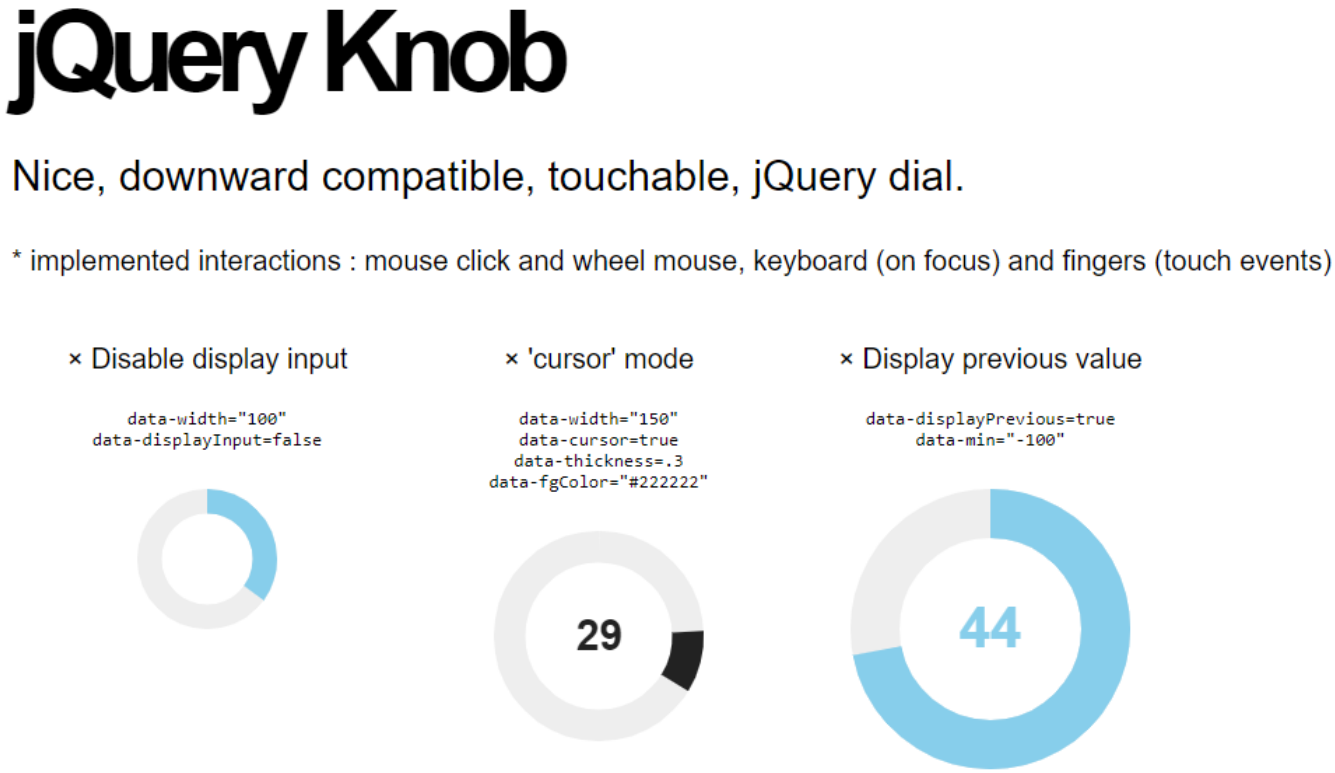
Integrating widgets for simulation

After you find any interesting widgets, please follow the steps below to integrate them for simulation. A free widget, named jQuery Knob, will be used in this demonstration. This widget can be found and downloaded via this link.



The jQuery Knob widget.

To integrate widgets for simulation

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1. See what information is needed to create the widget, e.g., the jQuery Knob widget needs an input element, scripts, and jQuery Knob library, as displayed below.

   Code example from https://github.com/aterrien/jQuery-Knob

   ```
   <input type="text" value="75" class="dial">

   <script>
           $(function() {
                   $(".dial").knob();
       });
   </script>
   ```

2. Create a **widget.HTML** file with the content below.

widget.HTML

```
<!doctype html>
<html>
        <head>
                <title>@title@</title>
        </head>

        <body class="widget" paths="@paths@">
        </body>
</html>
```

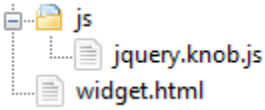
Information

- **class="widget"** informs the simulation web server that this file is widget.
- **paths="@paths@"** is used for generating HTML code from the widget, and the simulation web server will use the value of the paths attribute to register for value change.

Note

@**title**@ can be optionally replaced with any title. It is a predefined variable in simulation which will be replaced by the property name whose type is of this widget.

3. Create a new **js** folder. Copy the jQuery Knob library to the created **js** folder.



Note

Different widgets require different numbers of jQuery library files, including CSS files. Please ensure that you copy and include all those files.

4. Import required jQuery libraries and CSS files, if any, to the HTML head element, and add the widget code to the body element, as shown below.

widget.HTML

```
<!doctype html>
<html>
        <head>
                <title>@title@</title>

                <script type="text/javascript" src="js/jquery.knob.js"></script>
        </head>

        <body class="widget" paths="@paths@">
                <input type="text" class="dial">

                <script>
                        $(function(){
                                $(".dial").knob();
                        });
                </script>
        </body>
</html>
```

5. Because this widget requires the jQuery library, it needs to also import the jQuery library before the widget import statement. Alternatively, the @**scripts**@ predefined variable can be used so that simulation will generate jQuery files and replace this variable with jQuery import statements. In addition, the @**simulation_js**@ predefined variable must be added as the last import statement in the head element because simulation will replace this variable with the core simulation javascript import statement. See the code below for the detail in this step.

widget.HTML

```
<!doctype html>
<html>
        <head>
                <title>@title@</title>

                @scripts@
                <script type="text/javascript" src="js/jquery.knob.js"></script>
                @simulation_js@
        </head>

        <body class="widget" paths="@paths@">
                <input type="text" class="dial">

                <script>
                        $(function(){
                                $(".dial").knob();
                        });
                </script>
        </body>
</html>
```

6. Add the following attributes to the widget element, where the value of the **paths** attribute is the name of a property/Port that will be used as input /output in simulation.

```
runtime="true" pathType="widget" paths="value"
```

Apply the added attributes to the widget element as shown below.

widget.HTML

```
<!doctype html>
<html>
        <head>
                <title>@title@</title>

                @scripts@
                <script type="text/javascript" src="js/jquery.knob.js"></script>
                @simulation_js@
        </head>

        <body class="widget" paths="@paths@">
                <input type="text" class="dial" runtime="true" pathType="widget" paths="value">

                <script>
                        $(function(){
                                $(".dial").knob();
                        });
                </script>
        </body>
</html>
```

7. If the widget can be used as an output to display a value from simulation, you can override the **customSetHTMLValue** method and set the widget value in the overridden method, e.g., the jQuery Knob widget sets the value by using the following code.

Code example from https://github.com/aterrien/jQuery-Knob

```
<script>
    $('.dial')
        .val(27)
        .trigger('change');
</script>
```

It can then be integrated for simulation as follows.

widget.HTML

```
<!doctype html>
<html>
        <head>
                <title>@title@</title>

                @scripts@
                <script type="text/javascript" src="js/jquery.knob.js"></script>
                @simulation_js@
        </head>

        <body class="widget" paths="@paths@">
                <input type="text" class="dial" runtime="true" pathType="widget" paths="value">

                <script>
                        $(function(){
                                $(".dial").knob();
                        });

                        /**
                        * This method will be called when a value of the widget element is changed.
                        * @param item is an element with matching attribute paths in the body and the
element itself.
                        * @param data represents a new value.
                        * @param formattedValue indicates a new value formatted by the simulation web
server.
                        */

                        function customSetHTMLValue(item, data, formattedValue) {
                                if ($(item).is($(".dial"))) {
                                        $(item).val(data).trigger('change');
                                }
                        }
                </script>
        </body>
</html>
```

Note

The line of code shown below is needed to prevent the **customSetHTMLValue** method from being called when there is a value change from any other widgets with the same property paths. The following line of code checks if the updating widget (the **item** parameter), is the same element as this Knob widget.

```
if ($(item).is($(".dial"))) {
```

8. If the widget can be used as an input to change simulation value, you can call the **doSetWidgetValue** method when the widget changes the value, e.g., the jQuery Knob widget has a hook to tell when the value is changed, as demonstrated below.

Code example from https://github.com/aterrien/jQuery-Knob

```
<input type="text" value="75" class="dial">

<script>
    $(".dial").knob({
        'change' : function (v) { console.log(v); }
    });
</script>
```

This is integrated for simulation as following.

widget.HTML

```
<!doctype html>
<html>
        <head>
                <title>@title@</title>

                @scripts@
                <script type="text/javascript" src="js/jquery.knob.js"></script>
                @simulation_js@
        </head>

        <body class="widget" paths="@paths@">
                <input type="text" class="dial" runtime="true" pathType="widget" paths="value">

                <script>
                        $(function() {
                                $(".dial").knob({
                                        'release' : function(value) {
                                                //call the doSetWidgetValue method to set a simulation
value.
                                                doSetWidgetValue($(".dial"), value);
                                        }
                                });
                        });

                        /**
                        * This method will be called when a value of the widget element is changed.
                        * @param item is an element with matching attribute paths in the body and the
element itself.
                        * @param data represents a new value.
                        * @param formattedValue indicates a new value formatted by the simulation web
server.
                        */

                        function customSetHTMLValue(item, data, formattedValue) {
                                if ($(item).is($(".dial"))) {
                                        $(item).val(data).trigger('change');
                                }
                        }
                </script>
        </body>
</html>
```

9. If the widget has options, these options can be modified to customize in the widget Class in MagicDraw, e.g., the jQuery Knob widget has the **min** and **max** options in the code below.

Code example from https://github.com/aterrien/jQuery-Knob

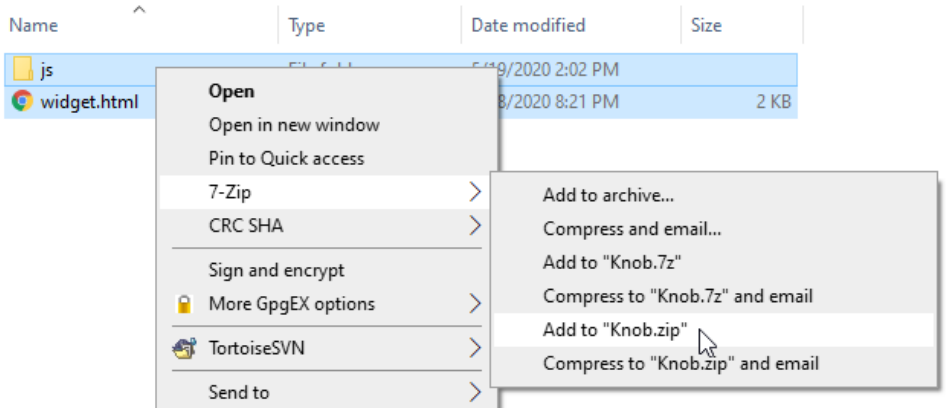
```
$(".dial").knob({
    'min':-50,
    'max':50
});
```

When integrated for simulation, the value for each option can be defined by using the **$widget_property$** format, where **widget_property** is the name of a property owned by the widget Class in MagicDraw as shown below.

widget.HTML

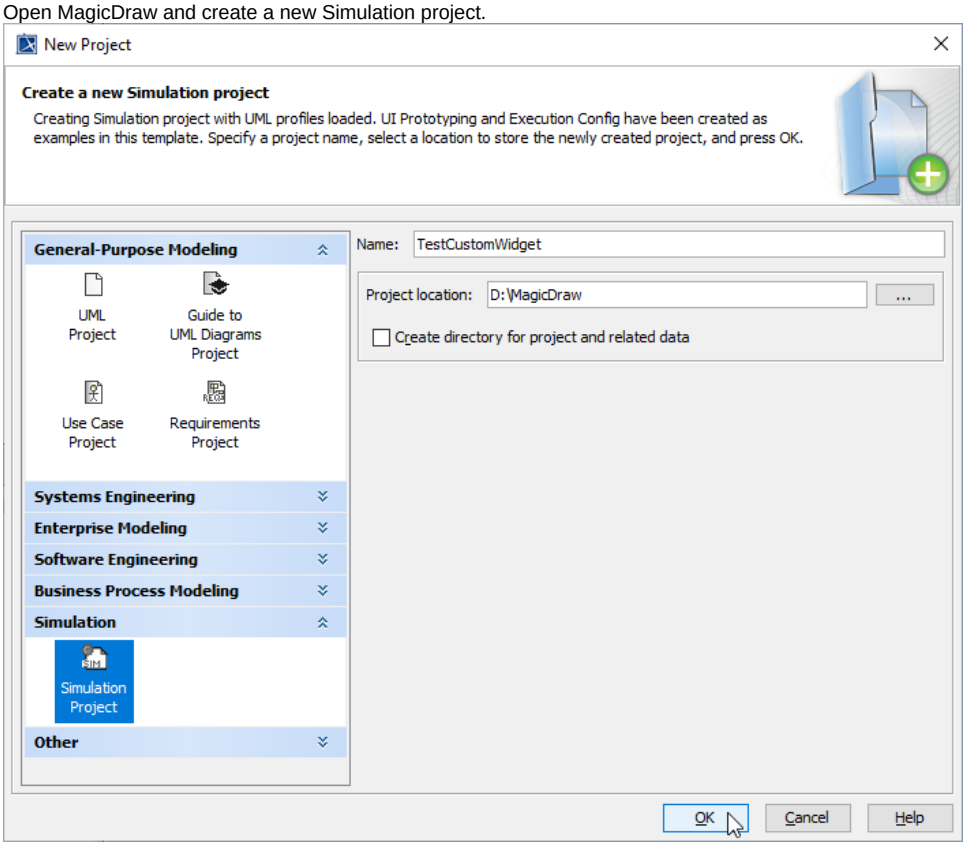
```
<!doctype html>
<html>
        <head>
                <title>@title@</title>

                @scripts@
                <script type="text/javascript" src="js/jquery.knob.js"></script>
                @simulation_js@
        </head>

        <body class="widget" paths="@paths@">
                <input type="text" class="dial" runtime="true" pathType="widget" paths="value">

                <script>
                        $(function(){
                                $(".dial").knob({
                                        'min' : $min$,
                                        'max' : $max$,
                                        'release' : function(value) {
                                                //call the doSetWidgetValue method to set simulation
value.
                                                doSetWidgetValue($(".dial"), value);
                                        }
                                });
                        });

                        /**
                        * This method will be called when a value of the widget element is changed.
                        * @param item is an element with matching attribute paths in the body and the
element itself.
                        * @param data represents a new value.
                        * @param formattedValue indicates a new value formatted by the simulation web
server.
                        */

                        function customSetHTMLValue(item, data, formattedValue) {
                                if ($(item).is($(".dial"))) {
                                        $(item).val(data).trigger('change');
                                }
                        }
                </script>
        </body>
</html>
```

10. Archive the **widget.HTML** file and the **js** folder into a zip file.



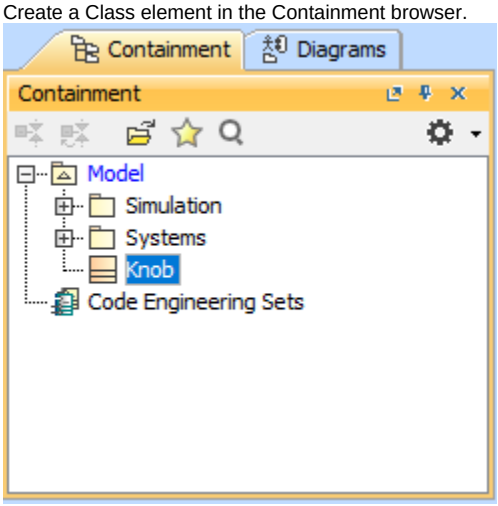
> **Note**
>
> The **widget.HTML** file and all related resources must be archived into a zip file and the **widget.HTML** file must be the root directory of the zip file.

11. Open MagicDraw and create a new Simulation project.

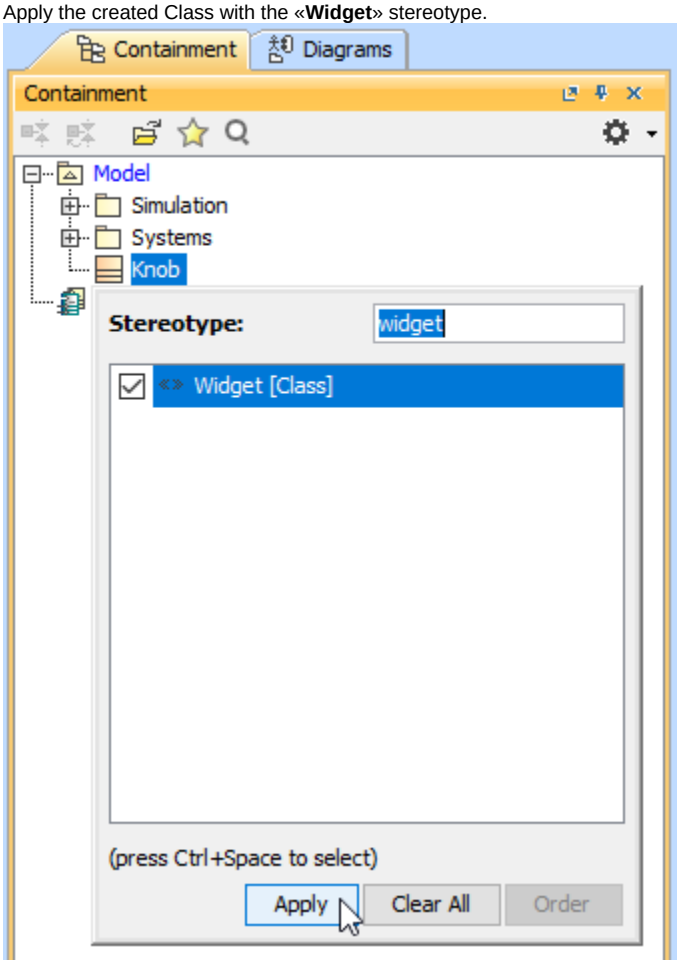


> **Information**
>
> You can also create other kinds of project, but you need to use the Simulation profile in your created project before proceeding to the next steps.

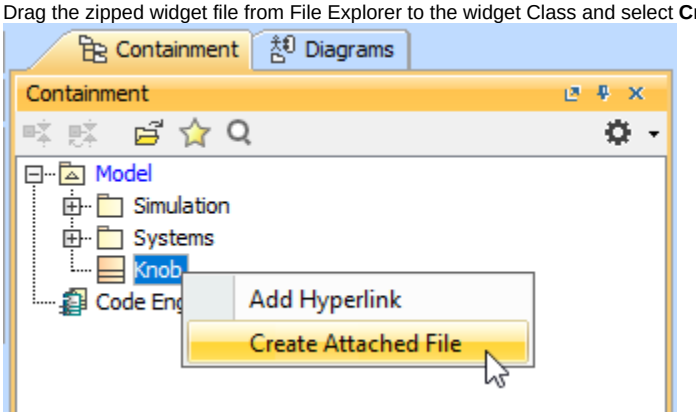
12. Create a Class element in the Containment browser.



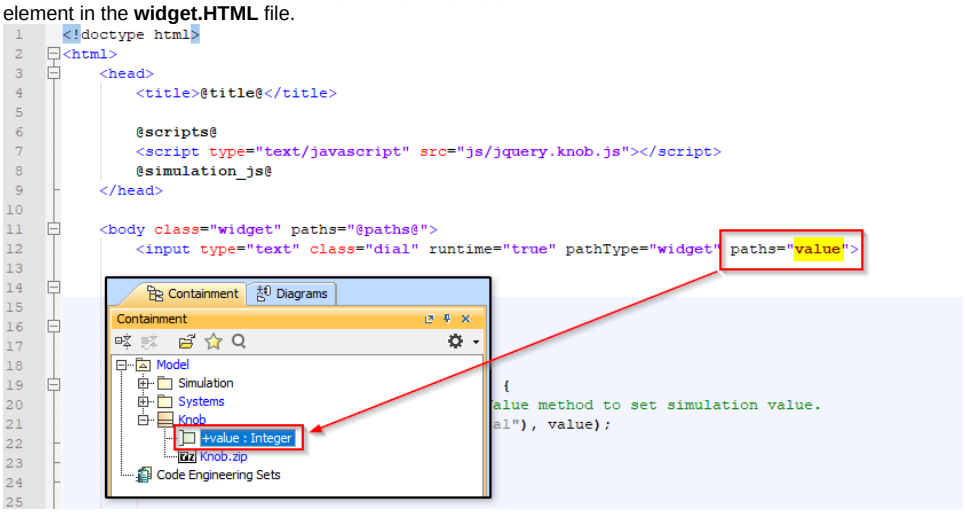
13. Apply the created Class with the «**Widget**» stereotype.



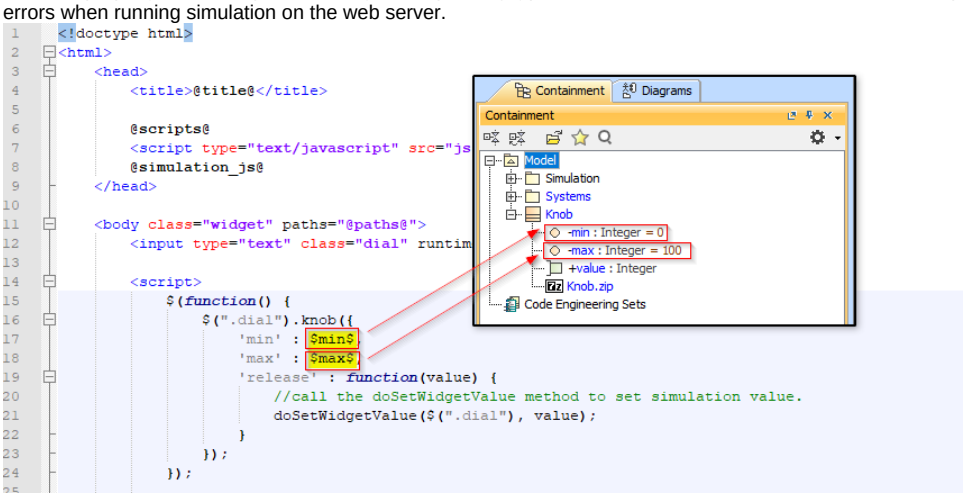
14. Drag the zipped widget file from File Explorer to the widget Class and select **Create Attached File**.



15. Create a Port element with any corresponding widget type. The name of the Port must match the value of the **paths** attribute of the widget element in the **widget.HTML** file.

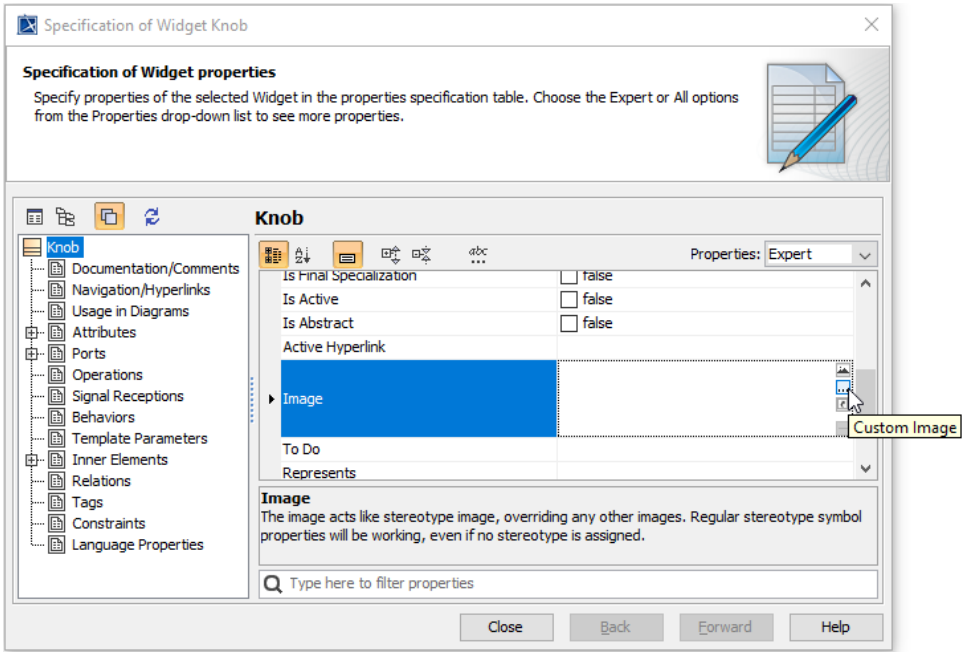


16. Create a property for each option with any corresponding type. Also, the default value must be set for each property to prevent javascript syntax errors when running simulation on the web server.

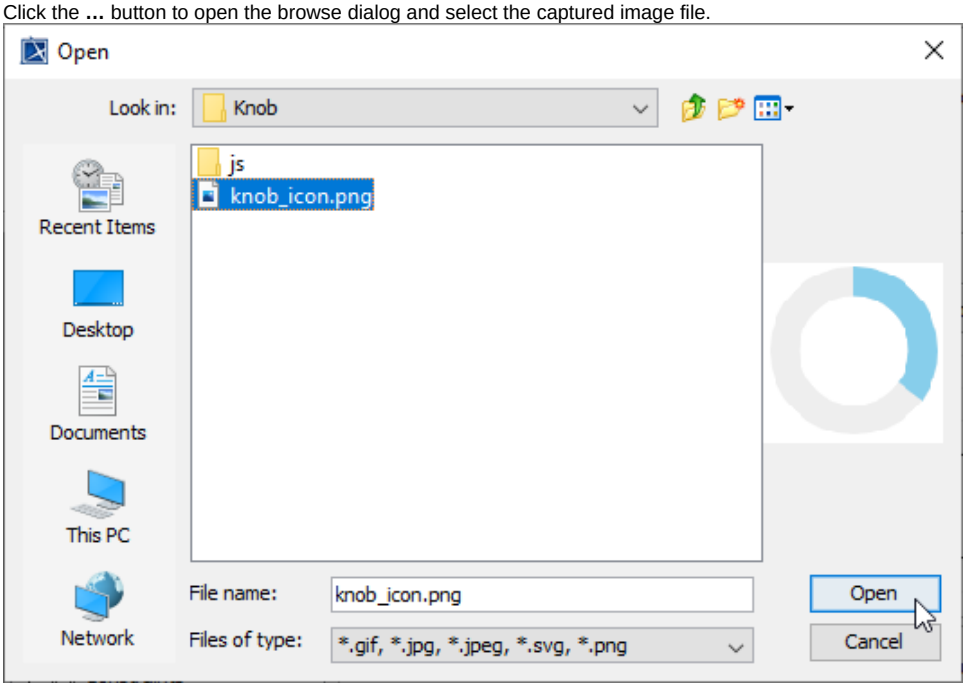


17. Capture the screen of jQuery Knob on the jQuery Knob Web site and save it as an image to be used as the icon of the widget Class.

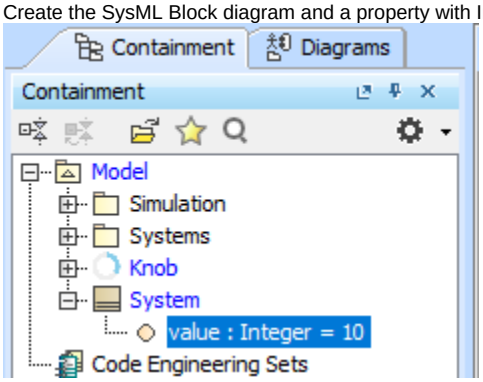
18. Open the Specification dialog of the widget Class. Find and select the value field of the **Image** property to set an icon for the widget Class.



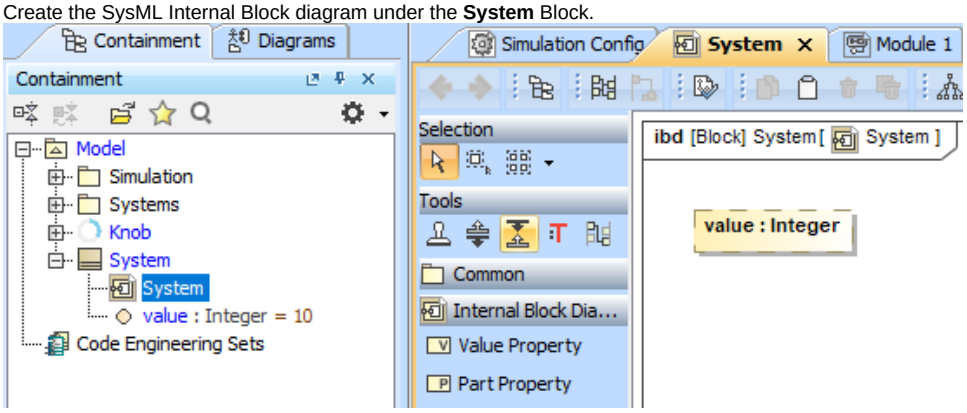
19. Click the **...** button to open the browse dialog and select the captured image file.



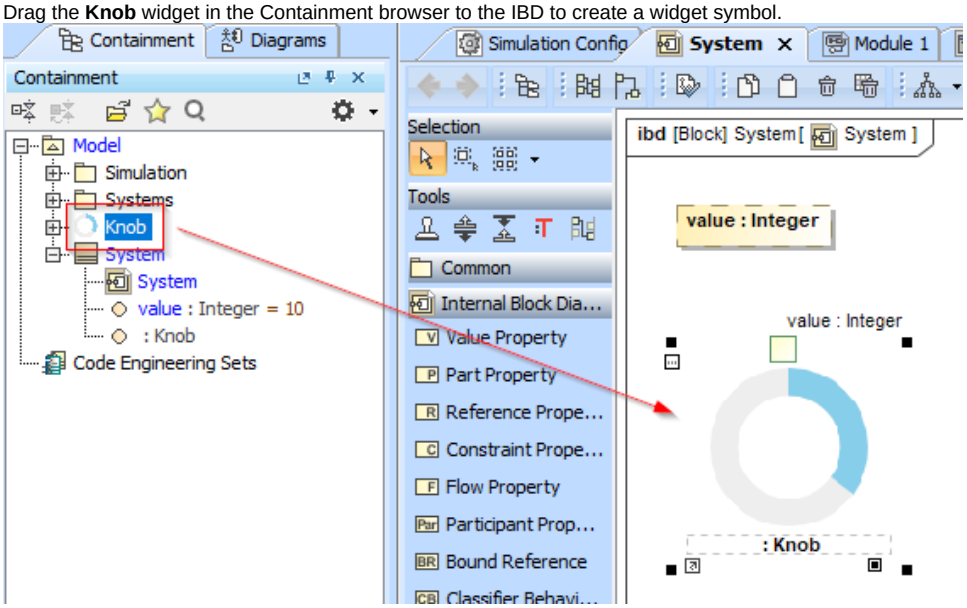
20. Create the SysML Block diagram and a property with Integer as type, and specify 10 as the default value, as illustrated below.



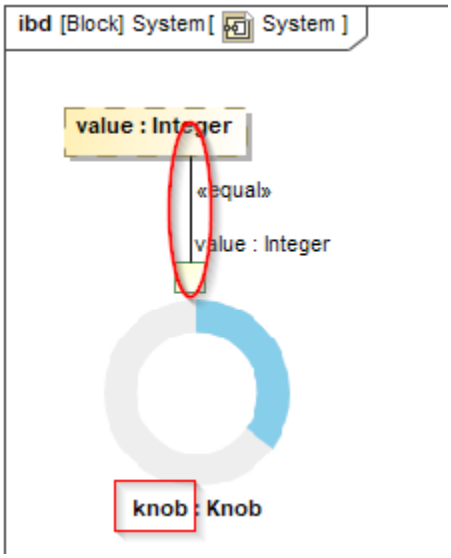
21. Create the SysML Internal Block diagram under the **System** Block.



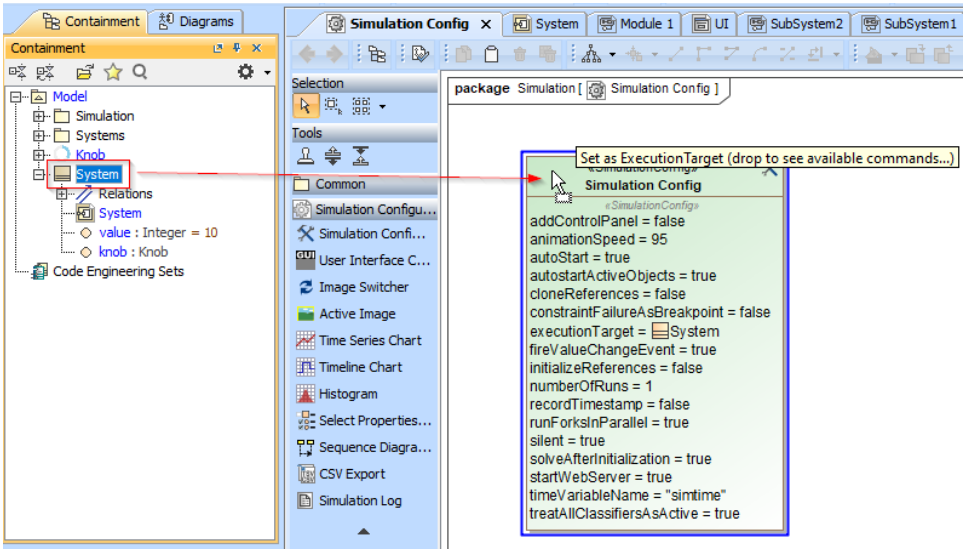
22. Drag the **Knob** widget in the Containment browser to the IBD to create a widget symbol.



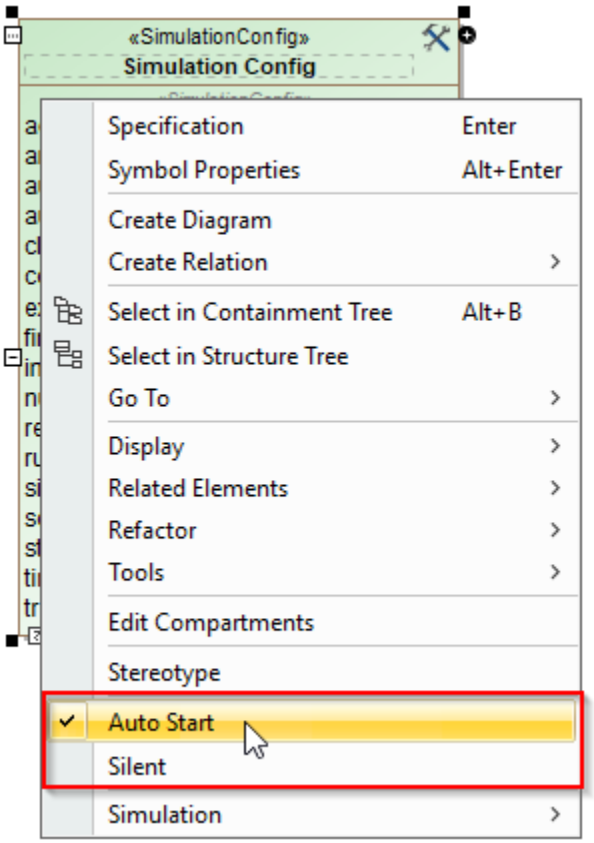
23. Specify a name for the widget property and create a binding Connector between the **value** Port of the widget and the **value** property.



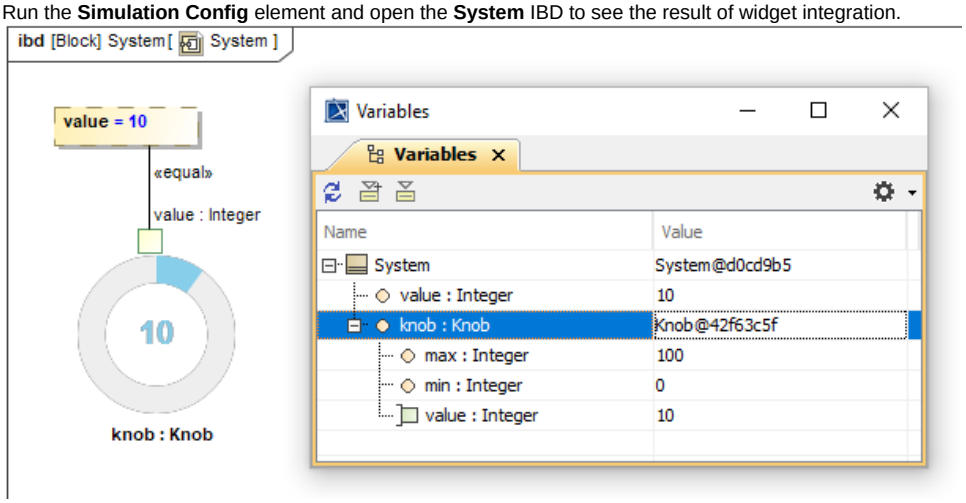
24. Open the Simulation Config diagram. Drag the **System** Block in the Containment browser to the **Simulation Config** element to set as the execution target.



25. Right-click the **Simulation Config** element. Set the **Auto Start** option as **true** and the **Silent** option as **false**. Also make sure that the **startWebSe rver** option is set **true**.



26. Run the **Simulation Config** element and open the **System** IBD to see the result of widget integration.



Predefined variables

The table below explains how predefined variables will be replaced when widget files are generated.

Variable name	Resolved text after generating widgets
@title@	A name of the Part property representing the widget.
@scripts@	Predefined javascript import statements: **<script type="text/javascript" src="js/jquery-1.12.4.min.js"></script>** **<script type="text/javascript" src="js/jquery-ui-1.12.0.min.js"></script>**
@simulation_js@	Core simulation javascript import statement: **<script type="text/javascript" src="js/Simulation.js"></script>**
@paths@	Auto-generated paths to the widget.
$widget_property$	**widget_property** as the name of a property, owned by the widget Class in MagicDraw. This variable will be replaced by the default value of the property or the slot value of the widget instance.