

## Developer Guide: Design Studio SDK



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# 1 About This Guide

## 1.1 Who Should Read This Guide?

This guide is intended for developers.

## 1.2 What is the Design Studio SDK?

The Design Studio SDK is a Software Development Kit that allows developers to develop 3rd party components, known as SDK extensions. Application designers can enhance their analysis applications using these custom components, as well as the standard palette of components in SAP BusinessObjects Design Studio. You can store and provide access to the analysis applications, which contain 3rd party components, on the BI platform, SAP NetWeaver, or SAP HANA.

### **i** Note

You can also create new chart types using the SAP Lumira SDK. These chart types are also known as CVOM chart extensions. Application designers can use them together with the components created with the Design Studio SDK and the standard components of SAP BusinessObjects Design Studio in their analysis applications. You can store and provide access to the analysis applications containing CVOM chart extensions on the BI platform and SAP NetWeaver. For more information about creating CVOM chart extensions using the SAP Lumira SDK, see the *SAP Lumira Visualization Extensions Developer Guide* on SAP Help Portal at <http://help.sap.com/lumira>.

## 2 Introduction to SDK Concepts

### 2.1 SDK Extensions

SDK extensions contain extension components, which are custom components developed by partners and customers. From a technical point of view, an SDK extension is an Eclipse plug-in (a ZIP archive with a predefined structure), which contains in particular the following files:

Table 1:

File	required/optional	Description
Contribution XML file	required	Defines the SDK extension and its extension components
Component JavaScript file	optional	Implements an extension component's functional behavior (this includes creating its visual appearance)
Component CSS file	optional	Defines a Cascading Style Sheet (CSS) for an extension component
Icon file	optional	Represents an extension component's icon (16 x 16 pixels)
Script Contribution file	optional	Implements the methods that extension components contribute to the Design Studio script editor
Additional Properties Sheet HTML file	optional	Implements the visual appearance of an extension component's Additional Properties Sheet
Additional Properties Sheet JavaScript file	optional	Implements the functional behavior of an extension component's Additional Properties Sheet

### 2.2 Client-Server Architecture

Design Studio standard and extension components use a client-server architecture. The JavaScript code you develop for an extension component runs in the browser (client) and at the same time there is also a generic implementation for extension components on the back end (server).

Design Studio scripts can only access property values of an extension component that are stored on the server. Therefore, whenever users of an extension component change a property value of this extension component in the browser (for example, by entering text into an input field of the extension component), you have to make sure that this change is sent to the server. You can do this by calling the SDK framework function `firePropertiesChanged` in the extension component's Component JavaScript.

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## Related Information

[Events \[page 35\]](#)

## 2.3 Restrictions

Extension components behave like standard components with the following restrictions:

- They cannot act as container components.
- They cannot use all available property types; they are restricted to a subset of property types.
- They cannot use large result sets.

### Note

The default limit is 10,000 data cells per data-bound property. You can adjust this limit.

- They cannot extend standard components (standard components are technically different from extension components).

---

## 3 Creating an SDK Extension

### 3.1 Getting Started

You can create an SDK extension using any XML and JavaScript editor. However, we recommend Eclipse as an integrated development environment (IDE). This makes SDK extension development much easier. You can create an SDK extension with the Eclipse IDE and test it by launching SAP BusinessObjects Design Studio from the Eclipse IDE. When launched, SAP BusinessObjects Design Studio will automatically contain the SDK extension that you have developed.

#### 3.1.1 Prerequisites

- You have installed SAP BusinessObjects Design Studio 1.5 (64-bit).
- You have basic knowledge of SAP BusinessObjects Design Studio concepts.
- You have installed the Java Development Kit 7 (or higher) (64-bit). You can download the JDK 7 (64-bit) from the Oracle Website.
- You have solid knowledge of HTML and JavaScript. Knowledge of CSS and the jQuery JavaScript framework is very helpful.

#### 3.1.2 Extracting the Design Studio SDK Samples and Templates ZIP File

##### Procedure

1. Download the *Design Studio SDK Templates and Samples* on SAP Help Portal at <http://help.sap.com/board>.
2. Extract the downloaded file to a folder, for example C:\ds\_sdk.

## 3.1.3 Installing the Eclipse IDE

### Procedure

1. Download *Eclipse IDE for Java EE Developers (64 bit)* from [download.eclipse.org](http://download.eclipse.org).

This edition contains the tools needed to work with the SDK, for example, Plugin Development Tools, XML Editor and JavaScript tools.

#### Caution

Make sure that you only download this Eclipse version. Other versions, especially 32-bit versions, may not work correctly with the Design Studio SDK.

2. Extract the downloaded file to a folder.
3. Locate and run the file `eclipse.exe`.
4. Close the welcome page.
5. Create a workspace, for example `C:\ds_sdk_workspace`.

The workspace will contain all your SDK extension projects and the Eclipse IDE settings.

## 3.1.4 Registering the Design Studio SDK XML Schema Definition

### Procedure

1. Choose **Window** > **Preferences**.
2. In the **Preferences** dialog box, choose **XML** > **XML catalog**.
3. Choose **Add...**
4. In the **Add XML Catalog Element** dialog box, choose **File System...**
5. Navigate to file `sdk.xsd` in your SDK Templates and Samples folder, for example `C:\ds_sdk\sdk.xsd`.
6. Choose **OK** twice.

## 3.1.5 Importing a Sample SDK Extension

### Procedure

1. Choose **File** > **Import**.
2. In the **Import** dialog box, choose **General** > **Existing Projects into Workspace**.
3. Choose **Next**.
4. Under **Select root directory**, choose **Browse...**
5. Select the SDK Templates and Samples folder, for example `C:\ds_sdk`.
6. Select sample SDK extension `com.sap.sample.coloredbox`.
7. Select the **Copy projects into Workspace** checkbox.
8. Choose **Finish**.


## 3.1.6 Setting the Target Platform

### Context

The target platform points to your SAP BusinessObjects Design Studio installation. This enables your Eclipse IDE to access the SDK framework included with SAP BusinessObjects Design Studio.


The default installation path for SAP BusinessObjects Design Studio is `C:\Program Files\SAP BusinessObjects\Design Studio`.

- If you have installed SAP BusinessObjects Design Studio in the default folder, follow these steps:
  1. Choose **Window** > **Preferences**.
  2. In the **Preferences** dialog box, choose **Plug-In Development** > **Target Platform**.
  3. Select the checkbox next to the list entry `designstudio`.
  4. Choose **OK**.
  5. Choose **Project** > **Clean**.
  6. Choose **Clean all projects**.
  7. Choose **OK**.  
This removes all error markers.
- If you have not installed SAP BusinessObjects Design Studio in the default folder, follow these steps:
  1. Choose **Window** > **Preferences**.
  2. In the **Preferences** dialog box, choose **Plug-In Development** > **Target Platform**.
  3. Select the checkbox next to the list entry `designstudio`.
  4. Choose **Edit**.
  5. Choose the **Definition** tab.

6. Choose [Add...](#)
7. Choose [Directory](#) and then choose [Next](#).
8. Choose [Browse...](#) and select the folder of your SAP BusinessObjects Design Studio installation that contains the file `SapDesignStudio.exe`.
9. Choose [OK](#).  
A new folder appears in the [Locations](#) list.
10. Delete the list entry with the red error marker.
11. Save your changes.
12. Choose [Project](#) [Clean](#) .
13. Choose [Clean all projects](#).
14. Choose [OK](#).  
This removes all error markers.

## 3.1.7 Testing a Sample SDK Extension

### Procedure

1. The first time you test a sample SDK extension in your Eclipse IDE, create a Launch Configuration:
  - a. In the Eclipse IDE, choose menu item [Run](#) [Run Configurations...](#) .
  - b. Double-click [Eclipse Application](#) on the left.
  - c. In input field [Name](#), enter **SDK**.
  - d. Click the [Main](#) tab.
  - e. In group [Program to Run](#), choose [Run a product](#) and verify that the text in the adjacent input field reads [com.sap.ip.bi.zen](#).
  - f. Click the [Arguments](#) tab.
  - g. In input field [VM arguments](#), enter:

```
-Xmx1024m
-Xms256m
-XX:PermSize=32m
-XX:MaxPermSize=512m
```
  - h. Choose [Apply](#), then choose [Close](#).
  - i. Choose the [Organize Favorites...](#) menu item in the toolbar in the [Run](#) popdown (triangle to the right of the green [Play](#) button).
  - j. Choose [Add...](#)
  - k. Add **SDK**.
  - l. Close all dialog boxes with [OK](#).
2. Choose the **SDK** menu item in the Eclipse IDE toolbar in the [Run](#) popdown (triangle to the right of the green [Play](#) button).

SAP BusinessObjects Design Studio starts. The [Components](#) view contains the extension component [Colored Box](#).

### Note

If a message is displayed after you start SAP BusinessObjects Design Studio informing you that Internet Explorer does not have the required version, add the following registry key to your system:

- Windows (32-bit version):  
`[HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Internet Explorer\MAIN\FeatureControl\FEATURE_BROWSER_EMULATION] "javaw.exe"=dword:00002328`
- Windows (64-bit version):  
`[HKEY_LOCAL_MACHINE\SOFTWARE\Wow6432Node\Microsoft\Internet Explorer\MAIN\FeatureControl\FEATURE_BROWSER_EMULATION] "javaw.exe"=dword:00002328`

Your system contains registry key `Security_HKLM_only`. Adding the above registry key forces all `javaw.exe` processes on your system (such as SAP BusinessObjects Design Studio) to run the Internet Explorer control in the required IE9 mode.

### Note

If you are using Windows 8.x and a 64-bit Eclipse IDE, and the message *no sapjco3 in java.library.path* appears when you launch an application from your Eclipse IDE, follow these steps:

1. Navigate to the SAP BusinessObjects Design Studio installation folder, for example `C:\Program Files\SAP BusinessObjects\Design Studio`.
2. In the `plugins` folder, locate the file `com.sap.conn.jco.win32.x86_64_XXX.jar`.
3. Copy this file to a temporary location.
4. Change the extension from `.jar` to `.zip`.
5. Unzip the file.
6. Navigate to the `lib` folder of the unzipped folder.
7. Copy the file `sapjco3.dll` to the installation folder of your Eclipse IDE (the folder that contains `eclipse.exe`).

## 3.2 Creating a New SDK Extension

### Context

You can create a new SDK extension by copying the sample SDK extension *Colored Box* and renaming specific parts of it.

Assume your company name is **Sample Company**, your reversed Internet domain name is **com.samplecompany** and your custom component name is **Box**. Perform the operations listed below.

### Note

During these operations, Eclipse may ask you for read/write access to some files. Allow access.

## Procedure

1. In the *Package Explorer*, copy project `com.sap.sample.coloredbox` to `com.samplecompany.box`.
2. In file `MANIFEST.MF`, replace the following property values:
  - `Bundle-Name` Design Studio SDK Extension Sample Colored Box with Sample Company Box
  - `Bundle-SymbolicName` `com.sap.sample.coloredbox` with `com.samplecompany.box`
  - `Bundle-Vendor` SAP with Sample Company
3. In file `.project` in element `<name>`, replace `com.sap.sample.coloredbox` with `com.samplecompany.box`.

### ➔ Tip

To show the `.project` file, open the view menu in *Package Explorer*, choose *Filters...* and deselect *\*resources*.

4. In file `contribution.xml`, replace the following attribute values in element `<sdkExtension>`:
  - attribute `id` `com.sap.sample.coloredbox` with `com.samplecompany.box`
  - attribute `vendor` SAP with Sample Company
  - attribute `title` Design Studio SDK Extension Sample Colored Box with Sample Company Box

### i Note

If you choose a value other than 1.0 for element `<sdkExtension>`, attribute `version`, then adjust the first two numbers of the version number (major and minor version number) in the `Bundle-Version` entry in the `MANIFEST.MF` file accordingly. The first two numbers of the `Bundle-Version` and the version of the SDK extension must match.

5. In file `contribution.xml`, replace the following attribute values in element `<component>`:
  - attribute `id` `ColoredBox` with `Box`
  - attribute `title` `Colored Box` with `Box`
6. In file `contribution.ztl`, replace `class com.sap.sample.coloredbox.ColoredBox...` with `class com.samplecompany.box.Box...`
7. In file `component.js`, after `sap.designstudio.sdk.Component.subclass("... replace com.sap.sample.coloredbox.ColoredBox", ... with com.samplecompany.box.Box", ...`
8. In file `additional_properties_sheet.html`, replace `new com.sap.sample.coloredbox.ColoredBoxPropertyPage()` with `new com.samplecompany.box.BoxPropertyPage()`.
9. In file `additional_properties_sheet.js`, after `sap.designstudio.sdk.Component.subclass("... replace com.sap.sample.coloredbox.ColoredBoxPropertyPage with com.samplecompany.box.BoxPropertyPage.`

---

## 3.3 Adding an SDK Extension to an SAP BusinessObjects Design Studio Installation

### Context

Adding an SDK extension to an SAP BusinessObjects Design Studio installation enables you to create and execute local analysis applications, which contain this SDK extension.

### Procedure

1. Pack the SDK extension into an archive file that can be installed in SAP BusinessObjects Design Studio. This involves the following steps:
  - configuring the SDK extension *plug-in*
  - creating a *feature project* (wrapping the SDK extension),
  - creating a *category* (adding texts that represent the SDK extension in the Eclipse installation wizard), and
  - creating a *deployable feature* (wrapping the SDK extension and its category into an installable format).
2. Add the archive file containing the SDK extension to an SAP BusinessObjects Design Studio installation.

### Related Information

[Configuring the SDK Extension Plug-In \[page 14\]](#)

[Creating a Feature Project \[page 15\]](#)

[Creating a Category \[page 15\]](#)

[Creating a Deployable Feature \[page 16\]](#)

### 3.3.1 Configuring the SDK Extension Plug-In

### Context

## Procedure

1. Open the `plugin.xml` file of the SDK extension.
2. Choose the [Overview](#) tab.
3. In the [Version](#) input field, enter the version number **1.0.0.qualifier**.
4. Save your changes by pressing `Ctrl` + `S`.

### 3.3.2 Creating a Feature Project

## Procedure

1. In your Eclipse IDE, choose [File](#) > [New](#) > [Project...](#).
2. Choose [Plug-In Development](#) > [Feature Project](#).
3. Choose [Next](#).
4. Under [Feature](#), enter the feature name, for example **SampleExtensionFeature**.
5. Choose [Finish](#).
6. Select the [Plug-ins](#) tab and choose [Add...](#)
7. Add your SDK extension, for example `com.sap.sample.coloredbox`.

#### ➔ Tip

Start typing a part of your SDK extension name in the text field. Your SDK extension appears in the list.

8. Unselect the [Unpack the plugin-archive after installation](#) checkbox.
9. Save your changes (by pressing `CTRL` + `S`).

### 3.3.3 Creating a Category

## Procedure

1. Choose [File](#) > [New](#) > [Other...](#).
2. Choose [Plug-In Development](#) > [Category Definition](#).
3. Choose [Next](#).

4. Enter the feature that you created above, for example `SampleExtensionFeature`.
5. Choose *Finish*.
6. Choose *New Category*.
7. Under *ID\**, enter the category ID `com.sap.ip.bi.zen.sdk`. This is the common feature ID of SDK extensions.
8. Choose *Add feature...*
9. Select the feature that you created above, for example `SampleExtensionFeature`.
10. Choose *OK*.
11. Save your changes (by pressing `CTRL` + `S`).

### 3.3.4 Creating a Deployable Feature

#### Procedure

1. In the *Package Explorer*, right-click the created feature, for example `SampleExtensionFeature`.
2. Choose **File** > *Export...*
3. Choose **Plug-in Development** > *Deployable features*
4. Choose *Next*.
5. Under *Available Features*, select your feature, for example `SampleExtensionFeature`.
6. On the *Destination* tab, choose *Archive file* and enter the name of the archive file, for example `C:\SampleExtension.zip`.
7. On the *Options* tab, choose *Browse...* and select the category file of the feature, for example `C:\ds_sdk_workspace\SampleExtensionFeature\category.xml`.
8. Choose *Finish*.

#### Results

The archive file is created, for example `C:\SampleExtension.zip`.

---

## 3.3.5 Installing Design Studio SDK Extensions to SAP BusinessObjects Design Studio

### Context

You can add extensions developed with the Design Studio SDK to your SAP BusinessObjects Design Studio installation as new components.

### Procedure

1. In SAP BusinessObjects Design Studio, choose **Tools** > *Install Extension to Design Studio...*.
2. Depending on where the SDK extension is located, proceed as follows:
  - For locally saved extensions, choose *Archive...* and select the archive file containing the SDK extension, under `C:\SampleExtension.zip`, for example.
  - For extensions stored on a Web server, enter the URL of the Web server.
3. Choose *OK*.
4. Select the required feature, for example, *SampleExtensionFeature*.
5. Select the Design Studio extensions that you want to install.
6. Choose *Finish* to proceed with the installation.
7. Choose *Next* and again *Next* to confirm the installation.
8. Accept the terms of the license agreement and choose *Finish*.
9. Choose *Yes* to allow SAP BusinessObjects Design Studio to restart.

### Results

The SDK extension components appear in the *Components* view of SAP BusinessObjects Design Studio as new components.

The components are stored under `<user home directory>\Analysis-config`.

---

## 3.4 Removing Extensions from SAP BusinessObjects Design Studio

### Context

You can remove SDK extensions that you have added to your SAP BusinessObjects Design Studio installation as follows:

### Procedure

1. In SAP BusinessObjects Design Studio, choose ► [Help](#) ► [About...](#) ►.
2. Click the [Installation Details](#) button.
3. Select the feature containing the SDK extension, for example, [SampleExtensionFeature](#).
4. Choose [Uninstall...](#).
5. In the [Uninstall](#) wizard, choose [Finish](#).
6. Choose [Yes](#) to allow SAP BusinessObjects Design Studio to restart.

### Results

The SDK extension components are removed from the [Components](#) view of SAP BusinessObjects Design Studio. CVOM chart extensions are removed from the list in the [Additional Charts](#) dialog box.

---

## 3.5 Updating SDK Extensions of an SAP BusinessObjects Design Studio Installation

### Context

You can update SDK extensions in your SAP BusinessObjects Design Studio installation as follows:

### Procedure

1. Remove the old SDK extension.
2. Add the new SDK extension.

### Related Information

[Removing Extensions from SAP BusinessObjects Design Studio \[page 18\]](#)

[Adding an SDK Extension to an SAP BusinessObjects Design Studio Installation \[page 14\]](#)

## 4 SDK Extensions

An SDK extension contains the following files (any other, more technical files are omitted):

Table 2:

File	required/optional	Description
Contribution XML file	required	Defines the SDK extension and its extension components
Component JavaScript file	optional	Implements an extension component's functional behavior (this includes creating its visual appearance)
Component CSS file	optional	Defines a Cascading Style Sheet (CSS) for an extension component
Icon file	optional	Represents an extension component's icon (16 x 16 pixels)
Script Contribution file	optional	Implements the methods that extension components contribute to the Design Studio script editor
Additional Properties Sheet HTML file	optional	Implements the visual appearance of an extension component's Additional Properties Sheet
Additional Properties Sheet JavaScript file	optional	Implements the functional behavior of an extension component's Additional Properties Sheet

The following documentation chapters explain these files in detail. The examples are taken from the Sample SDK Extension **Colored Box**.

### 4.1 Contribution XML

The Contribution XML file specifies the SDK extension and all its extension components. SAP provides a documented XML schema definition file (`sdk.xds`) that defines the format of the Contribution XML file.

The example below is the Contribution XML of the SDK extension **Colored Box**. The file specifies the title, version, vendor name, as well as an extension namespace. The SDK extension contains one extension component. Its ID is `ColoredBox` (which is internally combined with the SDK extension namespace to create the unique extension component ID `com.sap.sample.coloredbox.ColoredBox`). The extension component has a title, an Additional Properties Sheet, it references an icon and so on. The extension also references its Component JavaScript and CSS file, defines two properties (`color` and `onClick`, which automatically appear in Design Studio's *Properties* view), and various initial values.

## Example

(File `contribution.xml`)

```
<?xml version="1.0" encoding="UTF-8"?>
<sdkExtension xmlns="http://www.sap.com/bi/zen/sdk" title="Design Studio SDK
Extension Sample Colored Box">
  version="1.0"
  vendor="SAP"
  id="com.sap.sample.coloredbox"
  <component
    id="ColoredBox"
    title="Colored Box"
    icon="res/icon.png"
    handlerType="div"
    propertySheetPath="res/additional_properties_sheet/
additional_properties_sheet.html">
    <jsInclude>res/js/component.js</jsInclude>
    <cssInclude>res/css/component.css</cssInclude>
    <property id="color" type="Color" title="Color" group="Display" />
    <property id="onclick" type="ScriptText" title="On Click" group="Events" />
    <initialization>
      <defaultValue property="LEFT_MARGIN">40</defaultValue>
      <defaultValue property="TOP_MARGIN">40</defaultValue>
      <defaultValue property="WIDTH">100</defaultValue>
      <defaultValue property="HEIGHT">100</defaultValue>
      <defaultValue property="color">red</defaultValue>
    </initialization>
  </component>
</sdkExtension>
```

## 4.1.1 Elements

See the XML schema definition file `sdk.xsd` for full details of what can be defined in the Contribution XML. Important elements are listed below.

### Note

Element names, attribute names, attribute values, and file paths used in the Contribution XML are case-sensitive.

### Tip

You see the XML schema definition file when you have downloaded and extracted the *Design Studio SDK Templates and Samples* on SAP Help Portal at <http://help.sap.com/boad>.

## Element <sdkExtension>

Specifies an SDK extension. Its attributes are:

Table 3:

Attribute	Required/Optional	Description
title	required	Title of the SDK extension
version	required	Version number in major.minor format, for example "1.0".
vendor	required	Vendor name
eula	optional	End user license agreement text
id	required	Specifies an SDK extension ID to avoid name conflicts between an SDK extension (and its extension components) and other SDK extensions (and their extension components). The specified string is combined with extension component IDs in this SDK extension, to create a unique extension component ID. Use a Java-like package notation, for example, <code>com.samplecompany</code> . Use lowercase letters, digits, and a period (.) as a delimiter.

Child elements:

Table 4:

Element	Cardinality	Description
license	0..1	License text
group	0..*	Custom group (see <group> element below)
component	0..*	Extension components (see <component> element below)

## Element <group>

Specifies a custom group in Design Studio's views. A custom group in the [Component](#) view contains extension components. A custom group in the [Properties](#) view contains properties of an extension component. Its attributes are:

Table 5:

Attribute	Required/Optional	Description
id	required	ID of the custom group  <b>i Note</b> Lowercase and uppercase letters are treated the same.
title	required	Title of the custom group
tooltip	optional	Tooltip of the custom group
visible	optional	If true, then the group is visible (default setting: <code>true</code> ).

## Element <component>

Specifies an extension component. Important attributes are:

Table 6:

Attribute	Required/Optional	Description
id	required	ID of the extension component
title	required	Title of the extension component
tooltip	optional	Tooltip of the extension component
visible	optional	If true then the extension component is visible in the Design Studio <a href="#">Components</a> view (default setting: <code>true</code> ).
group	optional	Group in the Design Studio's <a href="#">Component</a> view, where this extension component is displayed. Specify a custom group you have defined in this SDK extension. If no custom group is specified, this extension component is placed in the default Custom Component group.  <b>i Note</b> Lowercase and uppercase letters are treated the same.

Attribute	Required/Optional	Description
propertySheetPath	optional	References the HTML file of the Additional Properties Sheet. This file must be located in the /res folder of the extension component.
databound	optional	Indicates that this extension component is data-bound (uses data sources) (default setting: <code>false</code> ).
newInstancePrefix	optional	Prefix for the name of a newly created instance of this extension component. If this attribute is not specified, then a default name in the form "extension component type (uppercase) + number" is used, for example <code>COLOREDBOX_1</code> .
handlerType	optional	<p>Specifies the technology that implements this extension component. Specify one of the following values: <code>div</code>, <code>sapui5</code> (default setting: <code>div</code>).</p> <div> <p><b>i Note</b></p> <p>The type <code>datasource</code> marks this extension component as an SDK data source (see <a href="#">SDK Extensions as Data Sources (Data Source SDK)</a> [page 80]).</p> </div>
icon	optional	References an icon (16 x 16 pixels) displayed with this extension component in Design Studio's <i>Component</i> and <i>Outline</i> views. The path is relative to the root folder of the SDK extension.

Child elements are:

Table 7:

Element	Cardinality	Description
stdInclude	0..*	Includes a JavaScript framework at runtime (see <stdInclude> element below).

Element	Cardinality	Description
jsInclude	0..*	<p>References a JavaScript file to include with this extension component at run-time. It is either a relative path to the root folder of the SDK extension or a fully qualified URL.</p> <div> <p><b>Note</b></p> <p>It is not necessary to include the following frameworks with this element:</p> <ul style="list-style-type: none"> <li>jQuery JavaScript framework</li> <li>underscore JavaScript framework</li> </ul> <p>They are already included in the SDK framework.</p> </div> <div> <p><b>Note</b></p> <p>It is not necessary to include the D3 JavaScript framework with this element. See the &lt;stdInclude&gt; element for information.</p> </div>
cssInclude	0..*	References a CSS file to include with this extension component at runtime. It is either a relative path to the root folder of the SDK extension or a fully qualified URL.
property	0..*	Property of the extension component (see <property> element below)
initialization	0..1	Initialization values of properties (see <initialization> element below)
supportedBackend	0..*	Specifies which platform this extension component supports. Specify one of the following values: LOCAL, BIPLATFORM, HANA, or NETWEAVER. If this element is not specified, then all platforms support this extension component.

## Element <stdInclude>

Includes a JavaScript framework. Its attributes are:

Table 8:

Attribute	Required/Optional	Description
kind	required	JavaScript framework to include at run-time. Specify one of the following values: <code>d3</code> , <code>cvom</code> .

## Element <property>

Specifies an extension component property. Its attributes are:

Table 9:

Attribute	Required/Optional	Description
id	required	ID of the property  → <b>Tip</b> Use IDs with a lowercase first letter.
title	required	Title of the property
tooltip	optional	Tooltip of the property
visible	optional	If <code>true</code> then the property is visible in Design Studio (default setting: <code>true</code> )

Attribute	Required/Optional	Description
type	required	<p>Type of the property. Specify one of the following: <code>int</code>, <code>float</code>, <code>boolean</code>, <code>String</code>, <code>Text</code>, <code>ScriptText</code>, <code>Color</code>, <code>Url</code>, <code>ResultCell</code>, <code>ResultCellList</code>, <code>ResultCellSet</code>, and <code>ResultSet</code>. Properties of certain types offer a matching property dialog box (value help) in Design Studio's <a href="#">Properties</a> view.</p> <div> <b>Note</b> <ul style="list-style-type: none"> <li>The type <code>Text</code> marks the property as a translatable text.</li> <li>Data-bound properties of type <code>ResultCell</code>, <code>ResultCellList</code>, <code>ResultCellSet</code>, and <code>ResultSet</code> may contain nested options (see <code>&lt;option&gt;</code> element below).</li> </ul> </div>
group	optional	Group in the Design Studio's <a href="#">Properties</a> view where this property is displayed. Specify a custom group you have defined in this SDK extension or one of the following values: <code>Display</code> , <code>DataBinding</code> , or <code>Events</code> (default setting: <code>Display</code> ).
bindable	optional	If <code>true</code> then the property can be bound in Design Studio's <a href="#">Properties</a> view using Design Studio binding (not to be confused with SDK data-binding) (default setting: <code>false</code> ).

Child elements are:

Table 10:

Element	Cardinality	Description
possibleValue	0..*	Contains a possible value of this property. Use multiple elements to create an enumeration of possible values for this property.
option	0..*	Contains options for data-bound properties of type <code>ResultCell</code> , <code>ResultCellList</code> , <code>ResultCellSet</code> and <code>ResultSet</code> (see <code>&lt;option&gt;</code> element below).

## Element <initialization>

Initial values of properties (predefined and custom) for this extension component, when a new instance of this extension component is created.

Child elements are:

Table 11:

Element	Cardinality	Description
defaultValue	0..*	Default values of properties (see <defaultValue> element below).

## Element <defaultValue>

This element contains a default value of a property (predefined and custom) for the extension component, when a new instance of this extension component is created. Its attribute values are:

Table 12:

Attribute	Required/Optional	Description
property	required	Property ID

## Element <option>

You can apply options to data-bound properties `ResultCell`, `ResultCellList`, `ResultCellSet`, and `ResultSet` to fine tune the content and size of the Data Runtime JSON and Metadata Runtime JSON returned by the SDK framework (see “MetadataRuntime Jason” and “Data Runtime Jason” under [Runtime Property Values \[page 48\]](#)). Its attributes are:

Table 13:

Attribute	Required/Optional	Description
name	required	Option name (see table below)
value	required	Option value (see table below)

The following table lists the available option names of data-bound properties:

Table 14:

Option Name	Description
includeAxesTuples	If <code>true</code> then the JSON properties <code>axis_rows</code> and <code>axis_columns</code> are included in the Data Runtime JSON. They contain the tuples of the row axis and column axis.
includeTuples	If <code>true</code> then the JSON property <code>tuples</code> is included in the Data Runtime JSON. It contains the tuples of the data.

Option Name	Description
<code>includeResults</code>	If <code>true</code> then the result values, for example totals, are included in the Data Runtime JSON.
<code>presentationDelimiter</code>	String that separates presentations of dimension member values in the <code>text</code> JSON property of dimension members in the Metadata Runtime JSON
<code>selectionShape</code>	Integer value that indicates the geometry of the data in the Data Runtime JSON. Possible values: 0 ( <code>ResultCell</code> ), 1 ( <code>ResultCellList</code> ), or 2 ( <code>ResultCellSet</code> or <code>ResultSet</code> ).
<code>swapAxes</code>	If <code>true</code> then the axes (and the relevant data) are swapped (transposed) in the Data Runtime JSON and Metadata Runtime JSON.
<code>includeData</code>	If <code>true</code> then the JSON property <code>data</code> is included in the Data Runtime JSON. It contains the data values ( <code>float</code> numbers or <code>null</code> ).
<code>includeFormattedData</code>	If <code>true</code> then the JSON property <code>formattedData</code> is included in the Data Runtime JSON. It contains the formatted data values as strings.
<code>includeMetadata</code>	If <code>true</code> then the Metadata Runtime JSON is included as a part of the Data Runtime JSON.
<code>fillMetadataProperty</code>	If <code>true</code> then the SDK component's implicit property <code>metadata</code> contains the Metadata Runtime JSON.
<code>includeAttributes</code>	If <code>true</code> then the JSON properties <code>attributes</code> and <code>attributeMembers</code> are added to the Metadata Runtime JSON. They contain information about the display attributes of a result set. If the result set does not contain attributes then these JSON properties are not added, regardless of the value of <code>includeAttributes</code> .
<code>includeConditionalFormats</code>	If <code>true</code> then the JSON property <code>conditionalFormats</code> is added to the Metadata Runtime JSON and the JSON property <code>conditionalFormatValues</code> is added to the Data Runtime JSON. They contain information about conditional formatting of data values of the result set. If the result set does not contain conditional formats then these JSON properties are not added, regardless of the value of <code>includeConditionalFormats</code> .
<code>allDataOnEmptySelection</code>	If <code>true</code> then an empty selection string ( <code>""</code> or <code>{ }</code> ) set to this data-bound property returns the entire result set in the Metadata and Data Runtime JSONs. If <code>false</code> then an empty selection string ( <code>""</code> or <code>{ }</code> ) set to this data-bound property returns a Metadata Runtime JSON with no dimension information and an empty Data Runtime JSON ( <code>""</code> ).

Option Name	Description
maxCells	<p>The maximum number of selected result set cells that are sent to this data-bound property. If the number of selected result set cells is greater than the maximum number, then no result set cells are sent to this data-bound property.</p> <div> <p><b>Note</b></p> <p>You can also globally set the maximum number of selected result set cells on BW systems (and SAP R/3 systems in general) with the RSADMIN parameter <code>AAD_SDK_MAX_CELLS</code> (default value: 50000). If a value for the <code>maxCells</code> option and the RSADMIN parameter <code>AAD_SDK_MAX_CELLS</code> have been set, then the lower value is used.</p> </div> <div> <p><b>Caution</b></p> <p>Keep in mind that increasing the maximum number of selected result set cells that are sent to data-bound properties can severely degrade the performance of your application: Not only is the amount of data larger that is sent over the network to the browser, but also the memory consumption and processing load of the browser is increased.</p> <p>If the performance of your application is too slow, check if the maximum number of selected result set cells has been changed - either with the <code>maxCells</code> option or the RSADMIN parameter <code>AAD_SDK_MAX_CELLS</code> in the relevant BW system.</p> </div>

The following table lists the default values of each option, depending on the data-bound property type:

Table 15:

Option Name	Default Value for Property Type...			
	ResultCell	ResultCellList	ResultCellSet	ResultSet
includeAxesTuples	false	false	false	true
includeTuples	true	true	true	true
includeResults	true	true	true	true
presentationDelimiter				
selectionShape	0	1	2	2
swapAxes	false	false	false	false
includeData	true	true	true	true

Option Name	Default Value for Property Type...			
	ResultCell	ResultCellList	ResultCellSet	ResultSet
includeFormattedData	false	false	false	false
includeMetadata	false	false	false	true
fillMetadataProperty	true	true	true	false
includeAttributes	false	false	false	false
includeConditionalFormats	false	false	false	false
allDataOnEmptySelection	true	true	true	true
maxCells	10000	10000	10000	10000

## 4.2 Component JavaScript

You implement a Component JavaScript class for each extension component. You can implement the Component JavaScript class using both JavaScript and jQuery (version 1.10.2 at the time of writing), as jQuery is included in the SDK framework. The **class name** of the JavaScript class is the combination of the SDK extension namespace and the extension component ID, for example `com.sap.sample.coloredbox.ColoredBox`.

Below is an example; the Component JavaScript class of the extension component **Colored Box**. Its class name is `com.sap.sample.coloredbox.ColoredBox` and subclasses the generic JavaScript class `sap.designstudio.sdk.Component`. It implements an `init` function, which adds an CSS style sheet `coloredBox` and attaches an event handler to the click event of the extension component. When clicked, the extension component executes the script assigned to the extension component property `onclick`. It also defines a `color` function that acts as a combined setter and getter function for the extension component property `color`; in other words, the function sets and gets the background color of the extension component.

### Example

(File: `component.js`)

```
sap.designstudio.sdk.Component.subclass("com.sap.sample.coloredbox.ColoredBox",
function() {
    var that = this;
    this.init = function() {
        this.$().addClass("coloredBox");
        this.$().click(function() {
            that.fireEvent("onclick");
        });
    };
    this.color = function(value) {
        if (value === undefined) {
            return this.$().css("background-color");
        }
    };
});
```

```
    } else {  
        this.$().css("background-color", value);  
        return this;  
    }  
};  
});
```

The code in the Component JavaScript class controls important aspects of an extension component:

- creating the HTML of the extension component
- getting and setting extension component properties
- firing events

## Related Information

[Creating the HTML of the Extension Component \[page 32\]](#)

[Events \[page 35\]](#)

### 4.2.1 Creating the HTML of the Extension Component

You create the HTML of the extension component in the Component JavaScript.

At runtime the SDK framework provides a `<div>` element, which acts as a root element. The HTML of the extension component can then be placed into this element. You access this root element as a jQuery object with `this.$()`.

#### Caution

Ensure that your extension component only modifies elements of the HTML DOM inside the `<div>` element provided.

## Extension Component Lifecycle

When the extension component is rendered for the first time, the SDK framework performs the following sequence of JavaScript function calls:

- `init()`
- `beforeUpdate()`
- Update all extension component properties using their setter/getter functions (see next section)
- `afterUpdate()`

---

When the extension component is only updated (after it has already been rendered once), the SDK framework performs the following sequence of JavaScript function calls:

- `beforeUpdate()`
- Update all extension component properties using their setter/getter functions (see next section)
- `afterUpdate()`

When the extension component is deleted from the application, the SDK framework calls JavaScript function

- `componentDeleted()`

## Related Information

[JavaScript Function Calls \[page 33\]](#)

### 4.2.1.1 JavaScript Function Calls

#### Function `init`

Syntax: `init()`

Implement this function to perform JavaScript code after the extension component's root `<div>` element has been created.

#### Function `beforeUpdate`

Syntax: `beforeUpdate()`

Implement this function to execute JavaScript code before the properties of the extension component are updated.

## Property Getter and Setter Functions

For each extension property, you can implement a function that acts as a combined setter and getter function.

- The **function name** is the property's name.
- The function's **setter clause** must return `this` to allow function calls to be chained.

Example: (File component.js)

```
this.color = function(value) {
    if (value === undefined) {
        return this.$.css("background-color");
    } else {
        this.$.css("background-color", value);
        return this;
    }
};
```

## Function `afterUpdate`

Syntax: `afterUpdate()`

Implement this function to execute JavaScript code after all properties of the custom extension component have been updated.

## Function `componentDeleted`

Syntax: `componentDeleted()`

Implement this function to execute JavaScript code after your extension component has been deleted from the application (for cleanup operations, for example). Next, the extension component's root `<div>` element and its children are removed from the HTML DOM.

## Function `sap.zen.createStaticSdkMimeUrl(sExtensionId, sMimePath)`

This function returns a URL to a MIME resource, for example image or CSS file, that is contained in the SDK extension.

The argument `sExtensionId` is the extension id of your SDK component. The argument `sMimePath` is the path to the MIME resource relative to the root folder of your SDK extension.

In the example below, when this code is added to the `init` function of the [Colored Box](#), an icon appears within this component:

```
var url = sap.zen.createStaticSdkMimeUrl("com.sap.sample.coloredbox", "res/
icon.png");
this.$.append($("<img src=\"" + url + "\"></img>"));
```

## 4.3 Events

The following functions trigger execution of JavaScript code (events):

### Function `firePropertiesChanged`

Syntax: `firePropertiesChanged(["sPropertyname1", "sPropertyname2", ...])`

Call this function to inform the SDK framework when one or more properties of your extension component have changed in the browser.

#### Caution

Do not confuse the `firePropertiesChanged` function of the Component JavaScript with the `firePropertiesChanged` function of the Additional Properties Sheet JavaScript.

#### Example

```
this.firePropertiesChanged(["color"]);
```

This performs the following steps in detail:

1. The runtime is informed that the property `color` (maintained by the runtime) needs to be updated with the new property value now available in the Component JavaScript.
2. The runtime retrieves the new property value by calling the `color()` getter function of the Component JavaScript.
3. The runtime stores this property value in the property `color`.

#### Note

Calling `firePropertiesChanged` triggers a server roundtrip. Therefore, frequent use of this function may decrease the performance of your analysis application. We recommend that this function should only be called upon user interaction. We do not recommend calling this function to implement implicit changes to properties (so-called event cascading), as this may lead to a large number of (or even infinite) server roundtrips. Design Studio's standard components only trigger server roundtrips upon user interaction. This ensures efficient use of server roundtrips, which leads to better performance and avoids the threat of indeterministic (or even infinite) server roundtrips through event cascading.

### Function `fireEvent`

Syntax: `fireEvent("sPropertyname")`

Call this function to execute the Design Studio script that is stored in a property of type `ScriptText` of this extension component.

**Example:** (File `component.js`)

```
this.fireEvent("onclick");
```

### Note

Calling `fireEvent` triggers a server roundtrip. Therefore, frequent use of this function may decrease the performance of your analysis application. We recommend that this function should only be called upon user interaction. We do not recommend calling this function to implement implicit changes to properties (so-called event cascading), as this may lead to a large number of (or even infinite) server roundtrips. Design Studio's standard components only trigger server roundtrips upon user interaction. This ensures efficient use of server roundtrips, which leads to better performance and avoids the threat of indeterministic (or even infinite) server roundtrips through event cascading.

### Tip

Using Default Values of Properties of Type `ScriptText`

With the `fireEvent` function, you can execute a Design Studio script that was assigned to a property of type `ScriptText` at design time. However, you can also assign a default value to this property as a string that contains the Design Studio script.

If you set the visibility of this property to `false`, then you can use the keyword `this` in this string to refer to the "current" component to which this Design Studio script is applied.

### Example:

The Contribution XML file **contribution.xml** of your component contains a property **onclick** with a default value of **this.doSomething()**:

```
<sdkExtension ...>
  <component ...
    <jsInclude>res/js/component.js</jsInclude>
    <property
      id="onclick"
      type="ScriptText"
      visible="false".../>
    <initialization>
      <defaultValue property="onclick">this.doSomething();</defaultValue>
    </initialization>
  </component>
</sdkExtension>
```

The Script Contribution file `contribution.ztl` of your component contains the method `doSomething`. The method is marked as private and does not show up in the content assistance of the Design Studio script editor:

```
@Visibility(private)
void doSomething() {*
    // ...
*}
```

Whenever you fire an event on the property `onclick` - in one of the functions of the Component JavaScript file `component.js` with

```
fireEvent("onclick");
```

- this will execute the Design Studio script stored in the property `onclick`. This is the default value `this.doSomething()`; . This in turn executes the `doSomething()` Design Studio script method of your component.

## ➔ Tip

Using the Implicit Property `onBeforeRender`

SDK components have an implicit property `onBeforeRender` of type `ScriptText`. The Design Studio script assigned to this property is always executed before the SDK component is rendered in the browser. This makes this property an ideal place for initialization code.

The property `onBeforeRender` is not editable in Design Studio. However you can assign a default value, a string containing a Design Studio script, to this property in the SDK component's Contribution XML.

### Example:

In the following example, the Contribution XML file `contribution.xml` of your component defines a property `myDimension`, as well as the property `onclick` of type `ScriptText`. Both properties are not visible in the [Properties](#) view of Design Studio. The default value of the `onclick` property is `this.myHandleClick()`; . The default value of the `onBeforeRender` property is `this.myOnBeforeRender()`;

```
<sdkExtension ...>
  <component ...>
    ...
    <property
      id="myDimension"
      type="String"
      visible="false".../>
    <property
      id="onclick"
      type="ScriptText"
      visible="false".../>
    <initialization>
      <defaultValue property="onBeforeRender">this.myOnBeforeRender();</
defaultValue>
      <defaultValue property="onClick">this.myHandleClick();</
defaultValue>
    </initialization>
  </component>
</sdkExtension>
```

The Script Contribution file `contribution.ztl` of your component contains the Design Studio script methods `myOnBeforeRender` and `myHandleClick`. Both methods are marked as private and do not appear in the content assistance of the Design Studio script editor:

```
Visibility(private)
voidmyOnBeforeRender() {*
  this.myDimension = this.getDataSource().getDimensions()[0].name;
*}
@Visibility(private)
voidmyHandleClick() {*
  this.getDataSource().setFilter(this.myDimension, ...);
*}
```

Every time your SDK component is rendered, the Design Studio script method `myOnBeforeRender` is executed beforehand. This method retrieves the dimensions of the data source of the component, picks the name of the first dimension, and stores it in property `myDimension`. Now, whenever you fire an event in the Component Javascript of your SDK component by calling `fireEvent("onclick");`, the Design Studio script

stored as the default value of the `onclick` property is executed: `this.myHandleClick()`. This script sets a filter on the dimension that was retrieved before the rendering of your SDK component was started.

#### ➔ Tip

You can retrieve the data source alias (the Design Studio script `DataSourceAlias` object) of your data-bound SDK component with `<componentname>.getDataSource()`.

## Function `firePropertiesChangedAndEvent`

Syntax: `firePropertiesChangedAndEvent([sPropertyname1, sPropertyname2, ...], sPropertyname);`

This function is equivalent to

```
firePropertiesChanged([sPropertyname1, sPropertyname2, ...]);
fireEvent(sPropertyname);
```

Function `firePropertiesChangedAndEvent` is a faster implementation of this frequent combination of function calls and requires only one server round-trip.

#### i Note

Calling `firePropertiesChangedAndEvent` triggers a server roundtrip. Therefore, frequent use of this function may decrease the performance of your analysis application. We recommend that this function should only be called upon user interaction. We do not recommend calling this function to implement implicit changes to properties (so-called event cascading), as this may lead to a large number of (or even infinite) server roundtrips. Design Studio's standard components only trigger server roundtrips upon user interaction. This ensures efficient use of server roundtrips, which leads to better performance and avoids the threat of indeterministic (or even infinite) server roundtrips through event cascading.

## 4.4 Script Contributions

In analysis applications and in the Design Studio script editor, you can access the properties of an extension component with Design Studio scripts by adding a Script Contribution file `contribution.ztl` to the same folder as the Contribution XML.

- The content of `contribution.ztl` is a mix of **Java syntax** (script method signatures) and **JavaScript syntax** (script method bodies).

#### ➔ Tip

To open this file in Eclipse with the Java Editor, right-click on `contribution.ztl`, choose `contribution.ztl` and choose **Open with** **Other**. In the *Editor Selection* dialog box choose *Java Editor*.

- The JavaScript parts (script method bodies) are executed in the Design Studio script engine **on the server** and not in the browser. This means you are restricted to "sand-boxed" JavaScript, without access to the HTML DOM, for example.
- Enclose **script method bodies** in `{**}` pairs.
- Enclose **method blocks** within script body methods in regular braces `{ }`.
- Access **properties** defined in the Contribution XML file with the notation `this.<propertyName>`.
- The following **types** are available:
  - `String`
  - `int`
  - `float`
  - `boolean`
- **Comments** are automatically included in content assistance and tooltips of the Design Studio script editor.
- By **extending your SDK component class** in the Design Studio contribution file with `extends Component` your SDK component automatically inherits Design Studio script methods that are common to all SDK components, for example:

```
void    setWidth(intwidth)
int     getWidth()
void    setHeight(intheight)
int     getHeight()
void    setBottomMargin(intbottomMargin)
int     getBottomMargin()
void    setTopMargin(inttopMargin)
int     getTopMargin()
void    setLeftMargin(intleftmargin)
int     getLeftMargin()
void    setRightMargin(intrightMargin)
int     getRightMargin()
void    setCSSClass(String className)
String  getCSSClass()
void    setVisible(booleanisVisible)
boolean isVisible()
void    showLoadingState()
void    hideLoadingState()
```

#### ➔ Tip

By extending your class with `extends DataBoundComponent` your SDK component automatically additionally inherits the following Design Studio script methods:

```
DataSourceAlias getDataSource()
void            setDataSource(DataSourceAlias dataSourceAlias);
```

- The Script contribution file can contain script contributions of **multiple extension components**.

#### ➔ Tip

No Script Contribution file vs. Script Contribution file without methods

Although excluding the Script Contribution file completely hides your SDK component in the content assistance of the Design Studio Script editor, you may find it useful to provide a Script Contribution file without any methods. In this case, the SDK extension component automatically inherits Design Studio script methods that are common to all SDK extension components, for example `setWidth()`, `getWidth()`, etc.

This example shows the empty Script Contribution file of the extension component **Colored Box**:

```
class com.sap.sample.coloredbox.ColoredBox extends Component {  
}
```

The example below is the Script Contribution file of the extension component **Colored Box**.

### Example

(File `contribution.ztl`)

```
class com.sap.sample.coloredbox.ColoredBox extends Component {  
  
    /* Returns the current color of the box */  
    String getColor() {  
        return this.color;  
    }  
    /* Sets the current color of the box */  
    void setColor(/* the new color */ String newColor) {  
        this.color = newColor;  
    }  
}
```

## 4.5 Additional Properties Sheet

In Design Studio you can provide an extension component with an interactive Additional Properties Sheet, which allows users to set and get extension component property values. The Additional Properties Sheet of the extension component is displayed in Design Studio's *Additional Properties* view.

An Additional Properties Sheet consists of:

- an HTML file to specify the visual appearance
- a JavaScript file to implement the functional behavior

### 4.5.1 HTML

The HTML file specifies the visual appearance of the Additional Properties Sheet.

1. Place the Additional Properties Sheet HTML file in SDK extension's `res` folder or subfolder.
2. Reference the Additional Properties Sheet HTML file in the `propertySheetPath` attribute of the `<component>` element in the Contribution XML file.

The example below is the Additional Properties Sheet HTML file of the extension component **Colored Box**. It defines the visual appearance using `<form>` and `<fieldset>` elements. It also uses an `<input>` element - an input field that allows users to enter a color value.

### Note

- Here two JavaScript files are referenced: the generic Additional Properties Sheet JavaScript file of the SDK framework and the JavaScript file of this Additional Properties Sheet (see [JavaScript \[page 41\]](#) ).
- The Additional Properties Sheet JavaScript class is instantiated here (`new com.sap.sample.coloredbox.ColoredBoxPropertyPage();`)

### Example

(File `additional_properties_sheet.html`)

```
<html>
  <head>
    <title>Colored Box Property Sheet</title>
    <meta http-equiv="Content-Type" content="text/html; charset=utf-8" />
    <script src="/aad/zen.rt.components.sdk/resources/js/
sdk_propertysheets_handler.js"></script>
    <script src="additional_properties_sheet.js"></script>
  </head>
  <script>
    new com.sap.sample.coloredbox.ColoredBoxPropertyPage();
  </script>
  <body>
    <form id="form">
      <fieldset>
        <legend>Colored Box Properties</legend>
        <table>
          <tr>
            <td>Color</td>
            <td><input id="aps_color" type="text" name="color" size="40"
maxlength="40"></td>
          </tr>
        </table>
      </fieldset>
    </form>
  </body>
</html>
```

## 4.5.2 JavaScript

For each Additional Properties Sheet HTML file, you can implement a complementing Additional Properties Sheet JavaScript class to make the extension component's Additional Properties Sheet interactive. You can implement this JavaScript class using both JavaScript and jQuery (version 1.10.2 at the time of writing), as jQuery is included in the SDK framework.

1. Place the Additional Properties Sheet JavaScript file in the SDK extension's `res` folder or subfolder.
2. Reference this file in the complementing Additional Properties Sheet HTML file (see [HTML \[page 40\]](#)).

The example below is the Additional Properties Sheet JavaScript class of the extension component **Colored Box**. Its class name is `com.sap.sample.coloredbox.ColoredBoxPropertyPage` and subclasses the generic JavaScript class `sap.designstudio.sdk.PropertyPage`. It implements an `init` function, which attaches an event handler for the submit event to the `<form>` element with ID `form`. When the coloured box has been clicked,

the SDK framework is notified that the extension component's `color` property has changed in the browser. Furthermore, the JavaScript defines a `color` function, which acts as a combined setter and getter function for the input field with ID `aps_color`. This enables the SDK framework to get and set the value of the input entered in the Additional Properties Sheet HTML.

### Example

(File `additional_properties_sheet.js`)

```
sap.designstudio.sdk.PropertyPage.subclass("com.sap.sample.coloredbox.ColoredBoxPropertyPage", function() {
    var that = this;
    this.init = function() {
        $("#form").submit(function() {
            that.firePropertiesChanged(["color"]);
            return false;
        });
    };
    this.color = function(value) {
        if (value === undefined) {
            return $("#aps_color").val();
        } else {
            $("#aps_color").val(value);
            return this;
        }
    };
});
```

## Related Information

[JavaScript Functions for the Additional Properties Sheet \[page 42\]](#)

[Getting and Setting Extension Component Properties \[page 44\]](#)

### 4.5.2.1 JavaScript Functions for the Additional Properties Sheet

#### Function `init`

Syntax: `init()`

Implement this function to execute JavaScript code after the Additional Properties Sheet HTML page is associated with the extension component.

## Function `firePropertiesChanged`

Syntax: `firePropertiesChanged(["sPropertyName1", "sPropertyName2", ...])`

Call this function to inform the SDK framework when one or more properties of the extension component have changed in the Additional Properties Sheet.

### Caution

Do not confuse the `firePropertiesChanged` function of the Additional Properties Sheet JavaScript with the `firePropertiesChanged` function of the Component JavaScript.

### Example

```
this.firePropertiesChanged(["color"]);
```

This performs the following steps in detail:

1. The runtime is informed that the property `color` (maintained by the Runtime) needs to be updated with the new property value now available in the Additional Properties Sheet JavaScript.
2. The runtime retrieves the new property value by calling the `color()` getter function of the Additional Properties Sheet JavaScript.
3. The runtime stores this property value in the property `color`.
4. The runtime updates the component in the browser by calling the `color()` setter function of the Component JavaScript and passing the new property value of property `color`.

### Note

Calling `firePropertiesChanged` triggers a server roundtrip. Therefore, frequent use of this function may decrease the performance of your analysis application. We recommend that this function should only be called upon user interaction. We do not recommend calling this function to implement implicit changes to properties (so-called event cascading), as this may lead to a large number of (or even infinite) server roundtrips. Design Studio's standard components only trigger server roundtrips upon user interaction. This ensures efficient use of server roundtrips, which leads to better performance and avoids the threat of indeterministic (or even infinite) server roundtrips through event cascading.

## Function `callRuntimeHandler`

Syntax: `callRuntimeHandler("sFunctionname", "sArgument1", "sArgument2", ...)`

Call this function to execute a JavaScript function located in the Component JavaScript file. The argument of this function is a string with the name of the function to be called.

### Example

(File `additional_properties_sheet.js`)

```
this.callRuntimeHandler("getMetadataAsString");
```

### Example

You can pass arguments to the JavaScript function located in the Component JavaScript file by adding them to the call of function `callRuntimeHandler()`.

```
this.callRuntimeHandler("sampleFunction", "arg1", "arg2");
```

## Function `componentSelected`

Syntax: `componentSelected()`

Implement this function to execute JavaScript code when the extension component has been selected in Design Studio.

## Function `openPropertyDialog`

Syntax: `openPropertyDialog("sPropertyname")`

Call this function to open a property dialog box (value help) to select a property value. Property dialog boxes are supported for properties of the following types:

- `Color`
- `ScriptText`
- `ResultCell`
- `ResultCellList`
- `ResultCellSet`
- `ResultSet`

### Example

```
this.openPropertyDialog("color");
```

## 4.5.2.2 Getting and Setting Extension Component Properties

For each extension component property, you can implement a function that acts as a combined setter and getter function.

- The **function name** is the property's name.
- The function's **setter clause** must return `this` to allow function calls to be chained.

## Example

(File `additional_properties_sheet.js`)

Note the jQuery notation `$("#aps_color")` to access the `<input>` element.

```
this.color = function(value) {  
    if (value === undefined) {  
        return $("#aps_color").val();  
    } else {  
        $("#aps_color").val(value);  
        return this;  
    }  
};
```

## 5 SDK Extensions and Data Binding

You can create SDK extensions with extension components that retrieve and display data from the result set of a data source on an SAP NetWeaver BW or SAP HANA system (data binding).

SDK extension components can also retrieve data from result sets of an SDK data source.

### 5.1 Prerequisites

To enable data binding between an extension component and a data source, add the following attribute to the extension component's `<component>` element in the Contribution XML:

```
databound="true"
```

#### Note

- This automatically adds the `Data Source` property to the extension component. It is displayed in the *Properties* view of the extension component in SAP BusinessObjects Design Studio.
- This automatically adds the `metadata` property to the extension component.

### Related Information

[Runtime Property Values \[page 48\]](#)

### 5.2 Result Set Terminology

To simplify discussion about data binding, here is a quick review of result set terminology.

The result set of a data source is a two-dimensional table with a **column axis** and a **row axis**.

- Each axis has a list of **dimensions**.
- One dimension can contain **measures**.
- Each dimension has **dimension members** (or simply "**members**").
- The dimension members on an axis form an **axis tuple** at each axis position.
- The intersection of each row and column contains a **data value**.

### Example

The table below has two column dimensions (**Date** and **Measure**) and one row dimension (**City**). The dimension **City** has the members Berlin, Rio de Janeiro, Tokyo, and Overall Result. The dimension **Date** has the members 2010-01-01 and 2012-01-01. The dimension **Measures** has the members SALESREVENUE and QUANTITYSOLD. The column axis tuple [2010-01-01, SALESREVENUE] specifies the first column of the result set.

Table 16:

	2010-01-01	QUANTITYSOLD	2012-01-01	QUANTITYSOLD
	SALESREVENUE		SALESREVENUE	
Berlin	190,958.00	1,479	393,902.00	2,721
Rio de Janeiro	139,410.00	1,104	259,345.00	1,752
Tokyo	194,392.00	1,471	412,279.00	2,700
<b>Overall Result</b>	<b>524,760.00</b>	<b>4,054</b>	<b>1,065,526.00</b>	<b>7,173</b>

## 5.3 Data-Bound Properties

Several types of data-bound properties allow you to restrict the selection of data values from a result set. Data-bound property types also help the SDK framework to check the feasibility of your selection and restrict the available selections in the [Select Data](#) dialog box (value help of data-bound properties in Design Studio).

The following data-bound property types are available:

Table 17:

Property Type	Data Values
ResultCell	A single data value
ResultCellList	A single row or column of data values
ResultCellSet	A complex selection of data values from rows and columns (a Cartesian selection)
ResultSet	All data values of the result set

### Note

A Cartesian selection contains data points in the multidimensional cube that form a connected space.

## 5.3.1 Design Time Property Values

At design time, you assign a **selection string** to a data-bound property. It specifies which data values of the result set are received by the property. It is expressed in a JSON notation (called **Design time JSON**).

### Example

Selection string to select the cell containing the quantity sold in 2010 in Tokyo, in the result set example under [Data-Bound Properties \[page 47\]](#) (used with a `ResultCell` property):

```
{"DATE": "2010-01-01", "(MEASURES_DIMENSION)": "QUANTITYSOLD", "CITY": "Tokyo"}
```

### Example

Selection string to select the second column of the result set, in the result set example under [Data-Bound Properties \[page 47\]](#) (used with a `ResultList` property):

```
{"DATE": "2010-01-01", "(MEASURES_DIMENSION)": "QUANTITYSOLD"}
```

The design time JSON contains a list of dimension-member pairs for selecting a subset of the result set. The dimension-member pairs can be in any order. If a dimension is omitted, then all its members, including aggregate members, are selected.

### Note

Use `"(RESULT_MEMBER)"` as **member** to select the aggregate member of a dimension.

### Note

Use `"(MEASURES_DIMENSION)"` as **dimension** to select a measure structure. It is converted internally into the correct name of the measure structure.

## 5.3.2 Runtime Property Values

At runtime, the SDK framework retrieves the selected data values and stores them in the data-bound property in JSON format called **Data Runtime JSON**. The Data Runtime JSON contains mostly data value information. To complement this information, the SDK framework automatically creates a `metadata` property and assigns the metadata of the data values to it in a JSON format called **Metadata Runtime JSON** to this property. The Metadata Runtime JSON contains additional, helpful information about the data values. Data-bound extension components can examine the values of both the Metadata Runtime JSON and Data Runtime JSONs in order to create appropriate output.

---

**i** Note

For a data-bound property of type `ResultSet`, the Metadata Runtime JSON content is part of the Data Runtime JSON. There is no implicit `metadata` property and thus no separate Metadata Runtime JSON available.

**i** Note

If an extension component contains multiple data-bound properties, the `metadata` property contains a merged version of the Metadata Runtime JSONs of all data-bound properties.

## Metadata Runtime JSON

Here you see a formal representation of the Metadata Runtime JSON:

Table 18:

<pre> {   "dimensions": [     {       "key": &lt;string&gt;,       "text": &lt;string&gt;,       "axis": "COLUMNS" "ROWS",       "axis_index": &lt;integer&gt;,       "containsMeasures": true false,       "attributes": [         {           "key": &lt;string&gt;,           "text": &lt;string&gt;         }, ...       ],       "members": [         {           "key": &lt;string&gt;,           "text": &lt;string&gt;,           "formatString": &lt;string&gt;,           "unitOfMeasure": &lt;string&gt;,           "scalingFactor": &lt;integer&gt;,           "type": "RESULT",           "nodeState":             "COLLAPSED" "EXPANDED",           "level": &lt;integer&gt;           "attributeMembers": [             {               "key": &lt;string&gt;,               "text": &lt;string&gt;             }   null, ...           ]         }, ...       ],       ...     }, ...   ],   "externalDimensions": [     ...   ],   "conditionalFormats": [     {       "key": &lt;string&gt;,       "text": &lt;string&gt;,       &lt;customObject&gt;     }, ...   ],   "locale": &lt;string&gt; } </pre>	<p>Array of dimensions; column dimensions first, then row dimensions</p> <p>Dimension key</p> <p>Dimension text</p> <p>Axis on which the dimension is located</p> <p>Axis tuple index of the dimension, &gt;= 0</p> <p>Does dimension contain measures? (omitted when false)</p> <p>Array of attributes (omitted when result set has no attributes)</p> <p>Attribute key</p> <p>Attribute text</p> <p>Array of dimension's members</p> <p>Member key</p> <p>Member text (text may contain " " separator depending on used presentation)</p> <p>Format string, in Java DecimalFormat format (only with measures members)</p> <p>Unit of measure string (only with measures members)</p> <p>Scaling factor as exponent to base 10 (omitted when 0, only with measures members)</p> <p>Member is an aggregate value (omitted when not)</p> <p>Node state (only with hierarchy members)</p> <p>Indent level, &gt; 0 (only with hierarchy members)</p> <p>Array of attribute members (omitted when result set has no attributes)</p> <p>Attribute member key</p> <p>Attribute member text</p> <p>Attribute member is null for members of type "RESULT"</p> <p>Array of external dimensions</p> <p>(optional) Array element has same structure as an array element of JSON property dimensions. Currently only one element is supported.</p> <p>Array of conditional formats</p>
---	--

	Key of conditional format
	Text of conditional format
	(optional) Custom object containing custom parameters
	Browser locale string

### **i** Note

The `dimension` array contains the column dimensions first (sorted by increasing `axis_index`), then the row dimensions (sorted by increasing `axis_index`).

#### JSON property `externalDimensions`

If the result set contains a measures dimension, but this dimension is not contained in the row or the column dimensions of the `dimensions` JSON property, then this measures dimension is stored in the `externalDimensions` JSON property. It is an array, which can contain the measures dimension as its only element.

A result set can contain one measure dimension. It can be a dimension of the `dimensions` JSON property or the `externalDimension` JSON property. A measure has the `isMeasureDimension` JSON property set to `true`.

#### JSON property `attributes`

Contains information (key and text) about each attribute of a dimension. It is only present if the result set actually contains attributes and the data-bound property option `includeAttributes` is `true`.

#### JSON property `attributeMembers`

Contains information (key and text) about each attribute member of a dimension attribute. Is only present if the result set actually contains attributes and the data-bound property option `includeAttributes` is `true`.

#### JSON property `conditionalFormats`

Contains information about the conditional formats that have been applied to the result set. It is only present if the result set actually contains conditional formats and the data-bound property option `includeConditionalFormats` is `true`.

## Data Runtime JSON

Here you see a formal representation of the Data Runtime JSON:

Table 19:

<pre> {   "selection": [&lt;integer&gt;, ...],   "data": [&lt;float&gt; null, ...]   "formattedData": [&lt;String&gt;, ...]   "tuples": [[&lt;integer&gt;, ...], ...]   "axis_columns":   [[&lt;integer&gt;, ...], ...],   "axis_rows":   [[&lt;integer&gt;, ...], ...],   "conditionalFormatValues": [     {       &lt;string&gt;: &lt;integer&gt;,       ...     }   null, ...   ],   "columnCount": &lt;integer&gt;,   "rowCount": &lt;integer&gt; } </pre>	<p>Array of selection dimension member indexes, index = -1 (unspecified by selection)</p> <p>Array of data values in left-to-right, first-to-last row order, may contain null value</p> <p>Array of formatted data values in left-to-right, first-to-last row order</p> <p>Array of tuple arrays, one tuple for each data value. Tuple element = -1 (tuple element unspecified by selection)</p> <p>Array of tuple arrays, one tuple per column axis position specifying the column axis tuple elements. Tuple element = -1 (dimension is not on the column axis (only with properties of type ResultSet))</p> <p>Array of tuple arrays, one tuple per row axis position specifying the row axis tuple elements. Tuple element = -1 (dimension is not on the row axis (only with properties of type ResultSet))</p> <p>Array of conditional format maps, one map for each data value</p> <p>Array element is a map of conditional formats</p> <p>String contains key of conditional format, integer contains alert level (1..9)</p> <p>Array element is null if data value has no conditional format</p> <p>Number of columns of the data</p> <p>Number of rows of the data</p>
--	---

JSON property `formattedData`

Contains the data as an array of formatted strings in left-to-right, first-to-last row order.

JSON property `columnCount`

Contains the number of columns of the data.

JSON property `rowCount`

Contains the number of rows of the data.

JSON property `conditionalFormatValues`

It contains information about which conditional formats are applied to each data value of the result set. This JSON property contains an array of conditional format maps - one map for each data value of the result set or `null` if a data value has no conditional format. The conditional format maps contain one or more sets of key-value pairs. The key is the key of the conditional format in JSON property `conditionalFormats` in the Metadata Runtime JSON. The value is an integer between 1..9 that indicates the alert level (specifically: the highest alert level of this conditional format applied to this data value).

This JSON property is only present if the result set actually contains conditional formats and the data-bound property option `includeConditionalFormats` is `true`.

You can find fully-executed examples in the following chapters.

## Related Information

[Cell Selection \[page 53\]](#)

[Column or Row Selection \[page 55\]](#)

[Columns and Row Selection \(Multiple Columns or Rows\) \[page 57\]](#)

[Columns and Row Selection \("Checkerboard"\) \[page 60\]](#)

[Result Set Selection \[page 62\]](#)

### 5.3.3 Cell Selection

To get the data value of a single cell in a result set, use a data-bound property of type `ResultCell`.

For example, you have the following result set:

Table 20:

	2010-01-01 SALESREVENUE	QUANTITYSOLD	2012-01-01 SALESREVENUE	QUANTITYSOLD
Berlin	190,958.00	1,479	393,902.00	2,721
Rio de Janeiro	139,410.00	1,104	259,345.00	1,752
Tokyo	194,392.00	<b>1,471</b>	412,279.00	2,700
Overall Result	524,760.00	4,054	1,065,526.00	7,173

To select the highlighted cell (with value **1,471**) of this result set, use the following selection string:

```
{"DATE": "2010-01-01", "(MEASURES_DIMENSION)": "QUANTITYSOLD", "CITY": "Tokyo"}
```

The SDK framework returns the following Data Runtime and Metadata Runtime JSONs:

## Data Runtime JSON

```
{
  "selection": [0, 0, 0],
  "data": [1471],
  "tuples": [[0, 0, 0]],
  "columnCount": 1,
  "rowCount": 1
}
```

The `selection` JSON property reflects the selection. It contains an array of three indexes, corresponding to the three dimensions of the result set, in the order **DATE**, **Measures**, and **CITY** (see Metadata Runtime JSON below). The index values point at the selected dimension members (see Metadata Runtime JSON below):

- 0 = 2010-01-01 for dimension **DATE**
- 0 = QUANTITYSOLD for dimension **Measures**
- 0 = Tokyo for dimension **CITY**

The `data` JSON property contains an array with the single data value of the selected result set cell.

For each data value, the `tuples` JSON property contains a tuple of indexes for the selected dimension members (see Metadata Runtime JSON below):

- 0 = 2010-01-01 for dimension **DATE**
- 0 = QUANTITYSOLD for dimension **Measures**
- 0 = Tokyo for dimension **CITY**

## Metadata Runtime JSON

```
{
  "dimensions": [
    {
      "key": "DATE",
      "text": "DATE",
      "axis": "COLUMNS",
      "axis_index": 0,
      "members": [
        {
          "key": "2010-01-01",
          "text": "01/01/2010"
        }
      ]
    },
    {
      "key": "Measures",
      "text": "Measures",
      "axis": "COLUMNS",
      "axis_index": 1,
      "containsMeasures": true,
      "members": [
        {
          "key": "QUANTITYSOLD",
          "text": "QUANTITYSOLD",
          "formatString": "#.##0;-'#.##0"
        }
      ]
    },
    {
      "key": "CITY",
      "text": "CITY",
      "axis": "ROWS",
      "axis_index": 0,
      "members": [
        {
          "key": "Tokyo",
          "text": "Tokyo"
        }
      ]
    }
  ]
}
```

```

    ],
    "locale": "en_US"
  }

```

The `dimensions` JSON property contains dimension and member information for each dimension relevant for the selection.

The `locale` JSON property contains the browser's locale string.

## 5.3.4 Column or Row Selection

To get the data values of a single result set column or row, use a data-bound property of type `ResultCellList`.

For example, you have the following result set:

Table 21:

	2010-01-01		2012-01-01	
	SALESREVENUE	QUANTITYSOLD	SALESREVENUE	QUANTITYSOLD
Berlin	190,958.00	<b>1,479</b>	393,902.00	2,721
Rio de Janeiro	139,410.00	<b>1,104</b>	259,345.00	1,752
Tokyo	194,392.00	<b>1,471</b>	412,279.00	2,700
Overall Result	524,760.00	<b>4,054</b>	1,065,526.00	7,173

To select the highlighted column (**QUANTITYSOLD**) of this result set, use the following selection string:

```

{"DATE": "2010-01-01", "(MEASURES_DIMENSION)": "QUANTITYSOLD"}

```

### **i** Note

Row selection works in the same way.

The SDK framework returns the following Data Runtime and Metadata Runtime JSONs:

## Data Runtime JSON

```

{
  "selection": [0, 0, -1],
  "data": [
    1479,
    1104,
    1471,
    4054
  ]
  "tuples": [
    [0, 0, 0],
    [0, 0, 1],
    [0, 0, 2],
    [0, 0, 3]
  ]
}

```

```

],
"columnCount": 1,
"rowCount": 4
}

```

The `selection` JSON property reflects the selection. It contains an array of three indexes corresponding to the three dimensions of the result set in the order **DATE**, **Measures**, and **CITY** (see Metadata Runtime JSON below). The index values point at the selected dimension members (see Metadata Runtime JSON below):

- 0 = 2010-01-01 for dimension **DATE**
- 0 = QUANTITYSOLD for dimension **Measures**
- -1 = This dimension was not specified by the selection string.

The `data` JSON property contains an array with the data values of the selected result set column.

For each data value, the `tuples` JSON property contains a tuple of indexes of the selected dimensions members. For example, the first tuple [0, 0, 0] points at the following dimension members:

- 0 = 2010-01-01 for dimension **DATE**
- 0 = QUANTITYSOLD for dimension **Measures**
- 0 = Berlin for dimension **CITY**

The second tuple [0, 0, 1] points at the following dimension members:

- 0 = 2010-01-01 for dimension **DATE**
- 0 = QUANTITYSOLD for dimension **Measures**
- 1 = Rio de Janeiro for dimension **CITY** (see Metadata Runtime JSON below).

## Metadata Runtime JSON

```

{
  "dimensions": [
    {
      "key": "DATE",
      "text": "DATE",
      "axis": "COLUMNS",
      "axis_index": 0,
      "members": [
        {
          "key": "2010-01-01",
          "text": "2010-01-01"
        }
      ]
    },
    {
      "key": "Measures",
      "text": "Measures",
      "axis": "COLUMNS",
      "axis_index": 1,
      "containsMeasures": true,
      "members": [
        {
          "key": "QUANTITYSOLD",
          "text": "QUANTITYSOLD",
          "formatString": "#.##0;'-'#.##0"
        }
      ]
    }
  ],

```

```

{
  "key": "CITY",
  "text": "CITY",
  "axis": "ROWS",
  "axis_index": 0,
  "members": [
    {
      "key": "Berlin",
      "text": "Berlin"
    },
    {
      "key": "Rio de Janeiro",
      "text": "Rio de Janeiro"
    },
    {
      "key": "Tokyo",
      "text": "Tokyo"
    },
    {
      "key": "Result",
      "text": "Overall Result",
      "type": "RESULT"
    }
  ]
},
"locale": "en_US"
}

```

The `dimensions` JSON property contains dimension and member information for each dimension relevant for the selection.

The `locale` JSON property contains the browser's locale string.

### 5.3.5 Columns and Row Selection (Multiple Columns or Rows)

To get the data values of multiple columns or rows, use a data-bound property of type `ResultSet`.

For example, you have the following result set:

Table 22:

	2010-01-01		2012-01-01	
	SALESREVENUE	QUANTITYSOLD	SALESREVENUE	QUANTITYSOLD
Berlin	190,958.00	<b>1,479</b>	393,902.00	<b>2,721</b>
Rio de Janeiro	139,410.00	<b>1,104</b>	259,345.00	<b>1,752</b>
Tokyo	194,392.00	<b>1,471</b>	412,279.00	<b>2,700</b>
Overall Result	524,760.00	<b>4,054</b>	1,065,526.00	<b>7,173</b>

To select the highlighted columns (both **QUANTITYSOLD** columns) of this result set, use the following selection string:

```

{"DATE": ["2010-01-01", "2012-01-01"], "(MEASURES_DIMENSION)": "QUANTITYSOLD"}

```

## **i** Note

Multiple row selection works in the same way.

The SDK framework returns the following Data Runtime and Metadata Runtime JSONs:

## Data Runtime JSON

```
{
  "selection": [[0, 1], 0, -1],
  "data": [
    1479,
    2721,
    1104,
    1752,
    1471,
    2700,
    4054,
    7173
  ],
  "tuples": [
    [0, 0, 0],
    [1, 0, 0],
    [0, 0, 1],
    [1, 0, 1],
    [0, 0, 2],
    [1, 0, 2],
    [0, 0, 3],
    [1, 0, 3]
  ],
  "columnCount": 2,
  "rowCount": 4
}
```

The `selection` JSON property `[[0, 1], 0, -1]` reflects the selection. It contains an array of three elements corresponding to the three dimensions of the result set in the order `DATE`, `Measures`, and `CITY` (see Metadata Runtime JSON below). The index values point to the selected dimension members (see Metadata Runtime JSON below):

- `0, 1` = 2010-01-01, 2012-01-01 for dimension `DATE`
- `0` = `QUANTITYSOLD` for dimension `Measures`
- `-1` = This dimension was not specified by the selection string.

If your code assumes that the elements of the `selection` JSON property are always integer numbers, this may lead to incompatible changes.

The `data` JSON property contains an array with the data values of the selected result set columns in the following order: left-to-right cell, first-to-last row.

For each data value, the `tuples` JSON property contains a tuple of indexes to the selected dimensions members. For example, the first tuple `[0, 0, 0]` points at the following dimension members:

- `0` = 2010-01-01 for dimension **DATE**
- `0` = `QUANTITYSOLD` for dimension **Measures**
- `0` = Berlin for dimension **CITY**

The second tuple [1, 0, 0] points at the following dimension members:

- 1 = 2012-01-01 for dimension **DATE**
- 0 = QUANTITYSOLD for dimension **Measures**
- 0 = Berlin for dimension **CITY** (see Metadata Runtime JSON below)

## Metadata Runtime JSON

```
{
  "dimensions": [
    {
      "key": "DATE",
      "text": "DATE",
      "axis": "COLUMNS",
      "axis_index": 0,
      "members": [
        {
          "key": "2010-01-01",
          "text": "01/01/2010"
        },
        {
          "key": "2012-01-01",
          "text": "01/01/2012"
        }
      ]
    },
    {
      "key": "Measures",
      "text": "Measures",
      "axis": "COLUMNS",
      "axis_index": 1,
      "containsMeasures": true,
      "members": [
        {
          "key": "QUANTITYSOLD",
          "text": "QUANTITYSOLD",
          "formatString": "#,##0;'-'#,##0"
        }
      ]
    }
  ],
  {
    "key": "CITY",
    "text": "CITY",
    "axis": "ROWS",
    "axis_index": 0,
    "members": [
      {
        "key": "Berlin",
        "text": "Berlin"
      },
      {
        "key": "Rio de Janeiro",
        "text": "Rio de Janeiro"
      },
      {
        "key": "Tokyo",
        "text": "Tokyo"
      },
      {
        "key": "Result",
        "text": "Result",
        "type": "RESULT"
      }
    ]
  }
}
```

```

    }
  ]
},
"locale": "en_US"
}

```

The `dimensions` JSON property contains dimension and member information for each dimension relevant for the selection.

The `locale` JSON property contains the browser's locale string.

### 5.3.6 Columns and Row Selection ("Checkerboard")

To get the data values of multiple sub columns and rows (also known as a "checkerboard"), use a data-bound property of type `ResultSet`.

For example, you have the following result set:

Table 23:

	2010-01-01		2012-01-01	
	SALESREVENUE	QUANTITYSOLD	SALESREVENUE	QUANTITYSOLD
Berlin	190,958.00	<b>1,479</b>	393,902.00	<b>2,721</b>
Rio de Janeiro	139,410.00	1,104	259,345.00	1,752
Tokyo	194,392.00	<b>1,471</b>	412,279.00	<b>2,700</b>
Overall Result	524,760.00	4,054	1,065,526.00	7,173

To select the highlighted sub columns and rows (with cells **1,479** , **1,471** , **2,721** and **2,700**) of this result set, use the following selection string:

```

{"DATE": ["2010-01-01", "2012-01-01"], "(MEASURES_DIMENSION)": "QUANTITYSOLD",
"CITY": ["Berlin", "Tokyo"]}

```

The SDK framework returns the following Data Runtime and Metadata Runtime JSONs:

#### Data Runtime JSON

```

{
  "selection": [[0, 1], 0, [0, 1]],
  "data": [
    1479,
    2721,
    1471,
    2700
  ]
  "tuples": [
    [0, 0, 0],
    [1, 0, 0],
    [0, 0, 1],

```

```

    [1, 0, 1]
  ],
  "columnCount": 2,
  "rowCount": 2
}

```

The `selection` JSON property `[[0, 1], 0, [0, 1]]` reflects the selection. It contains an array of three elements corresponding to the three dimensions of the result set in the order `DATE`, `Measures`, and `CITY` (see Metadata Runtime JSON below). The index values point at the selected dimension members (see Metadata Runtime JSON below):

- 0, 1 = 2010-01-01, 2012-01-01 for dimension `DATE`
- 0 = `QUANTITYSOLD` for dimension `Measures`
- 0, 1 = Berlin, Tokyo for dimension `CITY`

If your code assumes that the elements of the `selection` JSON property are always integer numbers this may lead to incompatible changes.

The `data` JSON property contains an array with the data values of the selected result set sub-columns in this order: left-to-right cell, first-to-last row.

For each data value, the `tuples` JSON property contains a tuple of indexes to the selected dimensions members. For example, the first tuple `[0, 0, 0]` points at the following dimension members:

- 0 = 2010-01-01 for dimension **DATE**
- 0 = `QUANTITYSOLD` for dimension **Measures**
- 0 = Berlin for dimension **CITY**

The second tuple `[1, 0, 0]` points at the following dimension members:

- 1 = 2012-01-01 for dimension **DATE**
- 0 = `QUANTITYSOLD` for dimension **Measures**
- 0 = Berlin for dimension **CITY** (see Metadata Runtime JSON below)

## Metadata Runtime JSON

```

{
  "dimensions": [
    {
      "key": "DATE",
      "text": "DATE",
      "axis": "COLUMNS",
      "axis_index": 0,
      "members": [
        {
          "key": "2010-01-01",
          "text": "01/01/2010"
        },
        {
          "key": "2012-01-01",
          "text": "01/01/2012"
        }
      ]
    },
    {
      "key": "Measures",

```

```

    "text": "Measures",
    "axis": "COLUMNS",
    "axis_index": 1,
    "containsMeasures": true,
    "members": [
      {
        "key": "QUANTITYSOLD",
        "text": "QUANTITYSOLD",
        "formatString": "#,##0;'-'#,##0"
      }
    ]
  },
  {
    "key": "CITY",
    "text": "CITY",
    "axis": "ROWS",
    "axis_index": 0,
    "members": [
      {
        "key": "Berlin",
        "text": "Berlin"
      },
      {
        "key": "Tokyo",
        "text": "Tokyo"
      }
    ]
  }
],
"locale": "en_US"
}

```

The `dimensions` JSON property contains dimension and member information for each dimension relevant for the selection.

The `locale` JSON property contains the browser's locale string.

### 5.3.7 Result Set Selection

To get the data values of the entire result set, use a data-bound property of type `ResultSet`.

For example, you have the following result set:

Table 24:

	2010-01-01		2012-01-01	
	SALESREVENUE	QUANTITYSOLD	SALESREVENUE	QUANTITYSOLD
Berlin	190,958.00	1,479	393,902.00	2,721
Rio de Janeiro	139,410.00	1,104	259,345.00	1,752
Tokyo	194,392.00	1,471	412,279.00	2,700
Overall Result	524,760.00	4,054	1,065,526.00	7,173

To select the entire result set, use the following selection string:

```
{ }
```

or an empty string.

The SDK framework returns the following Data Runtime JSON:

## Data Runtime JSON

```
{
  "selection": [-1, -1, -1],
  "data": [
    190958,
    1479,
    393902,
    2721,
    139410,
    1104,
    ...
    7173
  ],
  "tuples": [
    [0, 0, 0],
    [0, 1, 0],
    [1, 2, 0],
    [1, 3, 0],
    [0, 0, 1],
    [0, 1, 1],
    ...
    [1, 3, 3]
  ],
  "dimensions": [
    {
      "key": "DATE",
      "text": "DATE",
      "axis": "COLUMNS",
      "axis_index": 0,
      "members": [
        {
          "key": "2010-01-01",
          "text": "01/01/2010"
        },
        {
          "key": "2012-01-01",
          "text": "01/01/2012"
        }
      ]
    }
  ],
  {
    "key": "Measures",
    "text": "Measures",
    "axis": "COLUMNS",
    "axis_index": 1,
    "containsMeasures": true,
    "members": [
      {
        "key": "SALESREVENUE",
        "text": "SALESREVENUE",
        "formatString": "#.##0,00;-'#.##0,00"
      },
      {
        "key": "QUANTITYSOLD",
        "text": "QUANTITYSOLD",
        "formatString": "#.##0;-'#.##0"
      }
    ]
  }
}
```

```

        "key": "SALESREVENUE",
        "text": "SALESREVENUE",
        "formatString": "#.##0,00;-'#.##0,00"
    },
    {
        "key": "QUANTITYSOLD",
        "text": "QUANTITYSOLD",
        "formatString": "#.##0;-'#.##0"
    }
]
},
{
    "key": "CITY",
    "text": "CITY",
    "axis": "ROWS",
    "axis_index": 0,
    "members": [
        {
            "key": "Berlin",
            "text": "Berlin"
        },
        {
            "key": "Rio de Janeiro",
            "text": "Rio de Janeiro"
        },
        {
            "key": "Tokyo",
            "text": "Tokyo"
        },
        {
            "key": "Result",
            "text": "Overall Result",
            "type": "RESULT"
        }
    ]
}
],
"axis_columns": [
    [0, 0, -1],
    [0, 1, -1],
    [1, 2, -1],
    [1, 3, -1]
],
"axis_rows": [
    [-1, -1, 0],
    [-1, -1, 1],
    [-1, -1, 2],
    [-1, -1, 3]
],
"locale": "en_US",
"columnCount": 4,
"rowCount": 4
}

```

The `selection` JSON property reflects the selection. It contains an array of three indexes, corresponding to the three dimensions of the result set, in the order **DATE**, **Measures**, and **CITY**. An index value of -1 indicates that the respective dimension member is unspecified.

The `data` JSON property contains an array with the data values of all result set cells in the following order: left-to-right cell, first-to-last row.

For each data value, the `tuples` JSON property contains a tuple of indexes of the selected dimensions members. For example, the first tuple `[0, 0, 0]` points to the following dimension members:

- 0 = 2010-01-01 for dimension **DATE**

- 0 = SALESREVENUE for dimension **Measures**
- 0 = Berlin for dimension **CITY**

The second tuple [0, 1, 0] points to the following dimension members:

- 0 = 2010-01-01 for dimension **DATE**
- 1 = QUANTITYSOLD for dimension **Measures**
- 0 = Berlin for dimension **CITY**

The `axis_columns` JSON property specifies the column header cells. For each column axis position, this JSON property contains a tuple of indexes of the appropriate dimension members. The indexes are in the order **DATE**, **Measures**, and **CITY**. An index value of -1 indicates that the respective dimension is not on the column axis. For example, the last tuple [1, 3, -1] (representing the last column axis tuple) points to the following dimension members:

- 1 = 2012-01-01 for dimension **DATE**
- 3 = QUANTITYSOLD for dimension **Measures**
- -1 = Dimension **CITY** is not on the column axis

The `axis_rows` JSON property specifies the row header cells. For each row axis position, this JSON property contains a tuple of indexes of the appropriate dimension members. The indexes are in the order **DATE**, **Measures**, and **CITY**. An index value of -1 indicates that the respective dimension is not on the row axis. For example, the last tuple [-1, -1, 3] (representing the last column row tuple) points to the following dimension members:

- -1 = Dimension **DATE** is not on the axis
- -1 = Dimension **Measures** is not on the axis
- 3 = Overall Result for dimension **CITY**

## Metadata Runtime JSON

### Note

For a data-bound property of type `ResultSet`, the Metadata Runtime JSON content is part of the Data Runtime JSON. There is no separate Metadata Runtime JSON.

## 5.4 Sample Implementation

To learn about data binding with a real, simple data-bound extension component, you can import the *Simple Table* SDK extension. It is contained in the sample project `com.sap.sample.simpletable` in the *SDK Templates and Samples* folder. This is located, for example, under `C:\ds_sdk` (see [Importing a Sample SDK Extension \[page 10\]](#)).

The *Simple Table* displays up to three columns of data from columns (or rows) of a result set. The top cell of each column displays a column header text. An additional (first) column displays row header texts for each row.

Table 25: Example: Simple Table

	01/01/2010 SALESREVENUE	01/01/2010 QUANTITYSOLD	01/01/2012 SALESREVENUE
Berlin	190,958.00	1,479	393,902.00
Rio de Janeiro	139,410.00	1,104	259,345.00
Tokyo	194,392.00	1,471	412,279.00
Result	524,760.00	4,054	1,065,526.00

## 5.4.1 Configuring the Simple Table

### Procedure

1. To fill a *Simple Table* with data, assign a data source to the table.

#### Note

You can assign a data source by dragging and dropping a data source from the *Outline* view onto the data-bound extension component on the canvas.

2. In the *Properties* view of the *Simple Table*, you will see the properties *Column 1*, *Column 2*, and *Column 3*.
3. Click the button ... to the right of *Column 1*.  
The *Select Data* dialog box appears.
4. Select a column and close the dialog box.
5. Repeat steps 3 to 5 for *Column 2* and *Column 3*.

### Results

The system displays the selection strings in the *Properties* view.

## 5.4.2 Data Binding in the Simple Table

In the *Simple Table* implementation, there are two locations relevant for data binding:

- Contribution XML
- Contribution JavaScript

## 5.4.2.1 Contribution XML

In the `contribution.xml` file, there are two locations relevant for data binding:

- Attribute `databound`
- Data-bound properties

### Attribute `databound`

The `databound` attribute in the `<component>` element enables data binding for the *Simple Table*:

```
<component ... databound="true">
```

#### **i** Note

- This automatically adds the `Data Source` property to the *Simple Table*. It is displayed in the *Properties* view of the extension component in SAP BusinessObjects Design Studio.
- This automatically adds the `metadata` property to the *Simple Table*.

## Data-Bound Properties

The *Simple Table* uses three data-bound properties to provide data cell values of three result set columns at runtime:

```
<property id="column1" type="ResultCellList" title="Column 1" group="DataBinding">
  <option name="includeFormattedData" value="true"/>
  <option name="includeData" value="false"/>
</property>
<property id="column2" type="ResultCellList" title="Column 2" group="DataBinding">
  <option name="includeFormattedData" value="true"/>
  <option name="includeData" value="false"/>
</property>
<property id="column3" type="ResultCellList" title="Column 3" group="DataBinding">
  <option name="includeFormattedData" value="true"/>
  <option name="includeData" value="false"/>
</property>
```

The three properties `column1`, `column2`, and `column3` are displayed as *Column 1*, *Column 2*, and *Column 3* under *Data Binding* in the *Properties* view of the *Simple Table*. As they are properties of type `ResultCellList`, each property receives the data values of a single column (or row) from the result set at runtime. The selected column (or row) is specified at design time by the selection string (see [Design Time Property Values \[page 48\]](#)).

The properties `column1`, `column2`, and `column3` use options to include the `formattedData` JSON property and to remove the `data` JSON property in the Data Runtime JSON object. Therefore the properties only provide formatted data and not the float number data.

## 5.4.2.2 Component JavaScript

The Component JavaScript creates the visual appearance of the *Simple Table* component. This involves creating an HTML table and filling it with appropriate result set data.

### Function `init`

The `init()` function of the *Simple Table* component adds a CSS style class and a vertical scrollbar to the `<div>` element provided by the SDK framework. Then it creates a `<table>` element (which holds the HTML table) and adds it to the `<div>` element.

```
this.init = function() {
  this.$().addClass(CSS_CLASS_DIV);
  this.$().css("overflow-y", "scroll");
  this.jqTable = $("<table class=\"" + CSS_CLASS_TABLE + "\"/>");
  this.$().append(this.jqTable);
};
```

### Property Setter and Getter Functions

Three property setter/getter functions store and return values of the Simple Table's data-bound properties `column1`, `column2`, and `column3`. The setter clauses store the property values provided by the SDK framework in local variables `column1_data`, `column2_data`, and `column3_data` and the getter clauses return these values. The JavaScript code, which is executed after the property values have been set by the SDK framework using the setter clauses, can access these values. This especially applies to JavaScript code in function `afterUpdate()`.

#### **i** Note

A fourth setter/getter function `this.metadata()` stores and returns the value of the metadata property in the local variable `meta_data`. The property is implicitly added when declaring a property of type `ResultCell`, `ResultCellList`, or `ResultCellSet` in the Contribution XML.

```
var column1_data = null;
var column2_data = null;
var column3_data = null;
var meta_data = null;
this.column1 = function(value) {
  if (value === undefined) {
    return column1_data;
  } else {
    column1_data = value;
    return this;
  }
};
this.column2 = function(value) {
  if (value === undefined) {
    return column2_data;
  } else {
    column2_data = value;
```

```

        return this;
    }
};
this.column3 = function(value) {
    if (value === undefined) {
        return column3_data;
    } else {
        column3_data = value;
        return this;
    }
};
this.metadata = function(value) {
    if (value === undefined) {
        return meta_data;
    } else {
        meta_data = value;
        return this;
    }
};
};

```

## Function `afterUpdate`

### **i** Note

Most extension components place their visualization code in this function, because it is executed after all extension component property values have been updated by the SDK framework.

Function `afterUpdate()` fills the HTML table.

```

this.afterUpdate = function() {
    this.jqTable.empty();
    var column_data = getAnySetColumn_Data();
    if (column_data) {
        var jqHeader = $("<thead/>").appendTo(this.jqTable);
        var jqHeaderRow = $("<tr class=\"" + CSS_CLASS_TR_HEADER +
            "\"/>").appendTo(jqHeader);
        jqHeaderRow.append($("<td class=\"" + CSS_CLASS_TD_HEADER + "\"/>"));
        appendColumnHeaderCell(jqHeaderRow, column1_data);
        appendColumnHeaderCell(jqHeaderRow, column2_data);
        appendColumnHeaderCell(jqHeaderRow, column3_data);
        for (var i = 0; i < column_data.formattedData.length; i++) {
            var jqRow = $("<tr/>");
            this.jqTable.append(jqRow);
            appendRowHeaderCell(jqRow, i);
            appendCell(jqRow, column1_data, i);
            appendCell(jqRow, column2_data, i);
            appendCell(jqRow, column3_data, i);
        }
    }
};

```

First, nested elements are removed from the `<table>` element.

Then, the code checks if any of the column variables contain a value with the following helper function:

```

function getAnySetColumn_Data() {
    if (column1_data && column1_data.formattedData) {
        return column1_data;
    } else if (column2_data && column2_data.formattedData) {

```

```

    return column2_data;
} else if (column3_data && column3_data.formattedData) {
    return column3_data;
}
return null;
}

```

If a column variable does contain a value, the table header is composed. First, a `<thead>` (table header) element is created and added to the table. Then a `<tr>` (table row) element is added to the table header. Next, a `<td>` (table cell) element, which is an empty header cell, is added to the table row. The helper function `appendColumnHeaderCell()` is called three times to add the remaining three column header table cells.

A loop adds a `<tr>` (table row) element for each row in the result set to the table. Helper functions `appendRowHeaderCell()` and `appendCell()` add four table cells (one row header table cell and three data table cells) to each table row.

Note how the number of rows is determined in the loop: Variable `column_data` contains the Data Runtime JSON of one the properties `column1`, `column2` or `column3`. The JavaScript expression `column_data.formattedData` returns the value of the `formattedData` JSON property of the Data Runtime JSON, which is an array of string values. Adding `.length` to this expression returns the number of data values in this array, which is the number of rows of the result set.

## Function `appendCell`

Helper function `appendCell()` adds a cell to a table row. The cell contains the appropriate value from the result set. The passed arguments are a `<tr>` (table row) element, the Data Runtime JSON of a property of type `ResultCellList` and a row index.

After various safety checks (Is data available, in other words, does a Data Runtime JSON of the property actually exist? Is the row index in the correct range?), the JavaScript expression `column_data.data[i]` picks the appropriate data value from the Data Runtime JSON using the row index. The value is formatted as cell text with function `formatValue()` (passes tuple information about the data value, picked from the Data Runtime JSON with the expression `column_data.tuples[i]`). Finally, the cell text is placed into a `<td>` (table cell) element, which is added to the table row.

```

function appendCell(jqRow, column_data, i) {
    if (column_data && column_data.formattedData && (i <
column_data.formattedData.length)) {
        var cellText = column_data.formattedData[i];
        jqRow.append($("<td class='" + CSS_CLASS_TD_DEFAULT + "'>" + cellText + "</
td>"));
    }
}

```

## Function `appendRowHeaderCell`

Helper function `appendRowHeaderCell()` adds a row header cell to each table row. A row header cell contains a text concatenation of all row dimension member values in that row. The passed arguments are a `<tr>` (table row) element and a row index.

```
function appendRowHeaderCell(jqRow, i) {
    var column_data = getAnySetColumn_Data();
    if (meta_data && column_data && column_data.formattedData && (i <
column_data.tuples.length)) {
        var tuple = column_data.tuples[i];
        var headerText = "";
        for (var j = 0; j < tuple.length; j++) {
            if (column_data.selection[j] == -1) {
                headerText += " " + meta_data.dimensions[j].members[tuple[j]].text;
            }
        }
        headerText = headerText.replace("|", " "); // Delimiter used for multiple
presentations
        jqRow.append($("<td class=\"\" + CSS_CLASS_TD_HEADER + \"\">" + headerText + "</
td>"));
    }
}
```

After various safety checks (Is metadata available, in other words, does a Metadata Runtime JSON actually exist? Is data available, in other words, does a Data Runtime JSON of one of the properties `column1`, `column2` or `column3` actually exist? Is the row index in the correct range?), the JavaScript expression `column_data.tuples[i]` picks the appropriate tuple from the Data Runtime JSON using the row index. The tuple contains dimension member indexes for each dimension.

An empty row header text is defined.

A loop over the number of dimensions (equal to the number of tuple elements `tuples.length`) combines the row header text. Only row dimension members are combined to make the row header text. This is achieved by checking if the appropriate dimension member is flagged as unspecified (`= -1`) in the `selection` JSON property of the Data Runtime JSON. Since we made a **column** selection, this means column dimension member indexes in the `selection` JSON property are unequal to `-1` and row dimension member indexes are equal to `-1`. If a row dimension member is found, its dimension information is picked from the Metadata Runtime JSON with expression `meta_data.dimension[j]` and the corresponding dimension member is retrieved with `.members[tuple[j]]`. This member returns the dimension member text with `.text`. Finally, the combined row header text is placed into a `<td>` (table cell) element, which is added to the table row.

## Function `appendColumnHeaderCell`

Helper function `appendColumnHeaderCell()` adds a column header cell to the table header row. A column header cell contains a text concatenation of all column dimension member values in that column. The passed arguments are a `<tr>` (table header row) element and the Data Runtime JSON of the property representing that column.

```
function appendColumnHeaderCell(jqHeaderRow, column_data) {
    if (column_data && column_data.formattedData) {
        var headerText = "";
        for (var i = 0; i < column_data.selection.length; i++) {
```

```

    var selectionIndex = column_data.selection[i];
    if (selectionIndex != -1) {
        headerText += " " + meta_data.dimensions[i].members[selectionIndex].text;
    }
}
$("<td class=\"" + CSS_CLASS_TD_HEADER + "\">" + headerText + "</td>").appendTo(jqHeaderRow);
}
}

```

After a safety check (Is data available, in other words, does a Data Runtime JSON of the property representing that column actually exist?), an empty column header text is defined.

A loop over the number of dimensions (equal to the number of elements of the Data Runtime JSON `selection` JSON property) combines the column header text.

Only column dimension members are combined to make the column header text. This is achieved by checking if the appropriate dimension member is not flagged as unspecified (`!= -1`) in the `selection` JSON property of the Data Runtime JSON. Since we made a **column** selection, this means column dimension member indexes in the `selection` JSON property are unequal to `-1` and row dimension member indexes are equal to `-1`. If a column dimension member is found, its dimension information is picked from the Metadata Runtime JSON with expression `meta_data.dimensions[i]` and the corresponding dimension member is retrieved with `.members[selectionIndex]`. This member returns the dimension member text with `.text`. Finally, the combined column header text is placed into a `<td>` (table cell) element, which is added to the table header row.

## 5.5 Select Data Dialog Box

In the *Properties* view of Design Studio, the following properties are displayed with an input field (into which you can type a selection string) and a value help button:

- [ResultCell](#)
- [ResultCellList](#)
- [ResultCellSet](#)
- [ResultSet](#)

Using the value help button makes creating a selection string easier. The *Select Data* dialog box appears. In this dialog box, you can create your selection based on the result set data. Your selection is automatically restricted by the property type.

### Example

You can only select a single cell for a property of type [ResultCell](#), whereas you can select a single row or column of cells for a property of type [ResultCellList](#).

When you close the dialog box, the relevant selection string is displayed in the *Properties* view.

### Restriction

- The *Select Data* dialog box does not support all types of queries.

- 
- The *Select Data* dialog box only supports selections of multiple rows or columns for properties of type *ResultCellSet*.

## 6 SDK Extensions Using SAPUI5 Controls

The SDK also allows you to create SDK extension components based on SAPUI5 controls. The SDK uses the SAPUI5 extension mechanism of SAPUI5 to first extend an SAPUI5 control and then modify it. An SDK component inherits all the properties of the extended SAP UI5 component.

For more information, see the *SAPUI5 Developer Guide* at <https://sapui5.hana.ondemand.com/sdk/#docs/guide/OnTheFlyControlDefinition.html>.

The following sections describe the modifications that can be made to SDK extensions and extension components when creating SDK extension components based on SAPUI5 controls. The necessary modifications are described using the *RatingIndicator* component of the UI5 SDK sample extension as an example.

### 6.1 Contribution XML

Example: File `contribution.xml` of the SAPUI5 SDK extension

```
<?xml version="1.0" encoding="UTF-8"?>
<sdkExtension ...
  id="com.sap.sample.ui5">
  <component ...
    id="RatingIndicator"
    handlerType="sapui5">
    ...
    <property ...
      id="value"
      type="float"/>
    <property ...
      id="onChange"
      type="ScriptText"/>
    ...
  </component>
</sdkExtension>
```

The component ID `RatingIndicator` (ID does not have to match the name of the extended SAPUI5 control) is combined with the extension ID `com.sap.sample.ui5`, to create the unique extension component ID `com.sap.sample.ui5.RatingIndicator` for the *RatingIndicator* SDK extension component.

The component handler type must be `sapui5`.

To provide access to the property `value` of the SAPUI5 *RatingIndicator* control, define a property with the same name and type for the SDK component.

---

## 6.2 Component JavaScript

The component JavaScript of an SAPUI5-based SDK extension component uses a different syntax than a normal SDK extension component, because it has to follow SAPUI5 rules.

### Extension Component Lifecycle

SAPUI5-based SDK extension components also use the concept of a rendering lifecycle with functions that you can override, similar to normal SDK extension components. The following functions are called in the specified sequence during the rendering lifecycle:

- `initDesignStudio()`
- `beforeDesignStudioUpdate()`
- Property Setter and Getter Functions
- `afterDesignStudioUpdate()`
- `renderer()`

### Related Information

[JavaScript Function Calls \[page 75\]](#)

[Events \[page 78\]](#)

### 6.2.1 JavaScript Function Calls

#### Function `initDesignStudio`

Syntax: `initDesignStudio()`

Implement this function to execute JavaScript code when the SAPUI5-based SDK extension component is rendered for the first time, after the SAPUI5-based SDK extension component has been created. Usually you attach event listeners in this function.

#### Function `beforeDesignStudioUpdate`

Syntax: `beforeDesignStudioUpdate()`

Implement this function to execute JavaScript code before the properties of the SAPUI5-based SDK extension component are updated.

## Property Setter and Getter Functions

For SDK extension component properties that map to SAPUI5 control properties, no explicit getter-setter functions are necessary. The mapping is configured automatically by the SDK framework.

For SDK extension component properties that do not map to SAPUI5 control properties, you can implement a getter and a setter function. Their names follow this convention (note the uppercase and lowercase letters): For the property `fooProp`, the getter function is named `getFooProp`, and the setter function is named `setFooProp`.

Example: The SDK component in the following example has a property `copyrightText` of type `String`. It is defined in the file `contribution.xml` of the SDK component as follows:

```
...
<property
  id="copyrightText"
  title="Copyright Text"
  type="String"/>
...
```

Since this property is not a property of the SAPUI5 component, which the SDK component is based on, you need to define explicit getter and setter functions in the component's JavaScript file (unlike the properties of the SAPUI5 component, which are available automatically). Note that the first letter after `get` and `set` is in uppercase:

```
...
getCopyrightText: function() {
  return this.copyrightText;
},
setCopyrightText: function(copyrightText) {
  this.copyrightText = copyrightText;
}
...
```

## Function `afterDesignStudioUpdate`

Syntax: `afterDesignStudioUpdate()`

Implement this function to execute JavaScript code after the properties of the SAPUI5-based SDK extension component have been updated.

## Function `renderer`

Syntax: `renderer()`

If this SAPUI5 function is not empty, it contains `renderer` code. Usually it is empty. This is because you want to leverage the rendering of the SAPUI5 control, which this SAPUI5-based SDK extension component is based on. For more information, see the *SAPUI5 Developer Guide* at <https://sapui5.hana.ondemand.com/sdk/#docs/guide/OnTheFlyControlDefinition.html>.

## Function `fireDesignStudioPropertiesChangedAndEvent`

Syntax: `fireDesignStudioPropertiesChangedAndEvent([sPropertyname1, sPropertyname2, ...], sPropertyname);`

Function `fireDesignStudioPropertiesChangedAndEvent` is a faster implementation of this frequent combination of function calls requiring only one server round-trip.

### Note

Calling `fireDesignStudioPropertiesChangedAndEvent` triggers a server roundtrip. Therefore, frequent use of this function may decrease the performance of your analysis application.

We recommend that this function should only be called upon user interaction. We do not recommend calling this function to implement implicit changes to properties (event cascading), as this may lead to a large number of (or even infinite) server roundtrips. Design Studio's standard components only trigger server roundtrips upon user interaction. This ensures efficient use of server roundtrips, which leads to better performance and avoids the threat of indeterministic (or even infinite) server roundtrips through event cascading.

## 6.2.2 JavaScript Tips

### How can I add my own function to the JavaScript of an SAPUI5-based SDK component?

Example: To implement the function `myFunction(arg1, arg2)`, add

```
...  
myFunction: function(arg1, arg2) {  
    // method body  
},  
...
```

### How can I share variables in my functions in the JavaScript of an SAPUI5-based SDK component?

Use `this.` with the variable name.

### Note

Choose a variable name that does not conflict with the variable names of the SAPUI5 component, which your SDK component is based on.

Example: To get and set the value of variable `myVariable` in function `myFunction`, add the following:

```
...
```

```
myFunction1: function() {
    // ...
    this.myVariable = x; // set the shared variable value
    // ...
},
myFunction2: function() {
    // ...
    var x = this.myVariable; // get the shared variable value
    // ...
},
...
```

## 6.3 Events

SAPUI5-based SDK extension components also have event methods, similar to normal SDK extension components:

### Function `fireDesignStudioPropertiesChanged`

Syntax: `fireDesignStudioPropertiesChanged(["sPropertyName1", "sPropertyName2", ...])`

Call this function to inform the SDK framework that one or more properties of this SAPUI5-based SDK extension component have changed in the browser.

#### Note

Calling `fireDesignStudioPropertiesChanged` triggers a server roundtrip. Therefore, frequent use of this function may decrease the performance of your analysis application. We recommend that this function should only be called upon user interaction. We do not recommend calling this function to implement implicit changes to properties (so-called event cascading), as this may lead to a large number of (or even infinite) server roundtrips. Design Studio's standard components only trigger server roundtrips upon user interaction. This ensures efficient use of server roundtrips, which leads to better performance and avoids the threat of indeterministic (or even infinite) server roundtrips through event cascading.

### Function `fireDesignStudioEvent`

Syntax: `fireDesignStudioEvent("sPropertyName")`

Call this function to execute the Design Studio script that is stored in a property of type `ScriptText` of this SAPUI5-based SDK extension component.

#### Note

Calling `fireDesignStudioEvent` triggers a server roundtrip. Therefore, frequent use of this function may decrease the performance of your analysis application. We recommend that this function should only be called

upon user interaction. We do not recommend calling this function to implement implicit changes to properties (so-called event cascading), as this may lead to a large number of (or even infinite) server roundtrips. Design Studio's standard components only trigger server roundtrips upon user interaction. This ensures efficient use of server roundtrips, which leads to better performance and avoids the threat of indeterministic (or even infinite) server roundtrips through event cascading.

## Example

File `components.js` of the SAPUI5 SDK extension

```
...
sap.ui.commons.RatingIndicator.extend("com.sap.sample.ui5.RatingIndicator", {
    initDesignStudio: function() {
        this.attachChange(function() {
            this.fireDesignStudioPropertiesChanged(["value"]);
            this.fireDesignStudioEvent("onChange");
        });
    },
    renderer: {}
});
...
```

In the first line, the *RatingIndicator* SDK extension component is extended from the SAPUI5 *RatingIndicator* control using the unique extension component ID `com.sap.sample.ui5.RatingIndicator`.

Function `initDesignStudio()` implements initialization tasks. Event listeners are usually attached to the SAPUI5 control here in order to map SAPUI5 event listening to SDK event listening. Note the SAPUI5 naming convention: The name of the function starts with `attach`, followed by the SAPUI5 event name with the first letter in uppercase. For more information, see the *SAPUI5 Developer Guide* at <https://sapui5.hana.ondemand.com/sdk/#docs/guide/OnTheFlyControlDefinition.html>.

In the event listener code you can trigger:

- the update of SDK component properties with the `fireDesignStudioPropertiesChanged()` method (`value` is an SDK extension component property of type `float` defined in `contribution.xml`)
- the execution of Design Studio scripts with the `fireDesignStudioEvent()` methods (`onChange` is an SDK extension component property of type `ScriptText` defined in `contribution.xml`)

Function `renderer()` implements the actual rendering of the component. If this is left empty, then the renderer of the SAPUI5 parent class `sap.ui.commons.RatingIndicator` renders the SDK component.

---

## 7 SDK Extensions as Data Sources (Data Source SDK)

In addition to creating SDK components that simply visualize data from a data source, you can also create SDK components that act as data sources for SDK components (SDK data sources). In other words, not only can you create SDK components that **consume** data but also SDK components that **produce** data.

This enables SDK components to use SDK data sources, in order to access a broad range of data sources, for example, a local file, a Web service or a new type of back end system. When you implement an SDK data source, you implement the actual access to the data and supply the data to SDK components using the APIs of the Data Source SDK, which is a part of the Design Studio SDK.

### Restrictions

SDK data sources can be consumed by SDK components and standard components, with the exception of the standard *Crosstab* component and standard filter components such as *Dimension Filter* and *Filter Panel*.

### 7.1 Using SDK Data Sources in SAP BusinessObjects Design Studio

SDK data sources are added to and removed from a SAP BusinessObjects Design Studio installation like any other SDK component.

SDK data sources do not appear in the *Components* view of the design tool. In order to add an installed SDK data source to your application, follow these steps:

1. In the design tool, right-click the *Data Sources* folder in the *Outline* view.
2. Choose *Add Custom Data Source....* A submenu appears with a list of installed SDK data sources.
3. Choose one of the listed SDK data sources.

### Restrictions

- In general, an SDK data source operates on the provided data. It has no built-in concept of background dimensions, which can be used for filtering data, like normal data sources. However, you can implement SDK data sources that provide this background dimension-like behavior.
- The *Select Data* dialog box in the *Properties* view does not currently support SDK data sources.

## 7.2 Implementing an SDK Data Source

SDK data sources have the same project structure as any other SDK component. The following sections list and explain the differences.

### Prerequisites

You have understood sections [SDK Extensions \[page 20\]](#) and [SDK Extensions and Data Binding \[page 46\]](#).

### Contribution XML

The type of an SDK data source component is

```
handlerType="datasource"
```

### Component JavaScript

There are two ways of implementing the Component JavaScript part of an SDK data source:

- You can extend your SDK data source from the `DataSource` JavaScript class, which is provided by the SDK framework. This is the most basic way to implement an SDK data source. It offers you the most control over your SDK data source implementation but requires you to create the potentially intricate Metadata Runtime JSON and Data Runtime JSON objects.
- You can extend your SDK data source from the `DataBuffer` JavaScript class, which is provided by the SDK framework. This class sits on top of, or in other words, extends the basic `DataSource` JavaScript class. It offers you a more convenient way of implementing an SDK data source.

The two implementation options are transparent to application designers working with your SDK data source. They will not be able to recognize which option you used to implement your SDK data source.

## 7.3 Option 1: Extending the `DataSource` JavaScript class

The most basic way to implement an SDK data source is to extend it from the `DataSource` JavaScript class, which is provided by the SDK framework. The API that you need to implement consists of only two methods. In a nutshell, both methods return the Metadata Runtime JSON and the Data Runtime JSON objects, as specified in the sections on the “Metadata Runtime JSON” and “Data Runtime JSON” under [Runtime Property Values \[page 48\]](#). If you find it challenging to create JSON objects that conform to these specifications you might want to try Option 2.

The example below shows an extract of the Component JavaScript of the SDK data source component *Constant Data Source* that extends the `DataSource` JavaScript class:

#### Example

(File `component.js`)

```
sap.designstudio.sdk.DataSource.subclass("com.sap.sample.constantdatasource.ConstantDataSource", function() {
  var oMetadataRuntimeJson = ...;
  var oFullDataRuntimeJson = ...;
  this.fetchData = function(oSelection, oOptions) {
    return oFullDataRuntimeJson;
  };
  this.metadata = function(value) {
    if(value === undefined) {
      return JSON.stringify(oMetadataRuntimeJson);
    } else {
      return this;
    }
  };
});
```

## 7.3.1 JavaScript Function Calls

SDK data sources that extend from the `DataSource` JavaScript class share the same Component JavaScript API as other SDK extension components, implementing or calling JavaScript functions like `init`, `beforeUpdate`, `afterUpdate`, `firePropertiesChanged`, or `fireEvent`. However, there are a few additional JavaScript functions that are specific to SDK data sources that extend from the `DataSource` JavaScript class. They are listed in the following sections.

### Function `fetchData`

Syntax: `fetchData(oSelection, oOptions)`

Implement this function to return the Data Runtime JSON object as specified in "Data Runtime JSON" under [Runtime Property Values \[page 48\]](#). The argument `oSelection` is the Design Time JSON object ("selection string") (see [Design Time Property Values \[page 48\]](#)). The argument `oOptions` is a JSON object that contains property options for data-bound properties (see "Element <Option>" under [Elements \[page 21\]](#)).

With your implementation of this function, you may want to evaluate the Design Time JSON object and the property options before constructing and returning the appropriate Data Runtime JSON object.

The example below shows the implementation of this function in the SDK data source component *Constant Data Source*. It ignores the passed selection string and the options, and always returns a constant Data Runtime JSON object (hence the component's name):

Example: (File `component.js`)

```
this.fetchData = function(oSelection, oOptions) {
```

```
return oFullDataRuntimeJson;
};
```

Note that in this SDK data source component, the Metadata Runtime JSON part is always included in the Data Runtime JSON object for simplicity reasons. In a more elaborate implementation, you would decide (based on the Metadata Runtime and Data Runtime JSON specification in combination with the passed options) what properties to include in the Metadata Runtime JSON and Data Runtime JSON objects.

## Getter and setter function for property `metadata`

Implement this function as a combined getter and setter function for the property `metadata`. When called as a getter function, it must return the Metadata Runtime JSON object as a string. When called as a setter function, it must return `this` to allow function calls to be chained, thus creating a **fluent interface**.

The example below shows the implementation of this function in the SDK data source component [Constant Data Source](#). This function always returns a constant Metadata Runtime JSON object (hence the component's name). If the `metadata` property is set, it is ignored:

Example: (File `component.js`)

```
this.metadata = function(value) {
  if(value === undefined) {
    returnJSON.stringify(oMetadataRuntimeJson);
  } else{
    return this;
  }
}
```

## Function `fireUpdate`

Syntax: `fireUpdate(bWillUpdateServer)`

Call this function to notify the SDK framework that your SDK data source contains updated data. If the optional argument `bWillUpdateServer` is `true`, then the SDK framework also notifies the server on the back end of the change. This may lead to back end round-trips.

## 7.3.2 Script Contributions

SDK data sources, like other SDK components, can contribute Design Studio script methods, which are defined in their `contribution.ztl` file. Even if your SDK data source does not contribute any Design Studio script methods, you may find it useful to add an empty Script Contribution file, which extends from the `DataSource` JavaScript class but which does not contain any Design Studio script methods.

The example below shows the empty Script Contribution file of the SDK data source *Constant Data Source*:

Example (File `contribution.ztl`)

```
class com.sap.sample.constantdatasource.ConstantDataSource extends SdkDataSource {  
  // needed to inherit parent class methods  
}
```

This will let your SDK data source automatically inherit the following Design Studio script methods (similar to a normal data source):

String	<code>getDataAsString(Measure measure, MultiDimFilter selection)</code>
DataCell	<code>getData(Measure measure, MultiDimFilter selection)</code>
DimensionArray	<code>getDimensions(optional AxisEnum axis)</code>
String	<code>getDimensionText(Dimension dimension)</code>
Dimension	<code>getMeasuresDimension()</code>
MemberArray	<code>getMembers(Dimension dimension, int maxNumber)</code>
void	<code>setFilter(Dimension dimension, FilterArray value)</code>
void	<code>clearAllFilters()</code>
void	<code>clearFilter(Dimension dimension)</code>
String	<code>getFilterText(Dimension dimension)</code>

Calling these methods in a Design Studio script may lead to calls of the `fetchData` method, which has to evaluate the passed arguments and return the appropriate Metadata Runtime and Data Runtime JSON objects.

## 7.4 Option 2: Extending the `DataBuffer` JavaScript Class

A more convenient way to implement an SDK data source is to extend it from the `DataBuffer` JavaScript class, which is provided by the SDK framework. The `DataBuffer` JavaScript class sits on top of, or in other words, extends the more basic `DataSource` JavaScript class and takes care of the potentially intricate details of creating the appropriate Metadata Runtime JSON and Data Runtime JSON objects.

The example below shows an extract from the Component JavaScript class of the SDK data source component CSV Data Source that extends the `DataBuffer` JavaScript class:

### Example

(File `component.js`)

```
sap.designstudio.sdk.DataBuffer.subclass("com.sap.sample.csvdatasource.CsvDataSource", function() {  
  ...  
});
```

### 7.4.1 JavaScript Function Calls

SDK data sources that extend from the `DataBuffer` JavaScript class share the same Component JavaScript API as other SDK extension components, which implement or call JavaScript functions like `init`, `beforeUpdate`,

`afterUpdate`, `firePropertiesChanged`, `fireEvent`. However, there are a few additional JavaScript functions that are specific to SDK data sources, which extend from the `DataBuffer` JavaScript class. These additional functions are listed in the following sections.

### 7.4.1.1 Function `defineDimensions`

Syntax: `defineDimensions(aoDimensions, oExternalMeasuresDimension)`

You must call this function to set the dimensions of your SDK data source.

The argument `aoDimensions` contains an array of JSON objects, each JSON object defining a dimension. This argument is the value of the `dimensions` JSON property of the Metadata Runtime JSON object (see “Metadata Runtime JSON” under [Runtime Property Values \[page 48\]](#)).

The optional argument `oExternalMeasuresDimension` contains a JSON object, defining an external dimension. This argument is equivalent to the single element of the array `externalDimensions`, a JSON property of the Metadata Runtime JSON object (see link above).

The example below shows an extract of the Component JavaScript class of the SDK data source component [CSV Data Source](#) that extends the `DataBuffer` JavaScript class. It defines a column dimension `cols`, a row dimension `rows`, and an external dimension `measures`.

The example specifies dimension members directly with the `members` JSON property (for the external dimension `measures`). The example leaves other dimension members unspecified (for column dimension `cols` and row dimension `rows`); those dimensions' members are created automatically when data is added with `setData` later.

#### Example

(File `component.js`)

```
this.defineDimensions([{\n  \"key\": \"cols\", \n  \"text\": \"Columns\", \n  \"axis\": \"COLUMNS\", \n  \"axis_index\": 0\n}, {\n  \"key\": \"rows\", \n  \"text\": \"Rows\", \n  \"axis\": \"ROWS\", \n  \"axis_index\": 0\n}], {\n  \"key\": \"measures\", \n  \"text\": \"Measures\", \n  \"containsMeasures\": true, \n  \"members\": [{\n    \"key\": \"Measure\", \n    \"text\": \"Measure\", \n  }]\n});
```

Typically, you call this function in the `init` function of the Component JavaScript of your SDK data source.

The example below shows an extract of the Component JavaScript class of the SDK data source component *CSV Data Source* that extends the *DataBuffer* JavaScript class:

Example: (File `component.js`)

```
this.init = function() {  
    this.defineDimensions(...);  
};
```

## 7.4.1.2 Function `setDataCell`

Syntax: `setDataCell(aCoordinates, value)`

Call this function to set the value of a single data cell of your SDK data source.

The argument `aCoordinates` contains either an array of dimension names (provided that dimension members were specified in the previous call of `defineDimensions`) or dimension member indexes. Either way, the array specifies the coordinates of the data cell.

The argument `value` contains the new value of the data cell. It is a float number, a string, or `null`.

If the value is a float number then it is added to the `data` JSON property (an array) of the Data Runtime JSON. Then, the value is converted to a string and added to the `formattedData` JSON property (an array) of the Data Runtime JSON.

If the value is a string then it is added to the `formattedData` JSON property (an array) of the Data Runtime JSON. Then, the SDK framework attempts to convert the value to a float number, which is added to the `data` JSON property (an array) of the Data Runtime JSON.

If the value is `null` then it is added to both the `data` JSON property (an array) of the Data Runtime JSON and the `formattedData` JSON property (an array) of the Data Runtime JSON.

### Caution

When populating your data source with data cells, you must strictly follow this sequence: Set the data cells left-to-right first, then top-to-bottom. Adding data cells randomly (with respect to their coordinates) may lead to an unusual arrangement of data cells.

The example below shows the correct sequence for setting the data cells of an SDK data source, in order to provide the data of the following result set: The result set has 3 dimensions, with the first dimension (Product) in the rows and the remaining two dimensions (Year and City) in the columns, with 2 x 2 x 3 member values:

Table 26:

	2013	Sydney	Tokyo	2014	Sydney	Tokyo
	Berlin			Berlin		
Product 1	1	2	3	4	5	6
Product 2	7	8	9	10	11	12

Define the dimensions (in function `init`) with:

```
this.defineDimensions({
  [
    {
      "key": "year",
      "text": "Year",
      "axis": "COLUMNS",
      "axis_index": 0,
      "members": [
        {
          "key": "2013",
          "text": "2013"
        }, {
          "key": "2014",
          "text": "2014"
        }
      ]
    }, {
      "key": "City",
      "text": "city",
      "axis": "COLUMNS",
      "axis_index": 1,
      "containsMeasures": true,
      "members": [
        {
          "key": "berlin",
          "text": "Berlin"
        }, {
          "key": "sydney",
          "text": "Sydney"
        }, {
          "key": "tokyo",
          "text": "Tokyo"
        }
      ]
    }, {
      "key": "products",
      "text": "Products",
      "axis": "ROWS",
      "axis_index": 0,
      "members": [
        {
          "key": "product1",
          "text": "Product 1"
        }, {
          "key": "product2",
          "text": "Product 2"
        }
      ]
    }
  ],
  "locale": "en"
});
```

Add the data (in method `afterUpdate`) using dimension members names. Note the particular sequence in which data are added:

```
this.setDataCell(["2013", "berlin", "product1"], 1);
this.setDataCell(["2013", "sydney", "product1"], 2);
this.setDataCell(["2013", "tokyo", "product1"], 3);
this.setDataCell(["2014", "berlin", "product1"], 4);
this.setDataCell(["2014", "sydney", "product1"], 5);
this.setDataCell(["2014", "tokyo", "product1"], 6);
this.setDataCell(["2013", "berlin", "product2"], 7);
```

```

this.setDataCell(["2013", "sydney", "product2"], 8);
this.setDataCell(["2013", "tokyo", "product2"], 9);
this.setDataCell(["2014", "berlin", "product2"], 10);
this.setDataCell(["2014", "sydney", "product2"], 11);
this.setDataCell(["2014", "tokyo", "product2"], 12);

```

An alternative way to add the data is using dimension member indexes instead of dimension member names:

```

this.setDataCell([0, 0, 0], 1);
this.setDataCell([0, 1, 0], 2);
this.setDataCell([0, 2, 0], 3);
this.setDataCell([1, 0, 0], 4);
this.setDataCell([1, 1, 0], 5);
this.setDataCell([1, 2, 0], 6);
this.setDataCell([0, 0, 1], 7);
this.setDataCell([0, 1, 1], 8);
this.setDataCell([0, 2, 1], 9);
this.setDataCell([1, 0, 1], 10);
this.setDataCell([1, 1, 1], 11);
this.setDataCell([1, 2, 1], 12);

```

### **i** Note

In case, you do not specify dimension members, you can proceed like this:

You defined the dimensions without members, for example, with

```

this.defineDimensions({
  [
    {
      "key": "year",
      "text": "Year",
      "axis": "COLUMNS",
      "axis_index": 0
    }, {
      "key": "City",
      "text": "city",
      "axis": "COLUMNS",
      "axis_index": 1,
      "containsMeasures": true
    }, {
      "key": "products",
      "text": "Products",
      "axis": "ROWS",
      "axis_index": 0
    }
  ],
  "locale": "en"
});

```

You can add data using dimension member indexes only (as no dimension member names are available):

```

this.setDataCell([0, 0,0], 1);
this.setDataCell([0, 1,0], 2);
this.setDataCell([0, 2,0], 3);
this.setDataCell([1, 0,0], 4);
this.setDataCell([1, 1,0], 5);
this.setDataCell([1, 2,0], 6);
this.setDataCell([0, 0,1], 7);
this.setDataCell([0, 1,1], 8);
this.setDataCell([0, 2,1], 9);
this.setDataCell([1, 0, 1], 10);
this.setDataCell([1, 1,1], 11);
this.setDataCell([1, 2,1], 12);

```

This is the resulting result set (note the dimension member indexes, which were created automatically):

Table 27:

	0	1	2	1	1	2
	0	1	2	0	1	2
0	1	2	3	4	5	6
1	7	8	9	10	11	12

### 7.4.1.3 Function fillWithArray

Syntax: `fillWithArray(aData, bHasHeaderRow, bHasHeaderColumn)`

If your SDK data source contains 2-dimensional data (arranged like a spreadsheet), and you defined a single row and column dimension with `defineDimensions` you can use this function to initialize the data cells in one go from an array of data. The necessary dimension members are created automatically.

The argument `aData` contains the data arranged as a nested 2-dimensional array. For example, an array of 3 columns x 2 rows containing data is expressed as `[[1, 2, 3], [4, 5, 6]]`.

The argument `bHasHeaderRow` indicates whether the data also contains the column header titles. If set to `true` then the first array element of the data contains the column header titles. They are used to name the column dimension members, which are created automatically.

#### **i** Note

To work properly, all column header titles must differ from each other, as they serve as dimension member names of the column dimension.

If set to `false` the column dimension members, which are created automatically, are named using letters A, B, C, and so on.

The argument `bHasHeaderColumn` indicates whether the data also contain the row header titles. If set to `true` then the first element of each array element of the data contains a row header title. They are used to name the row dimension members, which are created automatically.

#### **i** Note

To work properly, all row header titles must differ from each other, as they serve as dimension member names of the row dimension.

If set to `false` the row dimension members, which are created automatically, are named using numbers 0, 1, 2, and so on.

### Example

The example below shows the initialization of the data cells of an SDK data source from an array of 3 columns x 3 rows, with the first row containing the column header titles:

```
fillWithArray([[1, 2, 3], [4, 5, 6], [7, 8, 9]], false, false);
```

This is the resulting result set (note the titles of the column and row dimension members, which were generated automatically):

	A	B	C
1	1	2	3
2	4	5	6
3	7	8	9

### Example

The example below shows the initialization of the data cells of an SDK data source from an array of 3 columns x 3 rows with the first row containing the column header titles:

```
fillWithArray([["Column1", "Column2", "Column3"], [1, 2, 3], [4, 5, 6]], true, false);
```

This is the resulting result set (note the titles of the row dimension members, which were generated automatically):

	Column1	Column2	Column3
3	4	5	6
3			
2	1	2	3

### Example

The example below shows the initialization of the data cells of an SDK data source from an array of 3 columns x 3 rows with the first column containing the row header titles:

```
fillWithArray([["Row1", 1, 2], ["Row2", 3, 4], ["Row3", 5, 6]], false, true);
```

This is the resulting result set (note the titles of the row dimension members, which were generated automatically):

	B	C
Row1	1	2

	B	C
Row2	3	4
Row3	5	6

#### Example

The example below shows the initialization of the data cells of an SDK data source from an array of 3 columns x 3 rows with the first row containing the column header titles and the first column containing the row header titles:

```
fillWithArray([["Column 0", "Column1", "Column2"], ["Row 1", 1, 2], ["Row 2", 3, 4]], true, true);
```

This is the resulting result set (note that the first element of the first element of the array is ignored):

	Column1	Column2
Row 1	1	2
Row 2	3	4

## 7.4.1.4 Function clear

Syntax: `clear(bClearMembers)`

Call this function to reset the SDK data source to its initial state. In particular, this function clears all previously set data information. If the optional argument `bClearMembers` is `true` then the member information is also cleared. This is useful if function `setDataCell` is used with dimension member names (and not dimension member indexes) that automatically create dimension members. Note that the JSON property `externalDimensions` is never cleared.

## 7.4.1.5 Function fireUpdate

Syntax: `fireUpdate(bWillUpdateServer)`

Call this function to notify the SDK framework that your SDK data source contains updated data. If the optional argument `bWillUpdateServer` is `true`, then the SDK framework also notifies the server on the backend of the change. This may lead to backend round-trips.

### Note

This method is inherited from the `DataSource JavaScript` class, as SDK data sources extending from the `DataBuffer JavaScript` class (which in turn extends from `DataSource JavaScript` class) also inherit the methods of `DataSource`.

## 7.4.2 Script Contributions

SDK data sources, like other SDK components, may contribute Design Studio script methods, which are defined in their `contribution.ztl` file. Even if your SDK data source does not contribute any Design Studio script methods, you may find it useful to add an empty Script Contribution file extending from the `DataBuffer JavaScript` class but containing no Design Script methods.

The example below shows the empty Script Contribution file of the SDK data source **CSV Data Source**:

### Example

(File `contribution.ztl`)

```
classcom.sap.sample.csvdatasource.CsvDataSource extendsSdkDataBuffer {  
    // needed to inherit parent class methods  
}
```

This will let your SDK data source automatically inherit the following Design Studio script methods (similar to a normal data source):

```
String          getDataAsString(Measure measure, MultiDimFilterselection)  
DataCell        getData(Measure measure, MultiDimFilter selection)  
DimensionArray  getDimensions(optional AxisEnum axis)  
String          getDimensionText(Dimension dimension)  
Dimension       getMeasuresDimension()  
MemberArray     getMembers(Dimension dimension, intmaxNumber)  
void            setFilter(Dimension dimension, FilterArray value)  
void            clearAllFilters()  
void            clearFilter(Dimension dimension)  
String          getFilterText(Dimension dimension)
```

## 8 Sample Components

In this section, you will find information about the available sample components, in particular the prerequisites, usage, properties and Design Studio script API methods.

### Note

You can download the sample components under *Design Studio SDK Templates and Samples* on SAP Help Portal at <http://help.sap.com/boad>.

### 8.1 Colored Box

Sample component that displays a colored rectangle.

This component is an example of a minimal SDK extension component.

#### How To Proceed

Drag and drop a *Colored Box* into the editor area.

#### Properties

Table 28:

Name	Type	Description
Color	Color	The color of the <i>Colored Box</i>
On Click	Script Text	The Design Studio script that is executed when the user clicks the <i>Colored Box</i>

#### Design Studio Script API

- `void setColor(String newColor)`  
Sets the color of the *Colored Box*.

Table 29: Parameters

Name	Type	Description
newColor	String	The new color of the <i>Colored Box</i> . All CSS-like color values can be used, for example <b>red</b> or <b>#FF0000</b> .

- `String getColor()`  
Returns a string containing the color of the *Colored Box*.

## 8.2 Simple Table

Sample component that displays up to three columns of key figures from a data source in a table.

This component is an example of a data-bound SDK extension component.

### Prerequisites

You need a data source, which contains three key figure columns.

### How to Proceed

1. Drag and drop a *Simple Table* into the editor area.
2. Assign a data source to the *Data Source* property.
3. Assign columns of key figures from the data source to the properties *Column1*, *Column2*, and *Column3*. When you assign a column of key figures to this *Simple Table* for the first time, an additional column is displayed on the left of this column. The additional column contains the dimension member values of the rows.

#### Note

You can also assign rows of key figures from the data source. However, when you mix columns and rows of key figures, the resulting table may look unusual.

## Properties

Table 30:

Name	Type	Description
DataSource	DataSource	The data source of the <i>Simple Table</i>
Column 1	ResultCellList	The first column of key figures displayed in the <i>Simple Table</i>
Column 2	ResultCellList	The second column of key figures displayed in the <i>Simple Table</i>
Column 3	ResultCellList	The third column of key figures displayed in the <i>Simple Table</i>

## Design Studio Script API

- `void setColumn1Selection(ResultCellListSelection selection)`  
Sets the column of key figures to be displayed in the first column of key figures in the *Simple Table*. When you set columns of this *Simple Table* for the first time, an additional column is displayed on the left of this column. The additional column contains the dimension member values of the rows.

Table 31: Parameters

Name	Type	Description
selection	ResultCellListSelection	A selection that specifies a single column (or row) of key figures from a data source

- `void setColumn2Selection(ResultCellListSelection selection)`  
Sets the column of key figures to be displayed in the second column of key figures in the *Simple Table*. When you set columns of this *Simple Table* for the first time, an additional column is displayed on the left of this column. The additional column contains the dimension member values of the rows.

Table 32: Parameters

Name	Type	Description
selection	ResultCellListSelection	A selection that specifies a single column (or row) of key figures from a data source

- `void setColumn3Selection(ResultCellListSelection selection)`  
Sets the column of key figures to be displayed in the third column of key figures in the *Simple Table*. When you set columns of this *Simple Table* for the first time, an additional column is displayed on the left of this column. This additional column contains the dimension member values of the rows.

Table 33: Parameters

Name	Type	Description
selection	ResultCellListSelection	A selection that specifies a single column (or row) of key figures from a data source

## 8.3 Simple Crosstab

Sample component that display the data of a data source in a crosstab.

This component is an example of a data-bound SDK extension component.

### Prerequisites

You need a data source.

### How to Proceed

1. Drag and drop a *Simple Crosstab* into the editor area.
2. Assign a data source to the *Data Source* property.

### Properties

Table 34:

Name	Type	Description
DataSource	DataSource	The data source of the <i>Simple Crosstab</i>
Data Selection	ResultSet	The displayed result set
On Select	ScriptText	The Design Studio script that is executed after the user makes a selection in the <i>Simple Crosstab</i>

## Design Studio Script API

- `void setDataSelection(ResultSetSelection selection)`  
Sets a data selection for to the *Simple Crosstab*. This filters the displayed result set so that only the data selection is displayed.

Table 35: Parameters

Name	Type	Description
selection	ResultSetSelection	A data selection from a data source

- `String getVisualSelection()`  
Returns a string; a specification of the data cells in the *Simple Crosstab* currently visually selected by the user.
- `void setVisualSelection(ResultSetSelection selection)`  
Visually selects data cells in the *Simple Crosstab*.

Table 36: Parameters

Name	Type	Description
selection	ResultSetSelection	A selection that specifies the visually selected data cells in the <i>Simple Crosstab</i> .

- `Member getSelectedMember(Dimension dimension)`  
Returns a member; the visually selected dimension member of the *Simple Crosstab*. Member is `null` if the dimension has no visually selected dimension member.

Table 37: Parameters

Name	Type	Description
dimension	Dimension	The dimension of the selected member

## 8.4 Google Maps

Sample component that displays a Google map.

This component is an example of an SDK extension component, which uses a third party JavaScript API.

### Prerequisites

You need a Google API key (learn more about how to obtain a Google API Key on [https://developers.google.com/maps/documentation/javascript/tutorial#api\\_key](https://developers.google.com/maps/documentation/javascript/tutorial#api_key) 🗑️)

1. In the file `contribution.xml` of this SDK component extension, locate the `<component>` element with an `id` of `GoogleMaps`.

2. Add the Google API key after the keyword `key` in element `<jsInclude>http://maps.googleapis.com/maps/api/js?key=...`

This enables the SDK extension component to use the Google Maps JavaScript API.

## How to Proceed

Drag and drop a [Google Maps](#) into the editor area.

## Properties

Table 38:

Name	Type	Description
Map Type	String	The map type. Possible values: <a href="#">hybrid</a> , <a href="#">roadmap</a> , <a href="#">satellite</a> , <a href="#">terrain</a> (default setting: <a href="#">roadmap</a> ).
Zoom	int	The zoom factor. Possible values: <b>0</b> and greater. The value <b>0</b> shows the world map (default setting: <a href="#">14</a> ).
On Zoom	ScriptText	The Design Studio script that is executed when the user zooms the Google map.

## Design Studio Script API

- `void setZoom(int value)`  
Sets the zoom factor of the Google map.

Table 39: Parameters

Name	Type	Description
value	int	The zoom factor. Possible values: integers of 0 and greater. The value 0 shows the world map.

- `int getZoom()`  
Returns an integer; the zoom factor of the Google map. Possible values: integers of 0 and greater. The value 0 shows the world map.

## 8.5 Google Maps with Data

Sample component that displays a Google map overlaid with vertical bar charts at specific geographical locations. The values and geographical locations of the bar charts are retrieved from a data source.

This component is as an example of an SDK extension component, which uses a third party JavaScript API.

### Prerequisites

- You need a data source that contains a dimension with addresses (city names are sufficient) and two key figures in the columns.
  - You need a Google API key (learn more about how to obtain a Google API Key on [https://developers.google.com/maps/documentation/javascript/tutorial#api\\_key](https://developers.google.com/maps/documentation/javascript/tutorial#api_key) )
1. In the file `contribution.xml` of this SDK component extension, locate the `<component>` element with an `id` of `GoogleMaps`.
  2. Add the Google API key after the keyword `key` in element `<jsInclude>``http://maps.googleapis.com/maps/api/js?key=...`  
This enables the SDK extension component to use the Google Maps JavaScript API to map addresses to geographical locations on the Google Map.

### How to Proceed

1. Drag and drop a *Google Maps with Data* into the editor area.
2. Assign the data source to the *Data Source* property.
3. Assign the dimension containing the addresses to the *Address Dimension* property.
4. Assign a column of key figures to the *Red Markers* property.
5. Optional: assign a column of key figures to the *Blue Markers* property.
6. Optional: assign values to the *Red Scaling Factor* and *Blue Scaling Factor* properties to scale the bar charts.
7. Hide the result row of the data source. Its dimension member - and the corresponding bar charts - cannot be correctly mapped to a geographical location.

### Properties

Table 40:

Name	Type	Description
DataSource	DataSource	The data source of the <i>Google Maps with Data</i> component

Name	Type	Description
Address Dimension	String	The column dimension of the data source that contains addresses (city names are sufficient)
Red Markers	ResultCellList	A column of key figures from the data source
Red Scaling Factor	int	Red marker key figures are divided by this value before being displayed on the Google map (default setting: <i>10000</i> ).
Blue Markers	ResultCellList	A column of key figures from the data source
Blue Scaling Factor	int	Blue marker key figures are divided by this value before being displayed on the Google map (default setting: <i>10000</i> ).

## 8.6 Timer

Sample component that executes a Design Studio script periodically.

This component is an example of an SDK extension component without visualisation.

### How To Proceed

1. Drag and drop a *Timer* into the editor area.
2. Assign a Design Studio script to the *On Timer* property.
3. Assign a time interval in milliseconds to the *Interval in Milliseconds* property.
4. Start and stop the *Timer* using the Timer's *start()* and *stop()* Design Studio script commands.

### Properties

Table 41:

Name	Type	Description
Interval in Milliseconds	int	The time interval of the <i>Timer</i> (default setting: <i>1000</i> )
On Timer	ScriptText	The Design Studio script that is executed periodically, each time the time interval elapses.
Show Icon in Application	boolean	If set to <i>true</i> , the <i>Timer</i> icon is visible in the analysis application. If set to false, the icon is hidden (default setting: <i>true</i> ).

## Design Studio Script API

- `void start()`  
Starts the *Timer*. This executes the Design Studio script of the *On Timer* property periodically, each time the time interval elapses.
- `void stop()`  
Stops the *Timer*. This stops the Design Studio script of the *On Timer* property.
- `boolean isRunning()`  
Returns `true` if the *Timer* has been started or `false` if the *Timer* has been stopped.

## 8.7 Clock

Sample component that displays an animated clock.

This component is an example of an animated SDK extension component.

### How To Proceed

Drag and drop a *Clock* into the editor area.

### Properties

Table 42:

Name	Type	Description
Railway Clock	boolean	If set to <i>true</i> , the <i>Clock</i> is displayed as a railway clock. If set to false, the clock is displayed as a regular clock (default setting: <i>false</i> ).

## 8.8 JSONGrabber

Sample component that displays the Metadata Runtime JSON and Data Runtime JSON strings of data-bound property types. This allows you to examine the format and content of these strings.

## Prerequisites

You need a data source.

## How To Proceed

1. Drag and drop a *JSONGrabber* into the editor area.
2. Assign a data source to the *Data Source* property.
3. Assign an appropriate data selection from the data source to one of the properties *ResultCell*, *ResultCellList*, *ResultCellSet*, or *ResultSet*.
4. Select the property whose JSON strings you want to display in the *JSONGrabber* with the *Show Data-Bound Property* property.
5. Optional: set the *PrettyPrint* property to *true* to pretty print the JSON strings.

## Properties

Table 43:

Name	Type	Description
Data Source	DataSource	The data source of the <i>JSONGrabber</i>
ResultCell	ResultCell	The data-bound property that holds a single result cell of the data source
ResultCellList	ResultCellList	The data-bound property that holds a single row or column of result cells of the data source
ResultCellSet	ResultCellSet	The data-bound property that holds a complex selection of result cells of the data source
ResultSet	ResultSet	The data-bound property that holds all result cells of the data source
Show Data-Bound Property	String	Displays the selected data-bound property. Possible values: <i>ResultCell</i> , <i>ResultCellList</i> , <i>ResultCellSet</i> , and <i>ResultSet</i> (default setting: <i>ResultSet</i> ).
Pretty Print	boolean	If set to <i>true</i> , the JSON strings are pretty-printed (default setting: <i>false</i> ).

## 8.9 KPI Tile

Sample component that displays a single key figure from a data source in a highly customizable tile-like box.

## Prerequisites

You need a data source that contains a key figure.

## How To Proceed

1. Drag and drop a *KPI Tile* into the editor area.
2. Assign a data source to the *Data Source* property.
3. Assign a key figure from the data source to the *Data Value* property.
4. Optional: configure other properties of the *KPI Tile*.

## Properties

Table 44:

Name	Type	Description
Data Source	DataSource	The data source of the <i>KPI Tile</i>
Data Value	ResultCell	The result cell that contains the key figure displayed in the <i>KPI Tile</i>
Header	String	The header text (default setting: <i>Header</i> )
Header Visible	boolean	If set to <i>true</i> , the header is visible. If set to false, the header is hidden (default setting: <i>true</i> )
Header CSS Class	String	The header CSS class
Title Text	String	The title text (default setting: <i>Title</i> )
Title CSS Class	String	The title CSS class
Value Prefix Text	String	The value prefix text
Value Prefix Position	String	The value prefix position. Possible values: <i>superscript</i> , <i>normal</i> , <i>subscript</i> (default setting: <i>subscript</i> ).
Value Prefix CSS Class	String	The value prefix CSS class
Value Text	String	The value text (default setting: <i>Value</i> )
Value CSS Class	String	The value CSS class
Value Horizontal Alignment	String	The value horizontal alignment. Possible values: <i>left</i> , <i>right</i> (default setting: <i>left</i> ).
Value Decimal Places	int	The number of decimal places of the displayed value. Possible values range from <i>0</i> to <i>9</i> (default setting: <i>0</i> ).
Value Suffix Text	String	The value suffix text (default setting: <i>M\$</i> )
Value Suffix Position	String	The value suffix position. Possible values: <i>superscript</i> , <i>normal</i> , <i>subscript</i> (default setting: <i>subscript</i> ).
Value Suffix CSS Class	String	The value suffix CSS class

Name	Type	Description
Footer	String	The footer text (default setting: <i>Footer</i> )
Footer CSS Class	String	The footer CSS class
Footer Horizontal Alignment	String	The footer horizontal alignment. Possible values: <i>left</i> , <i>right</i> (default setting: <i>left</i> ).
On Click	ScriptText	The Design Studio script that is executed when the user clicks the <i>KPI Tile</i>

## Design Studio Script API

- `void setHeaderText(String text)`  
Sets the header text.

Table 45: Parameters

Name	Type	Description
text	String	The header text

- `String getHeaderText()`  
Returns a string containing the header text.
- `void setHeaderVisible(boolean isHeaderVisible)`  
Shows or hides the header.

Table 46: Parameters

Name	Type	Description
isHeaderVisible	Boolean	If set to <i>true</i> , the header is shown. If set to <i>false</i> , the header is hidden

- `boolean isHeaderVisible()`  
Returns *true* if the header is shown or *false* if the header is hidden.
- `void setHeaderCssClass(String cssClass)`  
Sets the header CSS class.

Table 47: Parameters

Name	Type	Description
cssClass	String	The header CSS class

- `String getHeaderCssClass()`  
Returns a string containing the header CSS class.
- `void setTitleText(String text)`  
Sets the title text.

Table 48: Parameters

Name	Type	Description
text	String	The title text

- `String getTitleText()`  
Returns a string containing the title text.
- `void setTitleCssClass(String cssClass)`  
Sets the title CSS class.

Table 49: Parameters

Name	Type	Description
cssClass	String	The title CSS class

- `String getTitleCssClass()`  
Returns a string containing the title CSS class.
- `void setValuePrefixText(String text)`  
Sets the value prefix text.

Table 50: Parameters

Name	Type	Description
text	String	The value prefix text

- `String getValuePrefixText()`  
Returns a string containing the value prefix text.
- `void setValuePrefixCssClass(String cssClass)`  
Sets the value prefix CSS class.

Table 51: Parameters

Name	Type	Description
cssClass	String	The value prefix CSS class

- `String getValuePrefixCssClass()`  
Returns a string containing the value prefix CSS class.
- `void setValueText(String text)`  
Sets the value text.

Table 52: Parameters

Name	Type	Description
text	String	The value text

- `String getValueText()`  
Returns a string containing the value text.
- `void setValueCssClass(String cssClass)`  
Sets the value CSS class.

Table 53: Parameters

Name	Type	Description
cssClass	String	The value CSS class

- `String getValueCssClass()`  
Returns a string containing the value CSS class.
- `void setValueHAlign(String hAlign)`  
Sets the value horizontal alignment.

Table 54: Parameters

Name	Type	Description
hAlign	String	The value horizontal alignment. Possible values: <i>left</i> , <i>right</i> .

- `String getValueHAlign()`  
Returns a string containing the value horizontal alignment. Possible values: *left*, *right*.
- `void setValueDecimalPlaces(int decimalPlaces)`  
Sets the number of decimal places of the value.

Table 55: Parameters

Name	Type	Description
decimalPlaces	int	The number of decimal places of the value. Valid values are between 0 and 9.

- `int getValueDecimalPlaces()`  
Returns an integer, the number of decimal places of the value. Valid returned values are between 0 and 9.
- `void setValueSuffixText(String text)`  
Sets the value suffix text.

Table 56: Parameters

Name	Type	Description
text	String	The value suffix text

- `String getValueSuffixText()`  
Returns a string containing the value suffix text.
- `void setValueSuffixCssClass(String cssClass)`  
Sets the value suffix CSS class.

Table 57: Parameters

Name	Type	Description
cssClass	String	The value suffix CSS class

- `String getValueSuffixCssClass()`  
Returns a string containing the value suffix CSS class.
- `void setFooterText(String text)`  
Sets the footer text.

Table 58: Parameters

Name	Type	Description
text	String	The footer text

- `String getFooterText()`  
Returns a string containing the footer text.
- `void setFooterCssClass(String cssClass)`  
Sets the footer CSS class.

Table 59: Parameters

Name	Type	Description
cssClass	String	The footer CSS class

- `String getFooterCssClass()`  
Returns a string containing the footer CSS class.
- `void setFooterHAlign(String hAlign)`  
Sets the footer horizontal alignment.

Table 60: Parameters

Name	Type	Description
hAlign	String	The footer horizontal alignment. Possible values: <i>left</i> , <i>right</i> .

- `String getFooterHAlign()`  
Returns a string containing the footer horizontal alignment. Possible values returned: *left*, *right*.
- `void setDataSelection(ResultCellSelection cellSelection)`  
Sets the result cell whose value is displayed by the *KPI Tile*.

Table 61: Parameters

Name	Type	Description
cellSelection	ResultCellSelection	The result cell that contains the value displayed by the <i>KPI Tile</i>

## 8.10 Sparkline

Sample component that displays a series of key figures from a data source in a simple line chart.

### Prerequisites

You need a data source that contains a series of key figures.

## How To Proceed

1. Drag and drop a [Sparkline](#) into the editor area.
2. Assign a data source to the [Data Source](#) property.
3. Assign a row or column of key figures from the data source to the property [Data Series](#).
4. Optional: configure the visualization of the line chart by modifying the property [CSS Style](#).

## Properties

Table 62:

Name	Type	Description
Data Source	DataSource	The data source of the <a href="#">Sparkline</a>
Data Series	ResultCellList	The result cell list, which represents the series of key figures displayed by the <a href="#">Sparkline</a>
CSS Style	String	The CSS style used to configure the visualization of the line chart (default setting: <code>stroke:steelblue;stroke-width:1;fill:none;</code> )
On Click	Script Text	The Design Studio script, which is executed when the user clicks the <a href="#">Sparkline</a>

## 8.11 Exception Icon

Sample component that displays an icon, whose image changes depending on the value of a key figure cell from a data source. You can use this component to create a traffic-light status icon with three different states: green, yellow and red.

### Prerequisites

You need a data source that contains a key figure.

## How To Proceed

1. Drag and drop an [Exception Icon](#) into the editor area.
2. Assign a data source to the [Data Source](#) property.

3. Assign a key figure from the data source to the property *Data Value*.
4. Assign an image to each of these properties: *Icon Green*, *Icon Yellow*, and *Icon Red*.
5. Assign decreasing threshold values to each of the properties *Value Icon Green*, *Value Icon Yellow*, and *Value Icon Red*.

## Properties

Table 63:

Name	Type	Description
Data Source	DataSource	The data source of the <i>Exception Icon</i>
Data Value	ResultCell	The result cell, which contains the key figure for selecting the <i>Exception Icon</i> 's image.
Icon Green	Url	The URL of the image (16 x 16 pixels) for the green icon. It is either a fully qualified URL or a local file path. The root of the local file path is the folder of the analysis application.
Icon Yellow	Url	The URL of the image (16 x 16 pixels) for the yellow icon. It is either a fully qualified URL or a local file path. The root of the local file path is the folder of the analysis application.
Icon Red	Url	The URL of the image (16 x 16 pixels) for the red icon. It is either a fully qualified URL or a local file path. The root of the local file path is the folder of the analysis application.
Value Icon Green	float	The lower threshold value for the green icon. It must be the largest of the three threshold values, in order to work correctly.
Value Icon Yellow	float	The lower threshold value for the yellow icon. It must lie between the other two threshold values, in order to work correctly.
Value Icon Red	float	The lower threshold value for the red icon. It must be the smallest of the three threshold values, in order to work correctly.
Exact Match	boolean	If set to <i>true</i> , the appropriate icon image is displayed - provided that the corresponding, rounded threshold value matches the key figure value exactly (default setting: <i>false</i> ).

Name	Type	Description
On Click	ScriptText	The Design Studio script, which is executed when the user clicks the <a href="#">Exception Icon</a>

## 8.12 Audio

Sample component that plays an audio file.

### How To Proceed

1. Drag and drop an [Audio](#) into the editor area.
2. Play an audio file using the [Audio's](#) `play()` Design Studio script command.

### Design Studio Script API

- `void play(String audioUrl)`  
Plays the audio file located at the URL.

Table 64: Parameters

Name	Type	Description
audioUrl	Url	<p>The audio file URL. It is either a fully qualified URL or a local file path. The root of the local file path is the folder of the analysis application.</p> <div> <b>i Note</b>  <a href="#">Audio</a> uses HTML5 to play audio. Not all browsers fully support HTML5. For best results, use Google Chrome. </div>

## 8.13 Video

Sample component that plays a video file.

## How To Proceed

1. Drag and drop a [Video](#) into the editor area.
2. Play a video file using the `Video's play()` Design Studio script command.

## Design Studio Script API

```
void play(String videoUrl)
```

Plays the video file located in the URL.

Table 65: Parameters

Name	Type	Description
videoUrl	Url	<p>The video file URL. It is either a fully qualified URL or a local file path. The root of the local file path is the folder of the analysis application.</p> <div><p><b>i Note</b></p><p>Video uses HTML5 to play the video. Not all browsers fully support HTML5 completely. For best results, use Google Chrome.</p></div>

## 8.14 ApplicationHeader

Sample component that provides an SAP UI5 ApplicationHeader control as an SDK component.

For more information, see <https://sapui5.hana.ondemand.com/sdk/#test-resources/sap/ui/commons/demokit/ApplicationHeader.html>.

## Properties

Table 66:

Name	Type	Description
Display Logoff	boolean	If set to <i>true</i> , the logoff area is displayed on the right of the application header. If set to <i>false</i> , the logoff area is not displayed.

Name	Type	Description
Display Welcome	boolean	If set to <i>true</i> , the welcome text is displayed. If set to <i>false</i> , the welcome text is not displayed. (default setting: <i>true</i> )
User Name	String	The user name that is displayed beside the welcome text
Logo Source	Url	The URI to the logo icon that is displayed in the application header
Logo Text	String	The text that is displayed beside the logo in the application header
On Logoff	ScriptText	The Design Studio script that is executed when the user logs off from the application

## Design Studio Script API

- `void setUserName(String userName)`  
Sets the user name that is displayed beside the welcome text.

Table 67: Parameters

Name	Type	Description
userName	String	The user name

- `String getHeaderText()`  
Returns a string containing the user name that is displayed beside the welcome text.
- `void setLogoText(String logoText)`  
Sets the text that is displayed beside the logo in the application header.

Table 68: Parameters

Name	Type	Description
logoText	String	The logo text

- `String getLogoText()`  
Returns a string containing the text that is displayed beside the logo in the application header.

## 8.15 ColorPicker

Sample component that provides an SAP UI5 ColorPicker control as an SDK component.

For more information, see <https://sapui5.hana.ondemand.com/sdk/#test-resources/sap/ui/commons/demokit/ColorPicker.html>.

## Properties

Table 69:

Name	Type	Description
Color	Color	Picked color (default setting: <i>red</i> )
On Color Change	ScriptText	The Design Studio script that is executed when the user clicks the <i>ColorPicker</i>

## Design Studio Script API

- `void setColor(String colorString)`  
Sets the picked color.

Table 70: Parameters

Name	Type	Description
colorString	String	The color string. It can be a hexadecimal string (for example <i>#FF0000</i> ), an RGB string ( <i>rgb(255,0,0)</i> ), an HSV string ( <i>hsv(360,100,100)</i> ), or a CSS color name ( <i>red</i> ).




- `String getColor()`  
Returns a string containing the picked color.

## 8.16 FormattedTextView

Sample component that provides an SAP UI5 FormattedTextView control as an SDK component.

For more information, see <https://sapui5.hana.ondemand.com/sdk/#test-resources/sap/ui/commons/demokit/FormattedTextView.html>.

### Note

A similar component is available as a basic component in the design tool. For more information, see the “User Interface Reference” in the *Application Designer Guide: Designing Analysis Applications* under  [Help](#)  [Help Contents](#)  in the design tool.

## Properties

Table 71:

Name	Type	Description
HTML Text	String	HTML text

## Design Studio Script API

- `void setHtmlText(String htmlText)`  
Sets the HTML text.

Table 72: Parameters

Name	Type	Description
htmlText	String	HTML text

- `String getHtmlText()`  
Returns a string containing the HTML text.

## 8.17 Paginator

Sample component that provides an SAP UI5 Paginator control as an SDK component.

For more information, see <https://sapui5.hana.ondemand.com/sdk/#test-resources/sap/ui/commons/demokit/Paginator.html>.

## Properties

Table 73:

Name	Type	Description
Current Page	int	The current page number
Number of Pages	int	The total number of pages that are embedded into the parent control (default setting: 3)
On Page Change	ScriptText	The Design Studio script that is executed when the user navigates to another page by selecting it directly, or by jumping forward or backward

## Design Studio Script API

- `void setCurrentPage(int currentPage)`  
Sets the current page number.

Table 74: Parameters

Name	Type	Description
currentPage	int	The current page number

- `String getHtmlText()`  
Returns an integer containing the current page number.
- `void setNumberOfPages(int numberOfPages)`  
Sets the total number of pages embedded into the parent control.

Table 75: Parameters

Name	Type	Description
numberOfPages	int	Total number of pages

- `int getNumberOfPages()`  
Returns an integer containing the total number of pages that are embedded into the parent control.

## 8.18 ProgressIndicator

Sample component that provides an SAP UI5 ProgressIndicator control as an SDK component. For more information, see <https://sapui5.hana.ondemand.com/sdk/#test-resources/sap/ui/commons/demokit/ProgressIndicator.html>

### Properties

Table 76:

Name	Type	Description
Bar Color	String	The color of the bar; one of the following values: <i>CRITICAL</i> , <i>NEGATIVE</i> , <i>NEUTRAL</i> , <i>POSITIVE</i> (default setting: <i>NEUTRAL</i> )
Display Value	String	The text value displayed in the bar.
Enabled	boolean	If set to <i>true</i> , the progress indicator is enabled. If set to <i>false</i> , the progress bar is disabled.
Percent Value	int	The numerical value for the displayed length of the progress bar.
Show Value	boolean	If set to <i>true</i> , the value is shown inside the bar. If set to <i>false</i> , the value is not shown (default setting: <i>true</i> ).

## Design Studio Script API

- `void setPercentValue(int percentValue)`  
Sets the percentage value of the progress bar.

Table 77: Parameters

Name	Type	Description
percentValue	int	The percent value

- `int getPercentValue()`  
Returns an integer containing the percentage value of the progress bar.
- `void setDisplayValue(String displayValue)`  
Sets the text value displayed in the bar.

Table 78: Parameters

Name	Type	Description
displayValue	String	The display value

- `String getDisplayValue()`  
Returns a string containing the display value.

## 8.19 RatingIndicator

Sample component that provides an SAP UI5 RatingIndicator control as an SDK component. For more information, see <https://sapui5.hana.ondemand.com/sdk/#test-resources/sap/ui/commons/demokit/RatingIndicator.html>.

### Properties

Table 79:

Name	Type	Description
Editable	boolean	If set to <i>true</i> , the rating indicator is enabled. If set to <i>false</i> , the rating indicator is disabled. The value <i>true</i> is required for changes on the rating symbols (default setting: <i>true</i> ).
Icon Hovered	Url	The URI to the image that is displayed when the mouse hovers over a rating symbol. If this is used, then all custom icons must have the same size. Note that when this attribute is set, the other icon attributes also need to be set.

Name	Type	Description
Icon Selected	Url	The URI to the image which shall be displayed for all selected rating symbols. If this is used, then all custom icons must have the same size. Note that when this attribute is set, the other icon attributes also need to be set.
Icon Unselected	Url	The URI to the image which shall be displayed for all unselected rating symbols. If this is used, then all custom icons must have the same size. Note that when this attribute is set, the other icon attributes also need to be set.
Max Value	int	The number of displayed rating symbols (default setting: 5)
Value	float	The number of displayed rating symbols.
On Change	ScriptText	The Design Studio script that is executed when the user selects a rating.

## Design Studio Script API

- `void setValue(float value)`  
Sets a rating value.

Table 80: Parameters

Name	Type	Description
value	float	The rating value

- `float getValue()`  
Returns a float containing the rating value.

## 8.20 Slider

Sample component that provides an SAP UI5 Slider control as an SDK component. For more information, see <https://sapui5.hana.ondemand.com/sdk/#test-resources/sap/ui/commons/demokit/Slider.html>.

## Properties

Table 81:

Name	Type	Description
Min	float	The minimum value of the <i>Slider</i> (default setting: 0)
Max	float	The maximum value of the <i>Slider</i> (default setting: 100)

Name	Type	Description
Value	float	The current value of the <i>Slider</i> (default setting: <i>0</i> )
TotalUnits	int	The number of units that are displayed by ticks (default setting: <i>10</i> )
Vertical	boolean	If set to <i>true</i> , the <i>Slider</i> is oriented vertically. If set to <i>false</i> , the <i>Slider</i> is oriented horizontally (default setting: <i>false</i> ).
SmallStepWidth	float	The grip can only be moved in steps of this width (default setting: <i>10</i> ).
On Change	ScriptText	The Design Studio script that is executed when the user has changed the position of the grip.

## Design Studio Script API

- `void setMin(float min)`  
Sets the minimum value.

Table 82: Parameters

Name	Type	Description
min	float	Minimum value

- `float getMin()`  
Returns a float containing the minimum value.
- `void setMax(float max)`  
Sets the maximum value.

Table 83: Parameters

Name	Type	Description
max	float	Maximum value

- `float getMax()`  
Returns a float containing the maximum value.
- `void setValue(float value)`  
Sets the value.

Table 84: Parameters

Name	Type	Description
totalUnits	int	Total units value

- `float getValue()`  
Returns a float containing the value.
- `void setTotalUnits(int totalUnits)`  
Sets the total units value.

Table 85: Parameters

Name	Type	Description
totalUnits	int	Total units value

- `int getTotalUnits()`  
Returns an integer containing the total units value.
- `void setSmallStepWidth(float smallStepWidth)`  
Sets the small step width value.

Table 86: Parameters

Name	Type	Description
smallStepWidth	int	Small step width value



- `float getSmallStepWidth()`  
Returns a float containing the small step width value.

## 8.21 ConstantDataSource

Sample component that acts as a data source providing constant data.

This component is an example of an SDK data source extension component. It is based on the `DataSource` JavaScript class, which is provided by the SDK framework.

### How to Proceed

1. In the *Outline* view, right-click the *Data Sources* icon.
2. Choose  *Add Custom Data Source* .
3. Drag and drop a *Simple Crosstab* into the editor area.
4. Assign the new data source to the *Data Source* property of the *Simple Crosstab*.

### Properties

Table 87:

Name	Type	Description
On Result Set Changed	ScriptText	The Design Studio script that is executed after the result set has been changed.

---

## Selection Strings

SDK components with data-bound properties can reference data values of a data source with a selection string. A selection string can contain zero, one or multiple dimension-member pairs.

For a *ConstantDataSource* SDK data source, selection strings are not honored; data-bound properties referencing the SDK data source are always assigned the full result set.

## 8.22 CSVDataSource

Sample component that acts as a data source providing data from a CSV file.

This component is an example of an SDK data source extension component. It is based on the `DataBuffer` JavaScript class, which is provided by the SDK framework.

### Prerequisites

- You need a CSV file (a file containing one or more rows with each row containing comma-separated values).

### How to Proceed

1. Create a new analysis application.
2. Choose **Application** > **Open Repository Folder**.
3. Place your CSV file into this folder.
4. In the **Outline** view, right-click the **Data Sources** icon.
5. Choose **Add Custom Data Source** > **CSV Data Source**.
6. In the **Properties** view of the added data source, enter the name of your CSV file.
7. Drag and drop a **Simple Crosstab** into the editor area.
8. Assign the new data source to the **Data Source** property of the **Simple Crosstab**.

## Properties

Table 88:

Name	Type	Description
CSV File	Url	The URL of the CSV file. It is either a fully qualified URL or a local file path. The root of the local file path is the folder of the analysis application.
Has Header Row	boolean	If set to <i>true</i> , the first line of the CSV file contains the column header titles (default setting: <i>false</i> ).
Has Header Column	boolean	If set to <i>true</i> , the first element of each line of the CSV file contains the row header titles (default setting: <i>false</i> ).
On Result Set Changed	ScriptText	The Design Studio script that is executed after the result set has been changed.

## Selection Strings

SDK components with data bound properties can reference data values of a data source with a selection string. A selection string can contain zero, one, or multiple dimension-member pairs.

For a *CSVDataSource* SDK data source, the dimension part of the dimension-member pair is "cols" to reference a column or "rows" to reference a row. The member part of the dimension-member pair, the member name, depends on whether the member is already contained in the CSV data:

- For column references: If the property *Has Header Row* is false, then the column member names are not part of the CSV data. Use member names "A", "B", "C", ... (like in Microsoft Excel) to reference the first, second, third, ... columns. If the property *Has Header Row* is true, then the column member names are part of the CSV data. Use the relevant values in the first line of the CSV data to reference the required columns.
- For row references: If the property *Has Header Column* is false, then the row member names are not part of the CSV data. Use member names "1", "2", "3", ... (like in Microsoft Excel) to reference the first, second, third, ... row. If the property *Has Header Column* is true, then the row member names are part of the CSV data. Use the relevant values in the first column of the CSV data to reference the required rows.

### Example

You have assigned a *CSVDataSource* SDK data source to a *Simple Table* SDK component. To display the first column of the CSV data in the *Simple Table* SDK component, set the *Column 1* property of the *Simple Table* SDK component to {"cols": "A"} and the *Has Header Row* property of the *CSVDataSource* SDK data source to false.

### Example

You have assigned a *CSVDataSource* SDK data source to a *Simple Table* SDK component. To display the second row of the CSV data in the *Simple Table* component, set the *Column 1* property of the *Simple Table* component to {"rows": "2"} and the *Has Header Row* property of the *CSVDataSource* SDK data source to false.

## Example

The *Simple Table* SDK component has data-bound properties of type `ResultCellList`, each referencing a single row or column. A data-bound property of type `ResultCellSet` is able to reference, for example, multiple columns or rows. To reference the second and third column of the CSV data for such a data-bound property, for example, you can use the selection string `{"cols": ["B", "C"]}`.

## 8.23 ScalingDataSource



Sample component that acts like a data source, whose data can be scaled at runtime.

This component is an example of an SDK data source extension component. It is based on the `DataBuffer` JavaScript class, which is provided by the SDK framework.

### Prerequisites

- You need SAP BusinessObjects Design Studio 1.5 (or higher)..
- You need a data source to be scaled.

### How to Proceed

1. Create a new application.
2. Add a data source as *DS\_1* to the application.
3. Drag and drop a *Chart* component to the application.
4. In the *Outline* view, right-click the *Data Source* symbol.
5. Choose  *Add Custom Data Source* .
6. In the *Properties* view of the *Scaling Data Source*, click the *Data* property, then click the *Binding* symbol in the toolbar of the *Properties* view and select *Data Set Binding*. The *Select Data* dialog box opens.
7. In the *Data Source* dropdown box, select data source *DS\_1*, then click *OK*. The entire result set is used as a source for scaling data cells.
8. In the *Properties* view of the *Scaling Data Source*, click the *Data Range to Scale* property, then click the *Binding* icon in the toolbar of the *Properties* view and select *Data Set Binding*. The *Select Data* dialog box opens.
9. In the *Data Source* dropdown box, select data source *DS\_1*, then click *OK*. The entire result set will be scaled.
10. Assign the *Scaling Data Source* as *DS\_2* to the *Chart* component.
11. Drag and drop a *Button* component to the application.
12. Add the following script to the *On Click* event of the *Button* component:

```
DS_2.setScalingFactor(5);
```

- 
13. Save and execute the application.
  14. Click the [Button](#) in the executed application.  
The values in the chart are multiplied by a factor of 5

## Properties

Table 89:

Name	Type	Description
Data	ResultCellSet	Source result set
Data Range to Scale	Source result set	Selection of data cells of the source result set to be scaled by the scaling factor
Scaling Factor	float	Factor to scale data cells of the source result set

## Design Studio Script API

```
void setScalingFactor(float factor)
```

Sets the factor to scale data from the source result set.

Table 90: Parameters

Name	Type	Description
factor	float	The scaling factor

---

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