

Introduction to QML for Web developers

QML is a **declarative language**, part of [Qt Quick](#), that allows describe how a UI looks and behaves with a JavaScript-based syntax.

Web developers who want approach QML will find a lot of common points between the two worlds: both QML and Web development are based on **declarative programming languages**, and in both worlds **JavaScript is used to specify how the UI behaves**.



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This article compares and contrasts [QML](#) and Web development technologies such as [HTML](#), and in doing so illustrates techniques for porting between Web and QML.

Note: this is a work in progress

UI Elements

Just like Web developers use HTML elements, QML is based on a **set of UI elements** that allow to build User Interfaces in a declarative manner.

All QML UI elements inherit from [Item](#). Just like an HTML node, a QML element is a rectangle with a given size, accessible through its [width](#) and [height](#) properties. Also, just like a classical HTML element, a QML element may have one parent and more children elements.

A QML document has a root element, just like the `<html>` root element for HTML documents, but differently from HTML the QML root element can be any of the available [Items](#).

Non visual elements

Differently from HTML, QML allows to specify non visual elements as part of the QML document. Examples of non-visual elements are: [Timer](#), [Connection](#), [FontLoader](#). Non-visual elements are useful to add behavior to the QML document without writing JavaScript code.

Defining new UI Elements

Differently from HTML, QML allows to define custom reusable UI elements (called [Components](#)). Components can be defined in two different manners:

- defined in an external `.qml` file named with the Component's name (for instance, "MyNewComponent.qml"). Each Component is a self-contained QML document, and can be used just like any other QML element by:
 - importing it where it needs to be used
 - using the file name as the Component's name
- defined inline, within the QML document that wants to use it. In this case, Components are defined through the [Component](#) element, and are used by the container QML document via its own id.

More information about the writing of new QML components can be found [here](#).

Quick hints

- QML, apart from the [TextEdit](#) and [TextInput](#) elements, does not provide support for data entry elements. However their are platform specific libraries of components for Symbian/Meego.
- The [WebView](#) element loads and displays complete HTML pages, in a manner similar to HTML IFrames.

Arranging UI Elements

HTML allows to position a UI element via various CSS properties, including: [top/right/bottom/left](#), [position](#), [float](#), [display](#) and many more.

On the other side, QML offers different ways to position a UI element:

- with an anchor-based method
- using [Positioner Items](#)
- using explicit x and y coordinates

Differently from HTML, where nodes are automatically arranged according to other nodes and to their nature (for instance, if "block" or "inline" nodes), QML elements are by default placed one above the other: for this reason, it is usually necessary to use one of the methods described here to arrange elements in an appropriate manner. Also, using one of the described methods excludes the others: for instance, anchoring a node to another and defining x/y coordinates brings to unexpected results.

Anchor-based Layout

A QML element can be anchored to its siblings or to its parent element thanks to the anchor properties: anchoring an element to another means aligning one or more of its anchor lines to the anchors lines of another element. The available anchors lines are: [top](#), [right](#), [bottom](#), [left](#), [horizontalCenter](#), [verticalCenter](#) and [baseline](#).

When anchoring an element to another, it is possible to define margins for each anchor ([top](#), [right](#), [bottom](#), [left](#)), similarly to the margin-top, margin-right, margin-bottom and margin-left CSS properties. Anchor margins are specified in pixels.

More information about anchors-based layouts can be found [here](#).

Using Positioner Items

Positioners are special containers that automatically arrange the position and size of their children Items. QML defines four different types of Positioner:

- **Column**: places children in a column, just as with **HTML block nodes** (placed one under the other)
- **Row**: places children in a row
- **Grid**: places children in a grid, just like an **HTML Table**
- **Flow**: places children as words of a text, one after the other. Using a Flow Positioner is similar to using the **CSS float property**

More information about Positioners can be found [here](#).

Using X and Y coordinates

The x and y coordinates are similar to the CSS left and top properties. Differently from what happens with CSS, the QML x and y properties are always relative to the Item's parent: so, there's no inbuilt property that allows to specify an absolute position or a fixed position.

More information about the usage of x and y coordinates can be found [here](#).

Styling the UI

QML does not offer a CSS-like way of defining the appearance of UI elements. Instead, a set of element properties can be used for this task.

The Item element defines a common set of properties that are shared by all UI elements (as all elements inherit from Item):

- **clip**: can assume true and false values. If true, its content is clipped to its bounding rectangle, just like with the **overflow: hidden** CSS rule. If false, no clipping is performed, just as with the **overflow: visible** CSS rule. There is no inbuilt method to achieve an effect similar to the **overflow: auto** CSS rule.
- **opacity**: defines the opacity of the element, assuming values between 0.0 and 1.0. It is equivalent to the **opacity CSS property**.
- **scale**, **rotation**, **transform**: these properties allow to apply scale, rotation and translation transformation to the element

Different elements also define different properties that that are specific to those elements. The most important element and properties are listed below:

- **Rectangle**
 - **color**: defines a background [color](#) for the Rectangle
 - **gradient**: defines a [Gradient](#) that fills the Rectangle
 - **border.color**: defines the border's background [color](#)
 - **border.width**: defines the border's width
- **Text**, **TextEdit**, **TextInput**
 - **color**: defines the text [color](#)
 - **font.family**: defines the font family used for the text
 - **font.pointSize** and **font.pixelSize**: allow to define the font size in points and pixels

Quick hint

- To display an element (for instance, an Image) with a border and/or with a colored background, use a [Rectangle](#) containing the desired element

UI Manipulation

Just like an HTML node, a QML document can be represented as a tree of elements, where each element has zero or more child elements. An element can be directly referred by using its own id. So, instead of writing:

```
var element = document.getElementById("myElementId");
```

QML allows to write:

```
var element = myElementId;
```

Accessing the children of a given elements differs depending on the nature of the children: visual children element are accessible through the [children](#) property, while non-visual children elements are accessible through the [resources](#) property. To access both visual and non-visual children at the same time, the [data](#) property can be used.

The parent of an element can be accessed through its [parent](#) property.

Dynamic elements creation

Elements can be dynamically created in two different ways:

- Using the `Qt.createComponent()` function: this method behaves in a manner similar to the `document.createElement()` DOM function, allowing to create an element of a given type. While the DOM function accepts the node name as argument, the `Qt.createComponent` function accepts the path of the Component that must be loaded
- Using the `Qt.createQmlObject()` function: this function accepts a string of QML as first argument, builds the related QML structure and appends that to the specified parent node. This approach is then similar to the DOM node's `innerHTML` property.

Removing an element can be performed via its `destroy()` JavaScript function: **only dynamically created elements can be destroyed.**

More information about dynamic object management can be found [here](#).

The JavaScript side

Just like with Web development, QML allows to use JavaScript to add advanced behavior to a QML application. JavaScript code can be defined within the QML document, or in external JavaScript files. When importing an external JavaScript file, a qualifier must be used:

```
import "MyLibrary.js" as LibraryName
```

All variables and functions belonging to the imported file will be accessible through the specified qualifier:

```
Item {  
    width: LibraryName.myProperty  
    onClicked: LibraryName.myFunction()  
}
```

Animations

While in the Web environment animations are usually performed by the periodic update of CSS properties (for instance, `x`, `y`, `opacity`), QML offers a greater support to create complex transitions with plain declarative QML.

Animations in QML can be implemented using several approaches, including:

- **PropertyAnimation** elements - allow to specify which property values must be updated, the duration and the easing to be applied to the animation
- **Behavior** elements - allow to specify how a property value should be animated when its value is changed
- **State changes** together with **Transition** elements - **State** elements define the value of a set of properties, allowing their value to be updated at once when the specific **State** is applied. **Transition** can be applied to **State** changes to animate the property value's changes.

Quick Hints

- There is no window or document object
- No global properties can be defined: all variables and functions must be locally defined, and belong to their local scope
- Due to the different environments, JavaScript frameworks intended for the Web are usually not compatible with QML
- The `setTimeout()` and `setInterval()` JavaScript functions are not supported: use **Timer** elements instead
- The **XMLHttpRequest** object is supported, and can be used to retrieve data from the network (note that synchronous mode is not supported)

More information about JavaScript usage in QML applications can be found [here](#)

