM1iY0nfwIA480qFPtI62wAAAAASUVORK5
↪",
                        "w": 1,
                        "h": 17,
                        "scaleX": true,
                        "scaleY": false
                    },
                    {
                        "url": "
↪iVBORw0KGgoAAAANSUhEUgAAABEAAAARCAYAAAA7bUf6AAAAn0lEQVQ4ja3TPQqDQBAF4Nemyw1yhnSezAPoQextlp1lS0kTdEk
↪gVDEtcO2hGCEZxhJ100MRniEafLvHvwLyQQrPYg9XJ19biEubzv/OgxaZ8VBAAAAAElFTkSuQmCC",
                        "w": 17,
                        "h": 17,
                        "scaleX": false,
                        "scaleY": false
                    }
                ]
            ],
            "lastScaleX": 1,
            "lastScaleY": 1
        }
```

```
    }
</Script>
```

Then in the code for the stencil that uses this nine-patch, you can use Pencil's built-in functions to simplify the code.

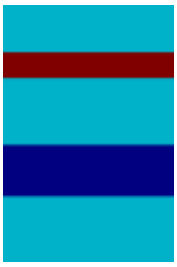
```
<Shape id="sample" displayName="NPathSampe" icon="Icons/sample.png">
    <Properties>
        <PropertyGroup>
            <Property name="box" type="Dimension">320,44</Property>
        </PropertyGroup>

        <PropertyGroup name="Text">
            <Property name="text" displayName="Text" type="PlainText">Content</
↪Property>
            <Property name="textFont" displayName="Default Font" type="Font">
↪Helvetica|bold|normal|20px</Property>
        </PropertyGroup>
    </Properties>
    <Behaviors>
        <For ref="bg">
            <NPatchDomContent>
                <Arg>collection.nPatches.sample</Arg>
                <Arg>$box</Arg>
            </NPatchDomContent>
        </For>
        <For ref="text">
            <TextContent>$text</TextContent>
            <Font>$textFont</Font>
            <Fill>Color.fromString('#ffffffff')</Fill>
            <BoxFit>
                <Arg>getNPatchBound(collection.nPatches.sample, $box)</Arg>
                <Arg>new Alignment(1, 1)</Arg>
            </BoxFit>
        </For>
    </Behaviors>
    <p:Content xmlns="http://www.w3.org/2000/svg">
        <g id="bg"></g>
        <text id="text" />
    </p:Content>
</Shape>
```

The *NPatchDomContent* behavior uses the provided nine-patch and dimension to perform scaling calculations and fill the bg element with images generated from the nine-patch.

The `getNPatchBound()` utility function is used here to obtain the bounds defined by the bottom and right markers in the nine-patch to place the text in the correct position.

4. More complex nine-patch

Despite the name of the technique, nine-patch images can be defined so that they are sliced into an unlimited number of pieces. Suppose that we have the following bitmap and we would like to have it scale in a way that in the vertical direction, only the blue and red parts are scaled while the cyan areas remain unscaled. In the horizontal direction the whole length of the image should be scaled.



To do this, we can add the scaling markers to the image as shown in the following nine-patch:

If we do not add right and bottom lines, getNPatchBound will return the bound that contains the whole image.

Using Shortcuts

A stencil may contain many properties. When a shape is dragged onto the canvas, each property is assigned its default value. It is often useful to be able to provide several variations of a shape, each with different default property values. Pencil supports this through **shortcuts**, which allow a stencil to be linked to by any number of shortcuts stencils, with each shortcut specifying its own default property values.

```
<Shape id="label" displayName="Label" icon="Icons/plain-text.png">
    <Properties>
        <PropertyGroup name="Text">
            <Property name="label" displayName="Label" type="PlainText">Hello World</
↪Property>
            <Property name="textColor" displayName="Color" type="Color">#808080ff</
↪Property>
            <Property name="shadowColor" displayName="Shadow Color" type="Color">
↪#008000ff</Property>
            <Property name="textFont" displayName="Font" type="Font">Arial,sans-
↪serif|normal|normal|13px</Property>
            <Property name="shadow" displayName="Width Shadow" type="Bool">false</
↪Property>
        </PropertyGroup>
    </Properties>
    <Behaviors>
        <For ref="text">
            <TextContent>$label</TextContent>
            <Fill>$textColor</Fill>
            <Font>$textFont</Font>
```

```
            <BoxFit>
                <Arg>new Bound(0, 0, 100, 12)</Arg>
                <Arg>new Alignment(0, 1)</Arg>
            </BoxFit>
        </For>
        <For ref="shadow">
            <Visibility>$shadow</Visibility>
            <TextContent>$label</TextContent>
            <Fill>$shadowColor</Fill>
            <Font>$textFont</Font>
            <BoxFit>
                <Arg>new Bound(1, 1, 100, 12)</Arg>
                <Arg>new Alignment(0, 1)</Arg>
            </BoxFit>
        </For>
    </Behaviors>
    <p:Content xmlns:p="http://www.evolus.vn/Namespace/Pencil" xmlns="http://www.w3.
↪org/2000/svg">
        <text id="shadow" />
        <text id="text" />
    </p:Content>
</Shape>

<Shortcut displayName="Label with shadow" icon="Icons/label-shadow.png" to="label">
    <PropertyValue name="shadow">true</PropertyValue>
</Shortcut>
```

Here, a shortcut is created to the `label` stencil, with the shortcut overriding the default value of the label's `shadow` property. All properties can be changed using this method. The `to` attribute should be equal to the target shape's `id`.

A shortcut may refer to a stencil from another collection. In this situation, the `to` property needs to be in the form of `collectionid:shapeId`.

```
<Shortcut displayName="name" icon="" to="collectionId:shapeId">
    <!-- ... -->
</Shortcut>
```

Note: Due to limitations in Pencil, the referenced collection needs to be loaded first otherwise the shortcut will not work.

Tips and Tricks

Visibility and Transform

Visibility and *Transform* are two universal behaviors in Pencil that can be applied to any type of object:

```
<Visibility>...</Visibility>
<Transform>...</Transform>
```

Forced dependencies

Upon changes being made to a specific property, all elements that have at least one behavior referring to that property will be invalidated and the behavior code will be executed. In some special cases, you may want a specific behavior to

be executed when a specific property changes even when that property is not explicitly referenced. In this case, add a comment with the format `//depends $propertyName` to the behavior concerned.

```
<For ref="text">
    <TextContent>new PlainText("Hello World")</TextContent>
    <Fill>Color.fromString("#000000ff")</Fill>
    <Font>new Font()</Font>
    <BoxFit>
        <Arg>new Bound(0, 0, 100, 12) //depends $textColor</Arg>
        <Arg>new Alignment(0, 1)</Arg>
    </BoxFit>
</For>
```

Reference Guide

Stencil Collection Structure and File Format

Stencil Collection Structure

A stencil collection is usually distributed as a single ZIP archive containing all related files for that collection.

This collection ZIP archive has one main XML file named (exactly) `Definition.xml` and other optional files or sub-directories containing supporting files for the main XML (primarily icon files).

The `Definition.xml` file name is case-sensitive and is the only required file for a collection. All other files can be omitted when not needed.

Format of the Definition.xml file

Each `Definition.xml` file defines a collection of stencils by providing collection information and all stencil definitions. This is just a standard XML file that can be created by virtually any text editor you have on your system.

General Structure

The Definition.xml file has the following structure:

```
<Shapes xmlns="http://www.evolus.vn/Namespace/Pencil"
    xmlns:p="http://www.evolus.vn/Namespace/Pencil"
    xmlns:svg="http://www.w3.org/2000/svg"
    xmlns:xlink="http://www.w3.org/1999/xlink"

    id="your_collection_id"
    displayName="Display name of your collection"
    description="More description about this collection"
    author="Names of the authors"
    url="Optional URL to its web page">

    <Properties>
        <!-- Collection properties -->
    </Properties>
    <Script>
        <!-- Shared script code for your collection -->
    </Script>
```

```
    <!-- Shape and shortcut definitions -->
    <Shape>...</Shape>
    <Shortcut>...</Shortcut>

</Shapes>
```

The following list summarizes the format:

- The out-most tag is `<Shapes>` with the namespace URI set to `http://www.evolus.vn/Namespace/Pencil`.
- Information about the collection is specified by the `<Shapes>` node's attributes: `id`, `displayName`, `description`, `author` and `url`.
- A collection may have properties that can referenced as initial values for shape properties. These properties should be defined in the `<Properties>` section of the collection.
- A collection may also have shared JavaScript code that can be re-used across its shapes. Such code can be defined in the `<Script>` tag.
- Each shape in the collection is defined in a separate `<Shape>` tag placed right under the root `<Shapes>` tag. Please refer the next section for details on definition structure for a shape.
- Beside shapes, a collection may also contain shortcuts which are references to another shape with different default values for its properties. Shortcuts are defined in `<Shortcut>` tags.

The <Shape> tag

Each shape in a collection is defined in a `<Shape>` tag with the following structure:

```
<Shape id="shape_id" displayName="Shape display name" icon="url_to_shape_icon">
    <Properties>
        <PropertyGroup name="Property group name">
            <Property name="..."
                displayName="..."
                type="...">{Default value}</Property>
            <Property>...</Property>
            <Property>...</Property>
        </PropertyGroup>
        <PropertyGroup>...</PropertyGroup>
    </Properties>
    <Behaviors>
        <For ref="target_element_id">
            <!-- Single argument behavior, for example 'Font' -->
            <Behavior_Name>JS expression for input value<Behavior_Name>

            <!-- Multi argument behavior, for example 'BoxFit' -->
            <Other_Behavior_Name>
                <Arg>JS expression for argument 1</Arg>
                <Arg>JS expression for argument 2</Arg>
                ...
            </Other_Behavior_Name>
        </For>
    </Behaviors>
    <p:Content xmlns:p="http://www.evolus.vn/Namespace/Pencil" xmlns="http://www.w3.
↪org/2000/svg">
        <!-- SVG content of the stencil
```

```
            Each element can be identified by the 'id' attribute
            which is referenced by the 'ref' attributes in the Behavior
            sections defined above -->
    </p:Content>
</Shape>
```

The collection's <Properties> tag

The collection's `<Properties>` tag is used as the place to define properties at the collection level. This is the recommended way for stencil author to define changeable default values for shape properties. Properties defined in this section can be referenced in the stencil's code using the `$$` syntax and can be changed by users by right-clicking on the collection in the collection pane.

The structure of this section is similar to the `<Properties>` section at the `<Shape>` level:

```
<Shapes>
    ...
    <Properties>
        <PropertyGroup name="Text">
            <Property displayName="Default Text Font"
                name="defaultTextFont"
                type="Font">Helvetica|normal|normal|12px</Property>
            <Property displayName="Default Text Color"
                name="defaultTextColor"
                type="Color">#000000ff</Property>
        </PropertyGroup>
    </Properties>
    ...
</Shapes>
```

The collection's <Script> tag

The collection's `<Script>` tag is used to define shared JavaScript code within a collection. JavaScript code in this section will be executed when the collection is loaded into Pencil. In the execution context of these scripts, a special object named `collection` is available and is virtually bound to the collection itself. This object is also available in the execution of behavior and action code of each stencil so developers can use it as a shared object for storing function definitions and constants that need to be used across stencils.

```
<Shapes>
    ...
    <Script commnent="Shared collection objects">
        //sample constant definition
        collection.DEFAULT_PADDING = 5;

        //sample shared function
        collection.gradToDeg = function (grad) {
            return grad * 180 / Math.PI;
        };
    </Script>
    ...
</Shapes>
```

The collection's <Shortcut> tag

The `<Shortcut>` tag creates an alias to an existing stencil and provides different initial values to that stencil's properties. The structure of this tag is described below:

```
<Shapes>
    ...
    <Shortcut displayName="Display name"
        icon="..."
        to="[collection_id:]stencil_id">
        <PropertyValue name="property_name">new default value</PropertyValue>
        <PropertyValue>...</PropertyValue>
        <PropertyValue>...</PropertyValue>
    </Shortcut>
    ...
</Shapes>
```

Pencil Data Types

Pencil supports various data types for shape properties. Some of them are equivalent to data types in popular programming languages while the others are for convenience.

This document lists all supported data types in Pencil, with both JavaScript syntax and XML syntax for use in stencil coding. Most of the supported data types have at least one way end-users can modify the value from the GUI.

Alignment

Data structure for storing two-dimension alignment.

class `Alignment` (*h*, *v*)

Arguments

- **h** (*number*) – horizotal alignment. 0: left, 1: center, 2: right
- **v** (*number*) – vertical alignment. 0: top, 1: middle, 2: bottom

`static Alignment.`**`fromString`**(*s*)

Arguments

- **s** (*string*) – string representation

Returns Alignment built from string representation

`Alignment.`**`toString`**()

Returns String representation of the Alignment

XML syntax

```
<Property name="test" displayName="Test" type="Alignment">h,v</Property>
```

Editor support

Property page:

Properties of type Alignment can be edited in the shape property page.

Bool

Data type for storing boolean values.

class `Bool` (*value*)

Arguments

- **value** (*boolean*) – `true` or `false`

`static Bool.`**`fromString`**`(`*s*`)`

Arguments

- **s** (*string*) – String representation

Returns Bool built from String representation

`Bool.`**`toString`**`()`

Returns String representation of this Bool

`Bool.`**`negative`**`()`

Returns negated Bool object

XML syntax

```
<Property name="sample" displayName="Sample" type="Bool">value</Property>
```

Editor support

Context menu:

Properties of type Bool can be edited in the context menu of the shape using a checkbox item.

Dimension

Data structure for storing object size, a pair of width and height values

class `Dimension` (*width*, *height*)

Arguments

- **width** (*number*) –
- **height** (*number*) –

`static Dimension.`**`fromString`**`(`*s*`)`

Arguments

- **s** (*string*) –

Returns Build a Dimension object from its string presentation.

`Dimension.`**`toString`**`()`

Returns String representation of the object

`Dimension.`**`narrowed`**`(`*paddingX*[, *paddingY*]`)`

Arguments

- **paddingX** (*number*) –
- **paddingY** (*number*) –

Returns Return a new Dimension object with is created by narrowing the callee by the provided paddings. If paddingY is omitted, paddingX will be used for both directions.

XML syntax

```
<Property name="box" displayName="Box" type="Dimension"
      p:lockRatio="true">width,height</Property>
```

Note:

p:lockRatio Meta constraint used in XML syntax to hint that the ratio of this object should be maintained when its width or height is changed.

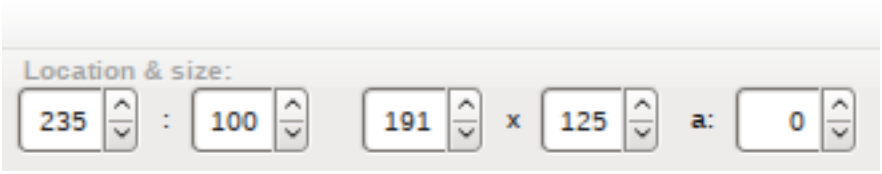
Editor support

On-canvas editor:

A Dimension property with the special name of box can be edited using the on-canvas geometry editor.

Toolbar editor:

And also via the geometry toolbar located on the top of the Pencil application window.



Bound

Data structure for storing a bounding box which is a composite of a location and a size.

class **Bound** (*left*, *top*, *width*, *height*)

Arguments

- **left** (*number*) –
- **top** (*number*) –
- **width** (*number*) –
- **height** (*number*) –

`static Bound.`**fromBox** (*box*, *paddingX*, *paddingY*)

Arguments

- **box** –
- **paddingX** (*number*) –
- **paddingY** (*number*) –

Returns a new Bound object from a *Dimension()* object narrowed down on each sides using the provided paddings

```
var b = Bound.fromBox(box, x, y);
//equals to:
var b = new Bound(x, y, box.w - 2 * x, box.h - 2 * y)
```

`static Bound.`**`fromString`**`(`*s*`)`

Arguments

- **s** (*string*) –

Returns A Bound object built from its string presentation

`Bound.`**`toString`**`()`

Returns string presentation of a Bound object

`Bound.`**`narrowed`**`(`*paddingX*, *paddingY*`)`

Arguments

- **paddingX** (*number*) –
- **paddingY** (*number*) –

Returns a new Bound object by using the callee and narrowing down each sides by the provided paddings

Color

Data structure for storing object color with alpha blending

class **`Color`**`()`

Default opaque black color

`static Color.`**`fromString`**`(`*String*`)`

Arguments

- **s** (*string*) – color representation

Returns a color object from string presentation in CSS numerical color syntax.

```
Color.fromString("#ffffffff"); // solid white
Color.fromString("#ffffff"); // also solid white
Color.fromString("rgb(255, 0, 0)"); // solid red

// semi-transparent blue:
Color.fromString("rgba(0, 0, 255, 0.5)");

Color.fromString("transparent"); //transparent

//semi-transparent black:
Color.fromString("#00000033");
```

`Color.`**`toString`**`()`

Returns the extended hexa string presentation of the color: `#RRGGBBAA`

`Color.`**`toRGBString`**`()`

Returns the CSS color in the format of `rgb(red, green, blue)`

`Color.`**`toRGBAString`**`()`

Returns the CSS color in the format of `rgba(red, green, blue, alpha)`

`Color.`**`shaded`**`(`*`percent`*`)`

Arguments

- **`percent`** (*`number`*) –

Returns a darker version of a color using the provided percent.

`Color.`**`hollowed`**`(`*`percent`*`)`

Arguments

- **`percent`** (*`number`*) –

Returns a more transparent version of a color by the provided percent.

`Color.`**`inverse`**`()`

Returns negative version of a color

`Color.`**`transparent`**`()`

Returns a fully transparent version of a color

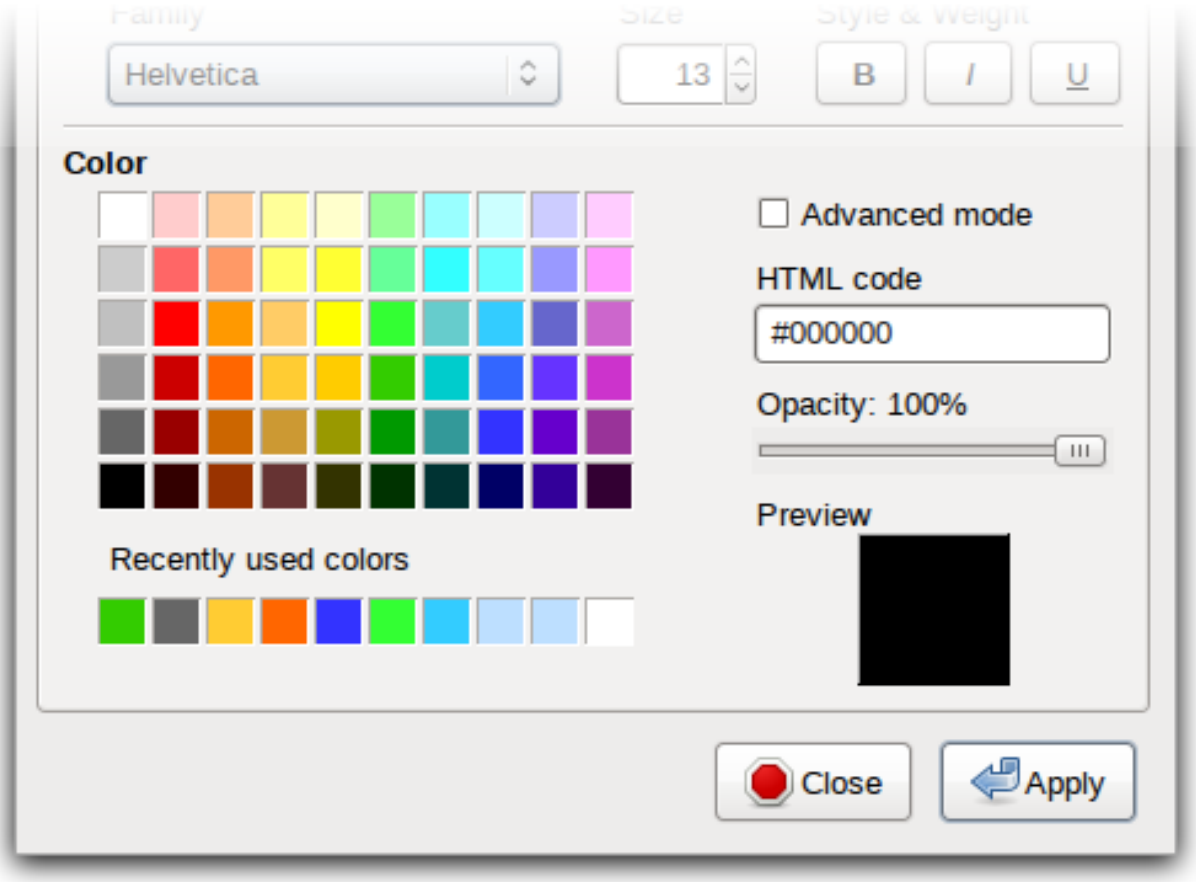
XML syntax

```
<Property name="color" displayName="My Color" type="Color">#000000ff</Property>
```

Editor support

Property page:

Properties of type Color can be edited in the property dialog with a color chooser that supports both simple and advanced mode.



Color properties with the following special names can be also edited with the Color toolbar: `textColor`, `fillColor` and `strokeColor`.

CSS

Provides a data object for styling SVG elements and HTML elements.

class CSS()

`CSS.`**`set`**(*name*, *value*)

Arguments

- **name** (*string*) – CSS property to set
- **value** (*string*) – Value to set the property to

Returns CSS object with newly added property

Sets a CSS property value, overriding existing one if any and returns the object itself.

`CSS.`**`toString`**()

Returns a string containing all specified properties.

`CSS.`**`clear`**()

Returns empty CSS object

Removes all properties contained in a CSS object and returns the object itself.

`CSS.`**`unset`**(*name*)

Arguments

- **name** (*string*) – Removes a specific property from a CSS object if any

Returns the object itself.

`CSS.`**`get`**(*name*)

Returns the properties value.

`CSS.`**`contains`**(*name*)

Returns Check whether a CSS object contains the property.

`CSS.`**`setIfNot`**(*name*, *value*)
Sets a property to `valuee` if the property has not already been set, returns the object itself

`static CSS.`**`fromString`**(*literal*)
Parses the CSS string and creates a CSS object containing all parsed property/value pairs.

`CSS.`**`importRaw`**(*literal*)
Parses the CSS string and add all parsed property/value pairs to the object overriding any existing properties.

Enum

Data structure to store an option with the possibility to specify available options via XML metadata.

XML syntax

```
<Property name="type" displayName="Type" type="Enum"
                  p:enumValues="['one|One', 'two|Two']">two</Property>
```

- **value**: Member field storing the selected value's id.
- **p:enumValues**: An array literal containing all possible options. Each option is in the syntax of `id|Display Name`.

Editor support

Context menu:

Properties of type Enum can be edited in the context menu of the shape.

Font

Data structure for manipulating font information.

class `Font()`

`static Font.fromString(s)`

Arguments

- **s** (*string*) –

Returns a Font object created from its string presentation.

`Font.getPixelHeight()`

Returns the font height in pixels.

`Font.toString()`

Returns a string representing the font object.

`Font.toCSSFontString()`

Returns the string presentation of the font object in CSS syntax.

`Font.getFamilies()`

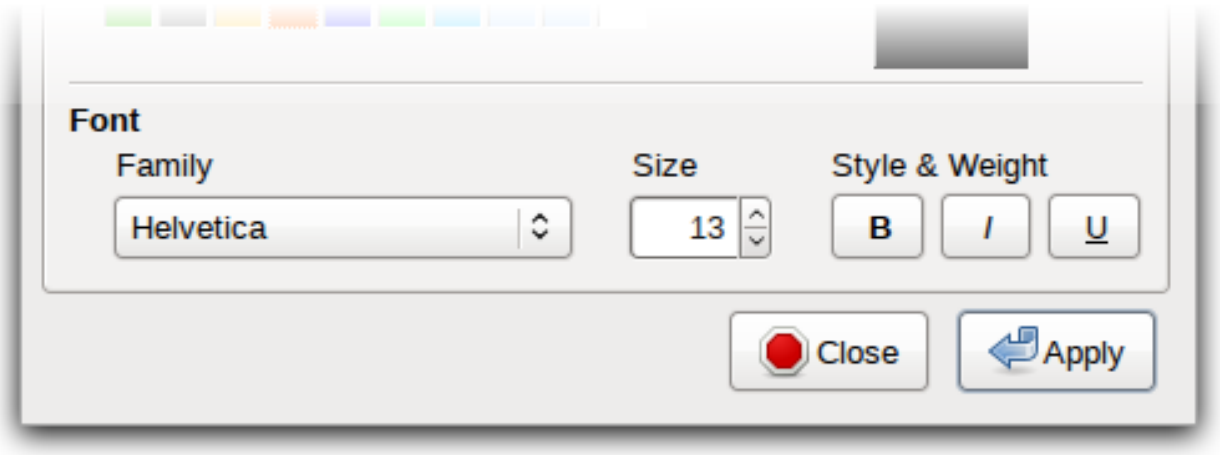
Returns the families field of the font.

XML syntax

```
<Property name="textFont" displayName="Text Font"
      type="Font">{families}|{weight}|{style}|{size}[|{decor}]</Property>
```

Editor support

Property page:



Properties of type Font can be edited in the property dialogue.

A Font property with the special name `textFont` is editable with the Font style toolbar.

Handle

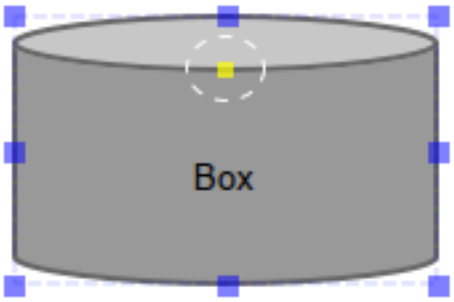
Provides a special data object representing a 2D coordinate that can be modified on the drawing canvas by user operations.

```
<Property name="a" displayName="Start Point" type="Handle">x,y</Property>
```

- **x**: Distance to the left border of the shape
- **y**: Distance to the top border of the shape
- **p:lockX**: The `x` value should not be changed, horizontal movement is disabled. Default value: `false`
- **p:lockY**: The `y` value should not be changed, vertical movement is disabled. Default value: `false`
- **p:minX**: Minimum value of `x`. Movement of the handle should not pass this lower limit.
- **p:maxX**: Maximum value of `x`. Movement of the handle should not pass this upper limit.
- **p:minY**: Minimum value of `t`. Movement of the handle should not pass this lower limit.
- **p:maxY**: Maximum value of `y`. Movement of the handle should 0not pass this upper limit.
- **p:noScale**: Disable auto-scaling of Handle value when the object `box` property is changed. Default value: `false`

Editor support

On-canvas editor:



Each property of type Handle is shown as a yellow bullet when the shape is focused. The property can be edited by moving the bullet.

ImageData

Data structure that stores a binary bitmap image.

class **`ImageData`** (*w*, *h*, *dataUrl*)

Arguments

- **`w`** (*`number`*) – The image width
- **`h`** (*`number`*) – The image height
- **`dataUrl`** (*`string`*) – The base64 data URL of the image

```
var image = new ImageData(10, 15, "...");
```

`static ImageData.`**`fromString`**`(`*`s`*`)`

Returns an ImageData object from its string presentation.

`ImageData.`**`toString`**`()`

Returns the string presentation of the object.

XML syntax

```
<Property name="image" displayName="Image"
      type="ImageData"><![CDATA[w,h,url]]></Property>
```

PlainText

Data object that represents a piece of plain text.

class `PlainText` (*s*)

Arguments

- **s** (*string*) – The text string

`static PlainText.`**`fromString`**`(`*`s`*`)`

Arguments

- **s** (*string*) –

Returns A PlainText object created from the given string

`PlainText.`**`toString`**`()`

Returns PlainText object as a String

`PlainText.`**`toUpper`**`()`

Returns Uppercase version of this PlainText

XML syntax

```
<Property name="text" displayName="Text"
      type="PlainText"><![CDATA[Pugnabant totidemque vos nam]]></Property>
```

Editor support

On-canvas editor:

PlainText properties can be edited right on the canvas using a simple text input.

RichText

Data structure for storing rich-text content in HTML format.

class `RichText` (*String s*)

Arguments

- **s** (*string*) – Rich text string

`static RichText.fromString` (*String s*)

Arguments

- **s** (*string*) – Rich text String

Returns a RichText object from the provided JS string

`RichText.toString()`

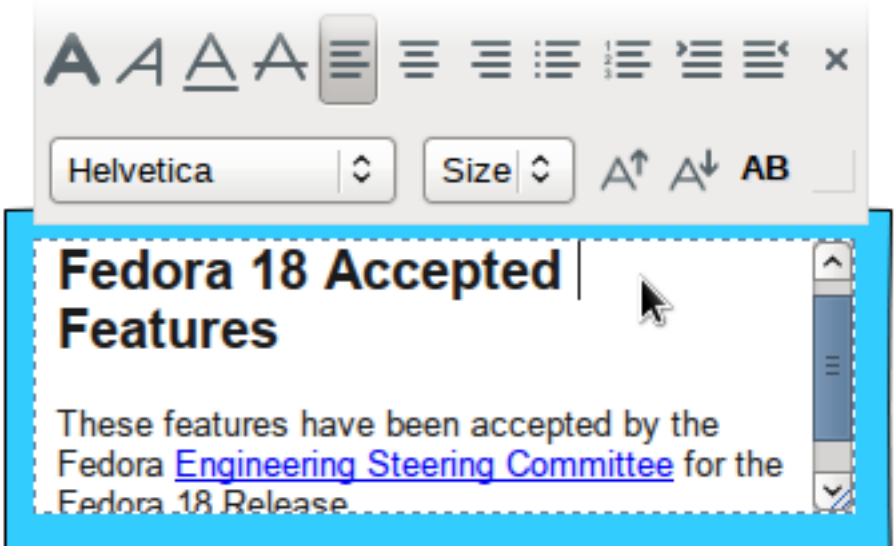
Returns The String representation of this object

XML syntax

```
<Property name="text" displayName="Text"
      type="RichText"><![CDATA[A <b>rich</b> text string]]></Property>
```

Editor support

On-canvas editor:



RichText properties can be edited right on the canvas using a rich-text input.

StrokeStyle

Data structure for storing stroke styling information.

class `StrokeStyle` (*width*, *dasharray*)

Arguments

- **`width`** (*number*) –
- **`dasharray`** (*array*) – The dasharray value is specified as a JavaScript array containing lengths of dashes and spaces. More information can be found in the SVG Specification for Stroke dash array.

```
// construct a 'dash-space-dot-space' stroke at 1px width
var stroke = new StrokeStyle("1,[4,2,1,2]");
```

`static StrokeStyle.`**`fromString`**(*s*)

Arguments

- **`s`** (*string*) –

Returns a StrokeStyle object from its string presentation.

`StrokeStyle.`**`toString`**()

Returns String representation of this object

`StrokeStyle.`**`condensed`**(*ratio*)

Arguments

- **`ratio`** (*number*) –

Returns a new version of the callee created by condensing the width by the provided ratio.

XML syntax

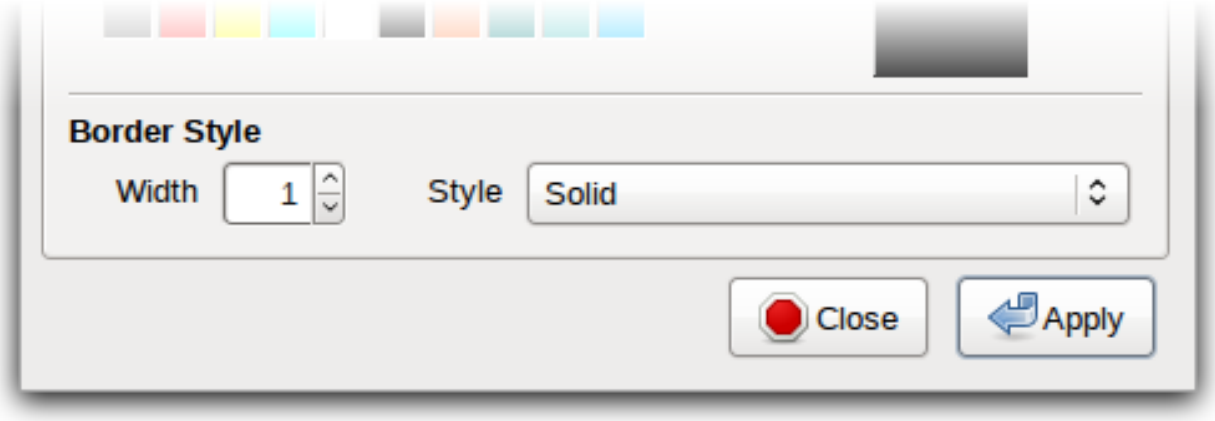
```
<Property name="stroke" type="StrokeStyle"
      displayName="Border Style">w|dasharray</Property>
```

When the `dasharray` is omitted, the stroke is considered solid.

```
<Property name="stroke" type="StrokeStyle"
      displayName="Border Style">1|[4,2,1,2]</Property>
```

Editor support

Property page editor:



StrokeStyle properties can be edited in the property page of the shape.

ShadowStyle

Data structure that stores shadow style information.

class ShadowStyle (*dx*, *dy*, *size*)

Arguments

- **dx** (*number*) –
- **dy** (*number*) –
- **size** (*number*) –

`static ShadowStyle.fromString(s)`

Arguments

- **s** (*string*) –

Returns a ShadowStyle object from its string presentation

```
var style = ShadowStyle.fromString("3|3|10");
```

`ShadowStyle.toString()`

Returns The string representation of this object

ShadowStyle.**toCSSString**()

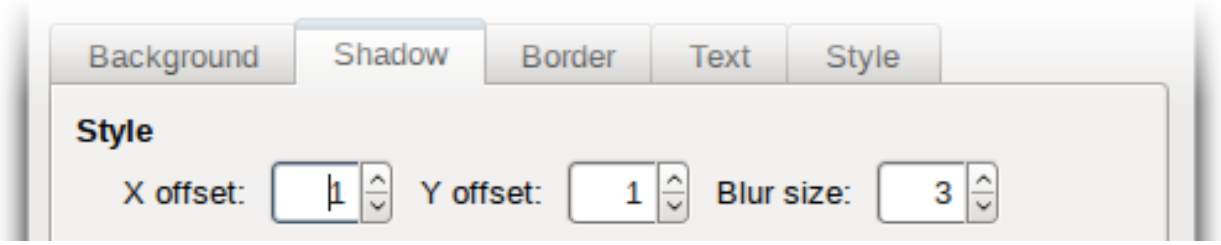
Returns the string representation in CSS syntax.

XML syntax

```
<Property name="shadow" type="ShadowStyle"
      displayName="Box Shadow">dx|dy|size</Property>
```

Editor support

Property page editor:



ShadowStyle properties can be edited in the property page of the shape.

Behavior Reference

To help Stencil developers define how the content in shapes should be changed to be reflect a shape's properties, Pencil provides the Behavior concept. With behaviors, attributes or content of the target object can be changed based on the Behavior's input values. The target object can be an SVG object or an HTML object in the `<Content>` section of the shape.

This section lists all supported behaviors in Pencil, each with XML syntax and examples.

Behaviors applied to an object within the shape are defined as below::

```
<For ref="target_object_id">
    <Behavior_1>....</Behavior_1>
    <Behavior_2>....</Behavior_2>
    .......
    <Behavior_n>....</Behavior_n>
</For>
```

For the ease of understanding the examples used in this document, let's assume that we have a box property of type *`Dimension()`* defined for the shape:

```
<Property name="box" type="Dimension">150,150</Property>
```

CustomStyle

This behavior is used to assign a value to a specific CSS attribute of the target object. Value and name are specified in the input arguments of the behavior.

Target object

Any object.

XML Syntax

```
<CustomStyle>
    <Arg>propertyName</Arg>
    <Arg>value</Arg>
</CustomStyle>
```

Input value

- **propertyName**: name of CSS property.
- **value**: value to assign to propertyName.

Result

The the CSS property `propertyName` of the target object is assigned the provided value.

Example

```
<CustomStyle>
    <Arg>"width"</Arg>
    <Arg>$box.w + "px"</Arg>
</CustomStyle>
```

Attr

This behavior is used to assign a value to a specific XML attribute of the target object. Value and name (and optional namespace URI) are specified in the input arguments of the behavior.

Target object

Any object.

XML Syntax

```
<Attr>
    <Arg>attributeName</Arg>
    <Arg>value</Arg>
    <Arg>namespace</Arg>
</Attr>
```

Input value

- **attributeName**: name of attribute.
- **value**: value to assign to propertyName.
- **namespace**: namespace URI that this attribute is in. If the attribute has no namespace, the namespace argument can be omitted.

Result

The `attributeName` attribute of the target object is assigned the provided value.

Example

```
<Attr>
    <Arg>"width"</Arg>
    <Arg>$box.w</Arg>
</Attr>
<Attr>
    <Arg>"xlink:href"</Arg>
    <Arg>value</Arg>
    <Arg>PencilNamespaces.xlink</Arg>
</Attr>
```

If the namespace was defined in a parent node, the namespace argument could be omitted.

```
<Attr>
  <Arg>"xlink:href"</Arg>
  <Arg>value</Arg>
</Attr>
```

Box

This behavior is used to assign values to the width and height attributes of the target object.

Target object

Any object that supports width and height attributes.

XML syntax

```
<Box>dimensionValue</Box>
```

Input value

- **dimensionValue**: an expression that returns a value of type *Dimension()*.

Result

The width and height attributes of the target object are set to the values represented by the dimensionValue object.

Example

```
<Box>$box</Box>
```

Or directly

```
<Box>new Dimension(50,50)</Box>
```

Bound

This behavior is used to assign values to the width and height attributes and set the position of the target object.

Target object

Any object that supports width and height attributes.

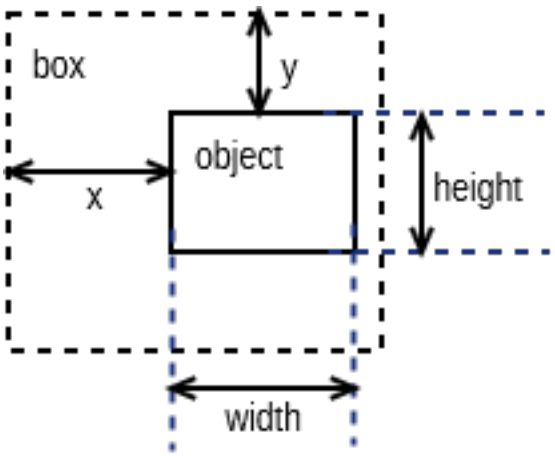
XML syntax

```
<Bound>bound</Bound>
```

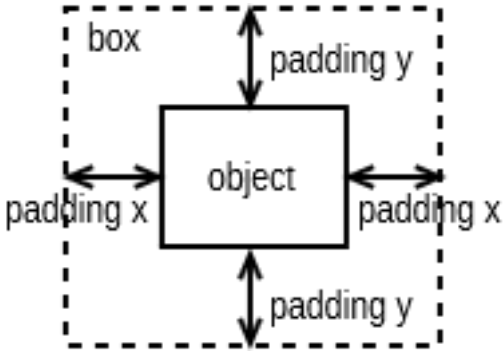
Input value

- **bound**: an object of type *Bound()*

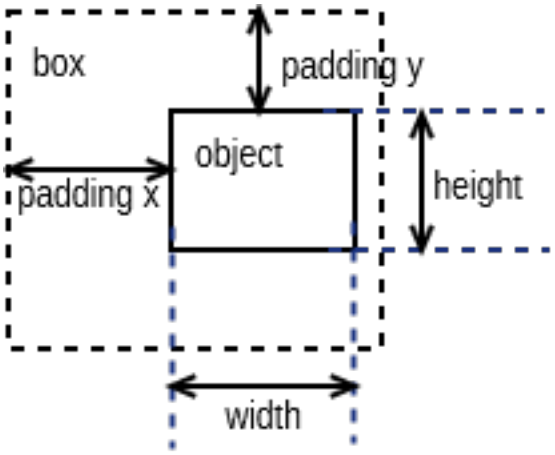
Example



```
<Bound>new Bound(x, y, width, height)</Bound>
```




```
<Bound>Bound.fromBox(Box, paddingX, paddingY)</Bound>
```




```
<Bound>Bound.fromBox(new Dimension(width, height), paddingX, paddingY)</Bound>
```

Radius

This behavior sets the `rx` and `ry` attributes of the target SVG objects that support corner radius (including Rectangle and Ellipse).

Target object

A rectangle or ellipse SVG element.

XML syntax

```
<Radius>
    <Arg>rx</Arg>
    <Arg>ry</Arg>
</Radius>
```

Input value

- **rx**: number - horizontal radius
- **ry**: number - vertical radius

Result

The target object's (Rectangle, Ellipse) `rx` and `ry` attributes are set to the given values.

Example

```
<Radius>
    <Arg>5</Arg>
    <Arg>5</Arg>
</Radius>
```

Fill

This behavior sets the `fill` and `fill-opacity` attributes of the target SVG objects that can be filled with color.

Target object

Any SVG object that can be filled with color.

XML syntax

```
<Fill>color</Fill>
```

Input value

- **color**: The color to fill the target with - an object of type *`Color()`*.

Result

The target object's color and opacity are set.

Example

```
<Fill>Color.fromString("#ffffffff")</Fill>
```

Or:

```
<Property name="color" displayName="fColor" type="Color">#000000ff</Property>
....
<Fill>$color</Fill>
```

Color

This behavior sets the `color` and `opacity` attributes of the target HTML object.

Target object

Any HTML object.

XML syntax

```
<Color>color</Color>
```

Input value

- **color**: The desired text color for the target - an object of type *`Color()`*.

Result

The target object's color and opacity CSS properties are set.

Example

```
<Color>Color.fromString("#ffffffff")</Color>
```

Or:

```
<Property name="color" displayName="fColor" type="Color">#000000ff</Property>
....
<Color>$color</Color>
```

StrokeColor

This behavior sets the `stroke` and `stroke-opacity` attributes of the SVG target objects that have stroke.

Target object

Any Object that can be given a stroke.

XML syntax

```
<StrokeColor>color</StrokeColor>
```

Input value

- **color**: Color of the stroke - an object of type *Color()*.

Result

The target object's stroke color and stroke opacity are set.

Example

```
<StrokeColor>Color.fromString("#ffffffff")</StrokeColor>
```

Or:

```
<Property name="color" displayName="fColor" type="Color">#000000ff</Property>
...
<StrokeColor>$color</StrokeColor>
```

StrokeStyle

This behavior is used to set the `stroke-width` and `stroke-dasharray` attributes of the target object.

Target object

Any Object that has a stroke.

XML syntax

```
<StrokeStyle>strokeStyle</StrokeStyle>
```

Input value

- **strokeStyle**: an object of type *StrokeStyle()*.

Result

The stroke of the target object is assigned the given value.

Example

```
<StrokeStyle>StrokeStyle.fromString("1|[1,3]")</StrokeStyle>
```

Or:

```
<Property name="strokeStyle"
          type="StrokeStyle"
          displayName="Border Style">1|[2,1,2,4]</Property>
...
<StrokeStyle>$strokeStyle</StrokeStyle>
```

Visibility

This behavior is used to assign value to the `visibility` and `display` attributes of the target object.

Target object

Any object.

XML Syntax

```
<Visibility>value</Visibility>
```

Input value

- **value**: Whether the object should be visible/displayed. Either Pencil's *`Bool()`* data object or a JavaScript `boolean` value.

Result

`visibility` and `display` attributes of the target object are changed according to the input value.

Example

```
<Visibility>Bool.fromString("true")</Visibility>
```

Or:

```
<Property name="value" displayName="Value" type="Bool">true</Property>
...
<Visibility>$value</Visibility>
```

BoxFit

This behavior is used to set text bounds and alignment.

Target object

An SVG text object.

XML syntax

```
<BoxFit>
    <Arg>bound</Arg>
    <Arg>alignment</Arg>
</BoxFit>
```

Input value

- **bound**: an object of type *Bound()*.
- **alignment**: an object of type *Alignment()*.

Result

The text content of the element is changed to fit the provided bound and given the provided alignment.

Example

```
<BoxFit>
    <Arg>Bound.fromBox($box)</Arg>
    <Arg>new Alignment(1,1)</Arg>
</BoxFit>
<Property name="textAlign"
          displayName="Text Alignment" type="Alignment">1,1</Property>
...
<BoxFit>
    <Arg>Bound.fromBox($box)</Arg>
    <Arg>$textAlign</Arg>
</BoxFit>
```

Font

This behavior is used to set the target object's text font. With this behavior, a set of font-related attributes are changed.

Target object

An SVG Text object or any HTML object.

XML Syntax

```
<Font>font</Font>
```

Input value

- **font**: an object of type *Font()*.

Result

`font-family`, `font-size`, `font-weight`, `font-style` and `text-decoration` attributes of the object are assigned values derived from the given Font object.

Note that the `text-decoration` attribute is only supported for HTML objects. It is impossible to set `text-decoration` on SVG Text objects.

Example

```
<Font>Font.fromString("Helvetica|normal|normal|14px")</Font>
<Property name="font" type="Font" displayName="Default Font">
↪Helvetica|normal|normal|14px</Property>
...
<Font>$font</Font>
```

D

This behavior is used to set the `d` attribute of an SVG path object. The provided array of drawing functions is converted to SVG drawing operations.

Target object

A path object.

XML Syntax

```
<D>[...]</D>
```

Input value

- **[...]**: an array of drawing instruction functions. Pencil supports drawing functions that are equivalent to popular SVG path data instructions:
  - **M(x,y)**: set point.
  - **L(x,y)**: draw a line from a point to x,y.

    Example: `<D>[M(0, 0), L(10,10)]</D>`
  - **C(x1, y1, x2, y2, x, y)**: the same as `C` in SVG.
  - **c(x1, y1, x2, y2, x, y)**: the same as `c` in SVG.
  - **S(x2, y2, x, y)**: the same as `S` in SVG.
  - **s(x2, y2, x, y)**: the same as `s` in SVG.
  - **Q(x1, y1, x, y)**: the same as `Q` in SVG.
  - **q(x1, y1, x, y)**: the same as `q` in SVG.
  - **z**: the same as `z` in SVG.

And two Pencil-specific instructions for drawing sketchy lines:

- **sk(x1, y1, x2, y2)**: move to `x1, y1` and draw a sketchy line to `x2, y2`
- **skTo(x, y)**: draw a sketchy line from the current position to `x, y`

Result

Each function in the input array is converted to its corresponding SVG drawing operation. Pencil-specific instructions are also converted to standard SVG drawing operations but using a special algorithm to make the lines sketchy. The resulting value is assigned to the `d` attribute of the path object.

Example

```
<D>[M(0, 0), L($box.w, 0), L($box.w, $box.h), L(0, $box.h), z]</D>
```

Transform

This behavior is used to control the `transform` attribute of SVG target objects. The provided array of transformation functions is converted to SVG transformation functions.

Target object

Any SVG object.

XML Syntax

```
<Transform>[...]</Transform>
```

Input value

[...]: an array of instruction functions. The functions are similar to the SVG transformation functions:

- rotate(x)
- translate(x, y)
- scale(x, y)
- skewX(a)
- skewY(a)

Result

The `transform` attribute of the SVG target object is assigned a value based on the input functions.

Example

```
<Transform>[scale($box.w.120, $box.h/100), transform(50, 70)]</Transform>
```

Scale

This behavior is used to assigned to the `scale` function in the `transform` attribute of an SVG object. This behavior is equivalent to the *Transform* behavior with just one `scale()`.

Target object

Any SVG object.

XML Syntax

```
<Scale>width_ratio, height_ratio</Scale>
```

Input value

- **width_ratio**: number - the horizontal scale ratio
- **height_ratio**: number - the vertical scale ratio

Result

The SVG object will be given a `transform` attribute containing a scale function with the given ratios. Note that using this behavior will empty the current value of the transform attribute.

Example

```
<Scale>
    <Arg>$box.w/120</Arg>
    <Arg>$box.h/100</Arg>
</Scale>
```

TextContent

This behavior is used to control the content of the target text object.

Note: this behavior does not support text wrapping for *`PlainText()`* content in SVG elements. To have the *`PlainText()`* content wrapped inside an SVG text element with a specific aligmnent, please use the *PlainTextContent* behavior.

Target object

An SVG text object or any HTML object.

XML Syntax

```
<TextContent>text</TextContent>
```

Input value

- **text**: a *PlainText()* or *RichText()* value.

Result

The target object's text content is changed.

Example

```
<TextContent>new PlainText("text here...")</TextContent>
<Property name="content"
          displayName="HTML Content" type="RichText">text here...</Property>
....
<TextContent>$label</TextContent>
```

PlainTextContent

This behavior is used to control the wrapped text inside an SVG text element. This is the recommended way to implement wrapped plain-text content instead of using HTML wrapping. This behavior produces compliant SVG output and the resultant drawing can be used in other SVG editors like Inkscape.

Target object

An SVG text element.

XML Syntax

```
<!--[CDATA[
<PlainTextContent-->
    <arg>plainTextValue</arg>
    <arg>bound</arg>
    <arg>alignment</arg>
```

Input value

- **text**: an object of type *PlainText()*.
- **bound**: an object of type *Bound()*.
- **alignment**: an object of type *Alignment()*.

Result

Content of the target object will be filled with `<tspan>` elements to create wrapped text content. The transform attribute of this element may be used in for controlling the bounding.

Example

```
<Property name="content"
    displayName="Text Content"
    type="PlainText">text here...
...
<plaintextcontent>
    <arg>$content</arg>
    <arg>Bound.fromBox($box, 10)</arg>
    <arg>new Alignment(1, 1)</arg>
</plaintextcontent>
```

DomContent

This behavior populates the target object with a child DOM node.

Target object

Any object.

XML Syntax

```
<DomContent>domContent</DomContent>
```

Input value

- **domContent**: a DOM element or a DOM fragment to add as a child of the target object.

Please refer the associated tutorial on *Dynamic DOM Content* for more information.

Image

This behavior is used to control the `xlink:href`, `width` and `height` attributes of an SVG `<image>` element.

XML Syntax

```
<Image>imageData</Image>
```

Input value

- **imageData**: an object of type *ImageData()*

Result

`xlink:href`, `width` and `height` attributes of the target `<image>` element are changed to be in sync with the provided `imageData` input value.

Example

```
<Property name="icon"
    displayName="Icon"
    type="ImageData"><![CDATA[10,15,...]]></Property>

...

<Image>$icon</Image>
```

EllipseFit

This behavior is used control an ellipse element so that it fits into the provided bound.

Target object

An SVG ellipse object.

XML Syntax

```
<EllipseFit>box</EllipseFit>
```

Input value

- **box**: an object of type *Dimension()*.

Result

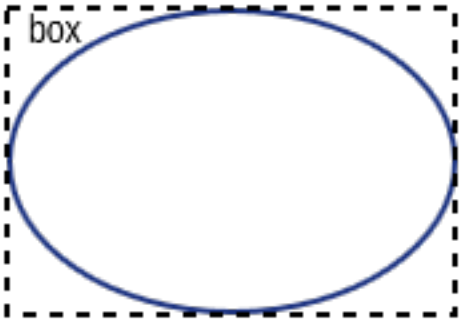
The `cx`, `cy`, `rx`, `ry` attribute values are changed.

Example

```
<EllipseFit>$box</EllipseFit>
```

Width

This behavior is used to assign the `width` attribute of the target object.



Target object

Any SVG object that supports the `width` attribute.

XML Syntax

```
<Width>width</Width>
```

Input value

- **width**: a number.

Result

The `width` attribute of the target object is assigned the given value.

Example

```
<Width>$box.w</Width>
```

Height

This behavior is used to assign the `height` attribute of the target object.

Target object

Any SVG object that supports the `height` attribute.

XML Syntax

```
<Height>height</Height>
```

Input value

- **height**: a number.

Result

The `height` attribute of the target object is assigned the given value.

Example

```
<Height>$box.h</Height>
```

NPatchDomContent

This behavior is used to fill the target `<g>` SVG element with `<image>` elements provided in the Nine-Patch with correct scaling for the provided dimensions.

Target object

An SVG `<g>` element.

XML Syntax

```
<NPatchDomContent>
    <arg>ninePatch</arg>
    <arg>dimension</arg>
</NPatchDomContent>
```

Input value

- **ninePatch**: a Nine-Patch data structure.
- **dimension**: an object of type *`Dimension()`*.

Result

The Nine-Patch data structure is used together with the dimension object to calculate scaling for patches. `<image>` elements for the patches are generated and added as children of the target `<g>` element.

Example

For more information on how to use this behavior, please refer the associated tutorial on *Using Nine-Patch*.

InnerText

This behavior is used to fill the content of the target object with a DOM text node.

Target object

Any object.

XML Syntax

```
<InnerText>value</InnerText>
```

Input value

- **value**: a string.

Result

A new DOM text node is generated with the provided value and added as a child of the target object.

Example

```
<InnerText>"put content here..."</InnerText>
```

Special Property Names

There is no actual limitation on the way shape properties can be named. Stencil developers can choose the names that best describe the purpose of each property. There is however a list of special names that Pencil provides special support for. The following list summarizes those special names together with how they are handled in Pencil.

Property Name	Type	Pencil Supports
box	Dimension	Shapes with this special property are supposed to be resizeable. Pencil will support resizing the shape by showing scaling handles when it is focused on the drawing canvas. Moving those handles will change the box property value. The way the shape is scaled upon changes of this property is defined by the stencil developer via the behavior definition.
textFont	Font	Value of this property can be changed using the Font toolbar
textColor	Color	Value of this property can be changed using the Text color toolbar button
fillColor	Color	Value of this property can be changed using the Background color toolbar button
strokeColor	Color	Value of this property can be changed using the Line color toolbar button
strokeStyle	StrokeStyle	Value of this property can be changed using the Line style toolbar

CHAPTER 2

Developer Documentation

This section contains useful information for people interested in contributing code to Pencil.

If you'll be testing & debugging using Firefox, you will probably want to start off by setting up an extension development environment.

Code Overview

The application code lives under `app/content/pencil/`.

Many of the files directly under `app/content/pencil/` are pairs of UI definitions and their JavaScript files (e.g. `exportWizard.xul` and `exportWizard.js`)

`mainWindow.xul` & `common/pencil.js` are good places to start reading the code - they are responsible for initializing the application.

`mainWindow.xul` is responsible for specifying the application's base UI, including keybindings, menus, toolbars, panes, and for including the application's JavaScript-Files. `mainWindow.js` contains mostly helper functions used in the `.xul` file, along with post-boot code like parsing command-line arguments & building the `Recent Documents` menu.

`common/pencil.js` initializes a global `Pencil` object & sets up event listeners on boot-up. The `Pencil` object contains attributes linked to the application's Controller, Rasterizer, etc.

`common/controller.js` is responsible for managing the `Document` & it's `Pages`. The `Controller` object contains methods for creating new Documents/Pages, saving/loading Documents & moving/removing/duplicating Pages.

`common/utils.js` is a huge grab bag of randomness, from DOM & SVG manipulation to font sorting to creating temp files to grabbing images from the clipboard to getting a file's extension from it's path.

`bindings/` contains components like the color picker & font editor. `stencils/` contains the default Stencil Collections bundled with Pencil.

You should also reference the *Developer API Documentation*.

Code Style

Some things to keep in mind:

- Wrap lines longer than ~80 characters
- Indent using 4 spaces, never use tabs
- Always use the strict equality operators === and !==.
- Run jshint on the changed files(this might generate a lot of errors on some files).

Debugging

If you set the `DEBUG` environmental variable when building Pencil, the `build.sh` script will enable debugging features like printing calls to `dump()` to the console or `debug()` to the javascript console:

```
export DEBUG=true
cd build
./build.sh linux
# If you've got XULRunner:
xulrunner Outputs/Linux/application.ini -console -jsconsole -purgecaches
# If you only have Firefox installed:
firefox --app Outputs/Linux/application.ini -console -jsconsole -purgecaches
```

Setting `DEBUG` will cause also Pencil to start a remote debugging server on port `6000`. This lets you use Firefox's DOM Inspector to debug Pencil - but only when you run Pencil using `xulrunner`. You can connect Firefox to the debugging server by going to `Firefox -> Tools -> Web Developer -> Connect...`. You may need to enable Remote Debugging under Firefox's `Web Developer Tools` Settings(`Ctrl-Shift-I` then click the gear icon in the upper-right).

Writing Documentation

This documentation is built using Sphinx, which adds some extra flavor on top of reStructuredText. If you're unfamiliar with these tools a good starting point is the reStructuredText Primer, Sphinx Markup & JavaScript Domain pages in Sphinx's documentation.

The API documentation is generated by the Sphinx plugin autoanysrc. This parses all the comments in javascript files from the `/app/` directory. If a comment follows the form `/*""" docs here */`, autoanysrc will add the comment to the *Developer API Documentation* page. For example:

```
/*"""
Module/Section Name
===================

A description about the current file
*/
function SomeClass(arg) {
    /*"""
    .. class:: SomeClass(arg)

        A text description of the class

        :param string arg: The argument you must pass in when initializing
```

```
        .. attribute:: arg

            The argument passed to the constructor
    */
    this.arg = arg;
}
SomeClass.prototype.someFunction = function() {
    /*"""
     .. function:: someFunction(void) {

         :returns: something
    */
    return this.arg;
    }
}
```

Note that the dots for the `function` annotation should be indented by one space, so they line up with the `*` of the `/*`. This will create the proper nesting in the final documentation.

The Build System

The `build.sh` script is responsible for building everything. Each build is usually in two steps: copying & modifying files common to all builds then customizing those files for the specific build(by removing files, embedding xulrunner, creating the expected directory structure, etc.).

The build script uses the `properties.sh` file to hold variables such as the current version & the minimum/maximum firefox/xulrunner versions. The script uses `replacer.sh` to replace all instances of `@VARIABLE@` with the value of `VARIABLE` in the file passed to it.

If you add a variable to `properties.sh` you **must** modify the `replacer.sh` script to replace the variable. If you add a variable to a file, you **must** make sure that file is processed by `replacer.sh` at some point(usually in the `prep()` function).

`replacer.sh` uses the `sed-debug-script` to remove all the text between `//DEBUG_BEGIN` and `//DEBUG_END`. This can be used to enable code only when building for development. If you add `//DEBUG_BEGIN` and `//DEBUG_END` to a file, make sure `build.sh` passes the file to `replacer.sh``(again, this usually happens in the ``prep()` function).

You can pass the `clean` argument to `build.sh` to remove all the outputs. You can use `maintainer-clean` to remove any XULRunner downloads as well.

CHAPTER 3

Developer API Documentation

This section contains documentation on Pencil's internal API for Pencil's developers.

Controller

The *Controller()* is responsible for managing the Document & its Pages. It is usually accesed via the global *Pencil* object.

class Controller(*win*)

Arguments

- **win** – The window the controller should manipulate.

Controller.**mainView**
The Element containing the application's main display window.

The Controller object contains methods for creating new Documents/Pages, saving/loading Documents & moving/removing/duplicating Pages.

Pencil

Initializes a global Pencil namespace & sets up event listeners on boot.

class Pencil()

The Pencil namespace contains attributes linked to the application's Controller, Rasterizer, etc. as well as various helper functions.

Pencil.**controller**
A *Controller()* initialized from the XUL window.

Pencil.**getDocumentExporterById**(*id*)

Arguments

- **id** – The id of a DocumentExporter.

Returns The requested DocumentExporter or `null` if a matching DocumentExporter cannot be found.

`Pencil.`**`setPainterCommandChecked`**(*id*)

Arguments

- **v** – boolean; currently only as false; determines state of the format painter function.

Returns undefined

Side Effect: If passed value v is false, it deactivates the format painter tool (used for copying formats of stencils on canvas) Side Effect: If passed value v is false, it removes the painter class from all canvas ("pages" in the GUI) if passed value v is false.

Called on click on stencils on canvas or if the toolbarFormatPainterCommand button is clicked.

`Pencil.`**`setupCommands`**()

Activates & deactivates commands via the *`Pencil._enableCommand()`* function along with the ids of the `<command>` XUL Elements from `mainWindow.xul`.

Called e.g. if an element is selected in order to provide applicable commands.

Whether a command is activated or deactivated depends on the state of the application(if a document has been created, if there is an active `canvas` element, etc.) and the active element (e.g. a selected stencil)

`Pencil.`**`_enableCommand`**(*name*, *condition*)

Arguments

- **name** (*`string`*) – An `id` of a `<command>` XUL Element.
- **condition** (*`boolean`*) – Determines whether the command is activated or deactivated. A value of `true` activates the command.

CollectionManager

class `CollectionManager`()

A namespace responsible for loading and unloading Stencil Collections.

CHAPTER 4

Maintainer Documentation

This section contains some information that's useful for Pencil maintainers.

Creating a New Release

There's a `release.sh` script that lives in the `build/` directory. This script automates:

1. Creating a release branch
2. Updating the version number
3. Sectioning off the changelog
4. Updating distribution-specific files
5. Creating a release commit & tag
6. Pushing the branch to origin
7. Creating a release on Github
8. Uploading the built packages to the Github release

You will need `git`, `curl`, `sed` and `jshon`. Then you can just pass the new version number to the script:

```
cd build
./release.sh 2.4.42
```

Once the script is complete, you will have to manually merge the release branch into the `master` and `develop` branches, then delete the release branch:

```
git checkout master
git merge release-v2.4.42
git push origin
git checkout develop
git merge release-v2.4.42
git push origin
```

```
git push origin :release-v2.4.42
git branch -d release-v2.4.42
```

CHAPTER 5

Indices and tables

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