

Platypus development guide

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Table of Contents

| | |
|---|----|
| 1. Introduction | 1 |
| 1.1. About the platform | 1 |
| 1.2. Application structure | 1 |
| 1.3. Runtime configurations | 2 |
| 1.4. Development steps | 4 |
| 2. Installation and configuration | 6 |
| 2.1. System requirements | 6 |
| 2.2. Installation guide | 6 |
| 2.3. Configuration tips | 7 |
| 2.4. Runtime environment setup | 8 |
| 3. Application project | 9 |
| 3.1. New project creation | 9 |
| 3.2. Opening an existing project | 9 |
| 3.3. Project properties | 9 |
| 3.4. Project structure | 10 |
| 3.5. Running and debugging | 11 |
| 3.6. Database connections | 12 |
| 3.7. Version control | 13 |
| 4. Database diagram | 14 |
| 4.1. New diagram creation | 14 |
| 4.2. Diagram visual editor | 14 |
| 5. SQL query | 19 |
| 5.1. New query creation | 19 |
| 5.2. Query editor | 20 |
| 5.3. Sql source | 24 |
| 5.4. Sql dialect source | 26 |
| 5.5. Security | 26 |
| 6. JavaScript modules | 28 |
| 6.1. New module creation | 28 |
| 6.2. JavaScript code editor | 28 |
| 6.3. Module system | 29 |
| 6.4. Dependencies of AMD modules resolving | 31 |
| 6.5. Dependencies of global modules resolving | 31 |
| 6.6. Security | 33 |
| 6.7. Resources loading | 34 |
| 6.8. Data model | 35 |
| 6.9. Server modules | 50 |
| 6.10. Scripting Java | 51 |
| 6.11. Remote procedure calls | 51 |
| 6.12. Local procedure calls | 52 |
| 6.13. WebSocket in platypus.js applications | 53 |
| 6.14. REST services in platypus.js applications | 55 |
| 6.15. Logging | 56 |
| 6.16. Filesystem I/O | 56 |
| 6.17. Miscellaneous | 57 |
| 7. User interface guide | 58 |
| 7.1. Form | 58 |

| | |
|--|-----|
| 7.2. New form creation | 58 |
| 7.3. Visual UI editor | 59 |
| 7.4. Form API | 60 |
| 7.5. Widgets events | 63 |
| 7.6. Standard widgets | 64 |
| 7.7. Model widgets | 75 |
| 7.8. Containers | 85 |
| 7.9. Menus | 95 |
| 7.10. UI utilities API | 98 |
| 7.11. Dialogs API | 101 |
| 8. Report | 103 |
| 8.1. Introduction to reports | 103 |
| 8.2. New report creation | 103 |
| 8.3. Reports editor | 104 |
| 8.4. Template tags | 104 |
| 8.5. Report API | 106 |
| 9. HTTP | 109 |
| 9.1. HTTP interface | 109 |
| 9.2. HTTP request and response API | 109 |

Chapter 1. Introduction

1.1. About the platform

The Platypus Platform is a JavaScript client and server applications platform for rapid development of enterprise-level information systems.

The platform uses two application programming languages:

- JavaScript (compatible with the ECMA-262-3 standard) is used to write program logic.
- SQL is used to access data.

Application creation and editing, deployment, debugging and maintenance are performed using the Platypus Application Designer IDE based on the NetBeans Platform. However, individual files, for example, JavaScript modules, can be edited in any text editor.

The IDE includes following development tools:

- Application database structure visual editor.
- SQL queries visual editor.
- JavaScript code editor.
- User interface forms visual editor.

The platform offers a set of features, making development process extremely productive:

- JavaScript modules automatic dependencies resolving, manual resolving is also available.
- SQL queries with named parameters and SQL clauses re-use.
- Data model and ORM (Object-Relation Mapping) for JavaScript.
- Desktop cross-platform as well as HTML5 web-browser user interface presentation sharing the same code and the GUI layout.
- The GUI widgets which directly interact with the data model, allowing implementation of a CRUD (Create-Read-Update-Delete) user interface with visual configuration and without or just a little coding.
- Built-in security support, including users authentication and authorization, constraints of access to application resources.

1.2. Application structure

Application has a tree structure which contains directories and files. Some files or file groups, called application elements, have a special meaning to the platform.

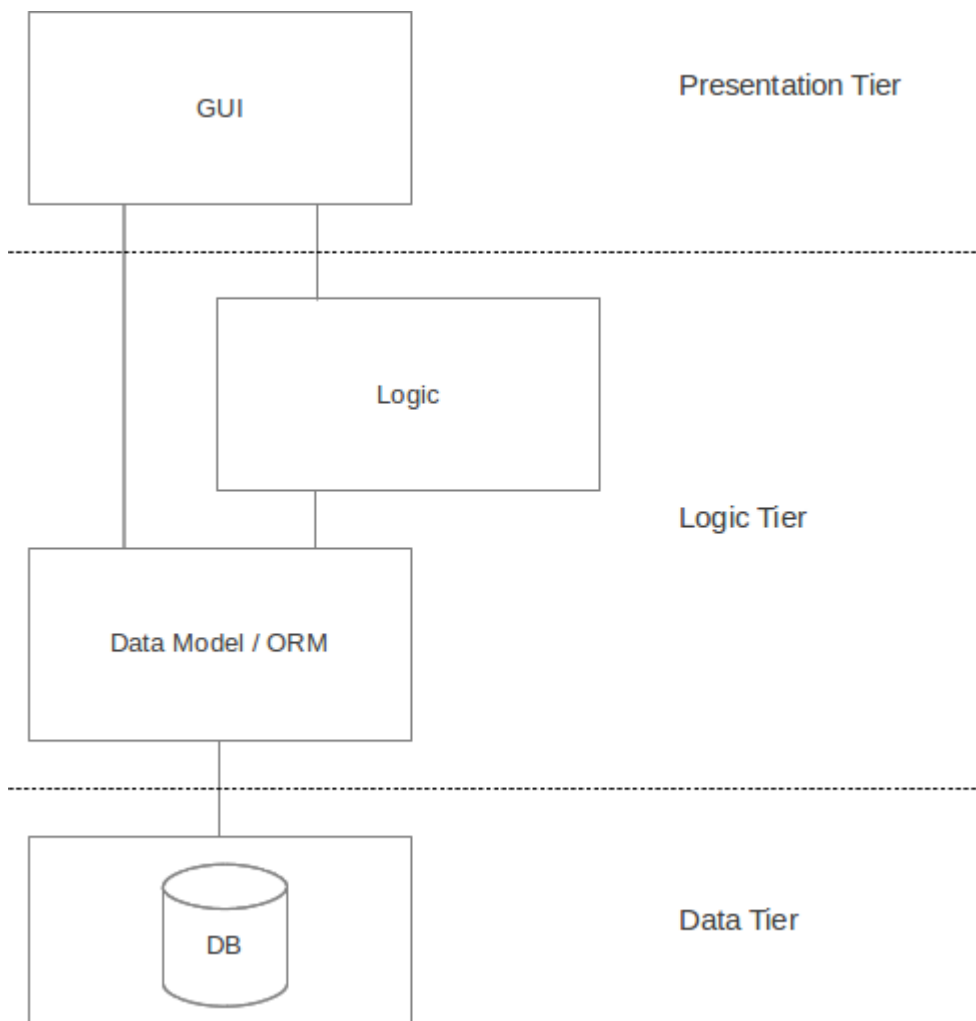
The types of application elements are:

- Query [#query-chapter] is a data source based on SQL query.
- Module [#module-chapter] is a structural unit of the JavaScript code.
- Form [#form-intro] is a module with UI layout.
- Report [#report-chapter] is a module with a template.
- Database diagram [#diagram-chapter] is a visual representation of the database structure.

During development process, the application tree is stored on disk in the project's directory `src` subfolder. For production operation application can be deployed into the database `MTD_ENTITIES` table.

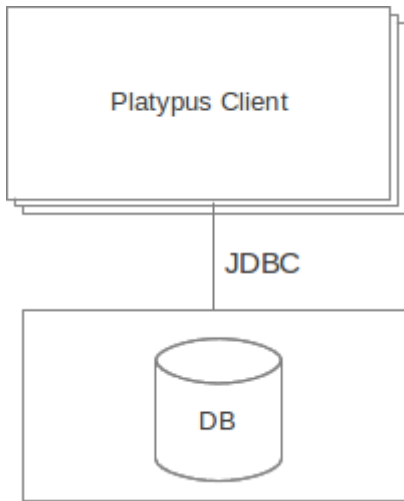
1.3. Runtime configurations

In general, the platform works on three-tier architecture including presentation, logic and data storage tiers. The presentation and the logic tier can be combined in some configurations.

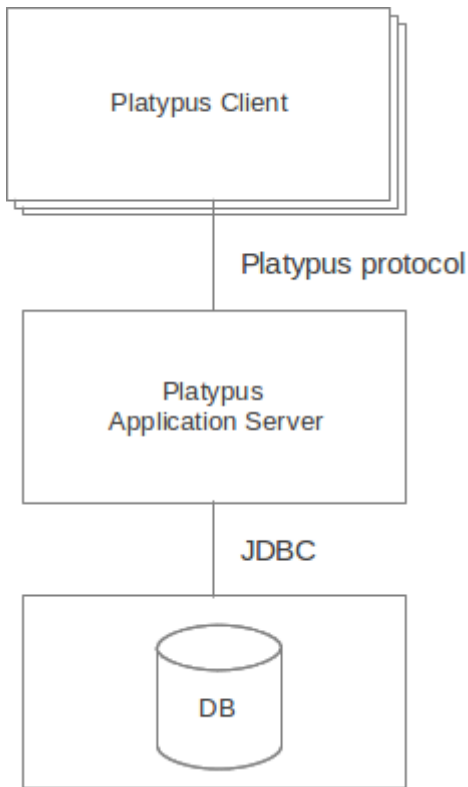


The platform's applications can work in the following configurations:

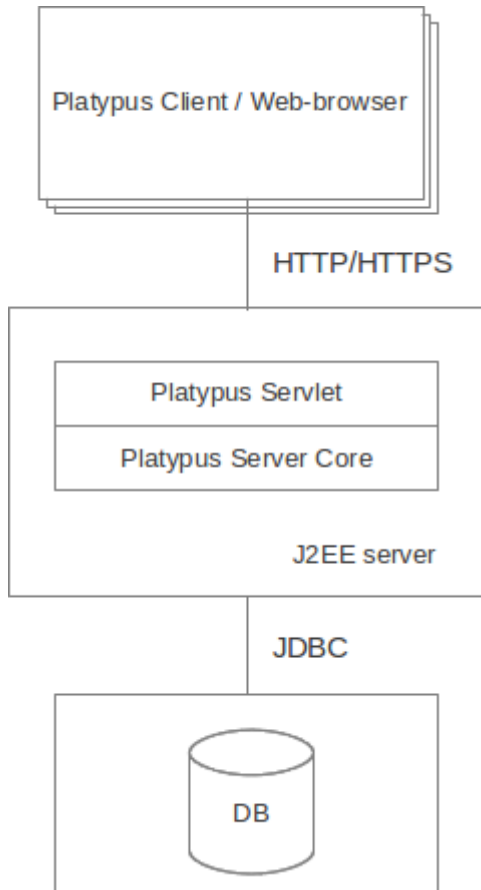
- 2-tier solution is the Java SE desktop client connects directly to the database server. This scheme is recommended for relatively simple applications, which do not require any application server.



* The 3-tier solution with desktop client and Platypus Application Server (PAS). This server is a lightweight non-J2EE Java application server. The custom binary protocol is used to transmit data. The application server, in turn, interacts with a database server.



* The 3-tier solution with a Java EE compatible server to host the platypus server components. The desktop client or HTML5 browser connects to the servlet container or J2EE server using HTTP/HTTPS protocol. In this case, an application's data source resources are managed by the Java EE container.



3-tier configuration has a number of advantages as compared with 2-tier one:

- Improved security, as the client has no direct access to the database and database request text is not transmitted via network.
- Improved performance, as business logic is executed on the server.
- Better system maintainability.
- Application is more scalable.
- The ability to use HTML5 web browser as a client when using J2EE servlet container or application server.

In case of no-server 2-tier configuration the presentation tier and logic tier operate at Java SE desktop client. In case of 3-tier server configuration the presentation tier operates in the client, either at Java SE desktop client or HTML5 browser and the logic tier runs on application server.

1.4. Development steps

To develop an application iteratively perform the following steps:

- Specify [#diagram-chapter] database structure using the database structure diagrams visual editor.

- Write [#query-chapter] the queries and specify their parameters. If required, implement the queries for updating and adding data in SQL language (it is not needed in general, because data inserts/updates/deletions in most cases can be completed automatically by the data model).
- Implement [#module-chapter] the application logic as JavaScript modules. Specify the module's data model using visual tool. Write the JavaScript code, for example to implement the business-logic.
- Implement [#gui-chapter] the application user interface as forms using visual tool. Specify the form's data model. Create the form's layout using the visual editor. Write JavaScript code responsible for the user interface.
- Implement [#report-chapter] reports using the reports tool. Specify the report's data model. Create the report template using the visual editor. Write JavaScript code if some non-standard data processing required.

Chapter 2. Installation and configuration

The platypus developer's kit all-in-one bundle contains Platypus.js IDE, Platypus.js runtime and Apache Tomcat 8 software packages.

Note

Platypus.js runtime installation instructions are provided in the Administration Guide.

2.1. System requirements

System requirements for installing the developer's kit on a computer includes:

- 32-bit (x86) or 64-bit (x64) CPU, 1 GHz or above
- 2 GB (for 32-bit system) or 3 GB (for 64-bit system) RAM
- 10 GB of free disk space
- Operating system with graphical user interface: Windows or Linux
- Oracle JDK 8.40+
- Internet access for updates downloading

2.2. Installation guide

To install the developer's kit, perform the following actions:

1. Run the `platypusdesigner-windows.exe` file for Windows OS or `platypusdesigner-linux.sh` for Linux. The Linux user must have access rights to launch the installer.
2. Click Next to proceed to the next installation step.
3. Read licensing terms and conditions, check the I accept the terms of the license agreement option to accept and click Next to proceed to the next step.
4. Select applications to be installed (Platypus application designer, Platypus.js runtime and Apache tomcat).
5. Select the applications installation directories and options for creating shortcuts on the desktop and in the installed programs menu and click Next to proceed to the next step.
6. Click Install to start selected applications installation process.
7. After the installation process is finished, click Finish.

Note

Specify the path to the JDK in the ``jdkhome`` parameter in the Platypus Application Designer configuration file at

```
`platypusdesigner/etc/platypusdesigner.conf`, if the its installation location is other than default. Incorrect value of the `jdkhome` parameter can lead to errors which may occur when launching the designer.
```

To remove Platypus.js runtime from you computer, perform the following actions:

1. Use the your OS standard mechanism of programs removal, as an alternative, use the `uninstall.exe` program for Windows or `uninstall.sh` for Linux from the installation directory.
2. Confirm the components removal by clicking Finish button.

To remove Platypus Application Designer from you computer, perform the following actions:

1. Use the your OS standard mechanism of programs removal, as an alternative, use the `uninstall.exe` program for Windows or `uninstall.sh` for Linux from the installation directory.
2. Confirm the components removal by clicking Finish button. If necessary, select the option of removing configuration data from the user's directory.

To remove Apache tomcat from you computer if it was installed using platypus developer's kit all-in-one installer, perform the following actions:

1. Use the your OS standard mechanism of programs removal, as an alternative, use the `uninstall.exe` program for Windows or `uninstall.sh` for Linux from the installation directory.
2. Confirm the components removal by clicking Finish button.

2.3. Configuration tips

Platypus Application Designer supports localization of menus, messages texts, etc. Currently, the following languages are supported:

- English
- Russian

The localization language is selected automatically when you launch the application designer according to the regional settings of the operating system.

To force the change of the localization language:

- Edit the Platypus Application Designer configuration file — append the `default_options` parameter with the `--locale ru:RU` or `--locale en:US` option.
- Restart the application designer.

You can also change the application designer localization language by adding the `--locale ru:RU` or `--locale en:US` option to the command line for launching the Platypus Application Designer.

Platypus Application Designer supports connection of the various user interface Look and Feel (L&F). There are L&Fs for specific operating systems, universal styles (`Metal` and `Nimbus`), and LaFs which can be supplied by third-party developers.

To change the Application Designer L&F:

- Edit the designer configuration file — append the `default_options` parameter with the `--laf` option, where LaF corresponds to the name of LaF or full name of the LaF class. If the third-party LaF is used, it is also necessary to include the style library into the path which can be accessed by the Application Designer classloader.
- Restart the application designer.

2.4. Runtime environment setup

The Platypus.js runtime is required to start, debug and deploy it's applications. You must specify the path to the runtime directory for the Platypus Application Designer to be able to run and debug your applications.

Specify the location of the Platypus.js runtime directory in the computer's file system:

- Select Tools Platypus Platform in the main menu of a the designer.
- In the selection dialog, specify path to the Platypus.js directory.

Add the J2EE server instance which can be used to launch the Platypus application:

- In the Services window of the Servers node context menu select the Add server... item.
- In the J2EE server adding wizard, select the server type, server name, and specify its preferences: path to the server directory, administrator's login and password.

Note If Platypus.js runtime and Platypus application designer were installed using platypus developer's kit all-in-one installer, Platypus.js location will be specified already.

Chapter 3. Application project

In the course of development and further during the application life cycle, the application is represented by the application project.

3.1. New project creation

To create a project, perform the following actions:

- Launch the application designer (if not launched yet). To do that, use the Platypus Application Designer shortcut on the desktop or the corresponding item in the installed applications menu.
- Select File New Project or click the New Project button on the toolbar.
- Select the project type as the Platypus Application Project and click Next.
- Specify the project name and location:
 - Specify the project directory name in the Project Folder Name field.
 - Select the parent directory, in which the Platypus application project will be created, in the Project Location field.
 - Specify the project title in the Project Title field.
 - Click Next to proceed to the next step.
- Click Finish to finish the Platypus project creation.

New project will be added to the Projects panel.

3.2. Opening an existing project

To open an existing project, perform the following actions:

- Select File Open Project or click the Open Project button on the toolbar.
- Select the project parent directory using the selection dialog, select the project folder, and click the Open Project button.

Opened project will be added to the Projects panel.

3.3. Project properties

To change the project properties, select the Properties item in the project root node context menu.

Set the application launching parameters:

- Select the Run category.

- Set the default application starting element; if necessary, use the application element selection dialog.
- Set the type of the client application to be launched: Platypus Client or HTML5 browser.
- Set the type of the server to be launched: None, Platypus Application Server or J2EE Server.
- Check the Don't start application server option to launch the client only.
- On the Client tab, in the Url field specify the URL of the application server which will be used by the Platypus Client application when launching, if the Don't start application server option is enabled.
- On the Client tab, in the Login and Password fields specify login and password for the Platypus Client application.
- On the Client tab, in the Options field specify additional parameters of the Platypus Client application launching, for example, LaF (Look and Feel).
- On the Platypus Application Server tab, in the Port field specify a port for the development application server.
- On the Platypus Application Server tab, in the Options field set additional parameters of the Platypus application server launching.
- On the J2EE Server tab, in the Server field select the server instance to be used for the application launching from the list of the installed J2EE servers.
- On the J2EE Server tab, in the Context field specify the name of the web-application in the J2EE server.
- On the J2EE Server tab, check the Enable security option to enable the security; in this case FORM authentication will be used for the web application.

Set the debugging parameters:

- Set the Platypus Client debugging port.
- Set the application server debugging port.

Specify the applicaton's default datasource:

- Select the database connecton from the list.

3.4. Project structure

A Platypus Platform project has the following structure:

- The project configuration files.
- The Application Elements node is the root directory, which contains the application elements tree.

You can perform the following operations on the application elements and directories:

- Create a new element using the `New` command.
- Rename an application element. click the selected application element or directory name, and press the F2 key.
- Copy and Paste an application element from the buffer to the specified project location using the `Paste` command.
- Copy and Move the directory or the application elements to the specified project location. To copy, hold the Ctrl key while dragging a node.
- Delete an application element using the `Delete` command.
- Search for an element in the project using the `Find` command.

These operations also available by the element context menu, Edit menu in the main menu, or the keyboard hotkeys. Some application elements nodes supports some specific operations, e.g. running or debugging. Specific operations are described in detail in the sections dedicated to the certain types of application elements.

To create a subdirectory in the applicaton tree:

- Select the `New` item in the parent directory context menu or select the parent directory and click `New File` in the main menu, or click the `New File` button on the toolbar, or use the hotkey.
- Select the `Folder` type in the context menu or select `Choose file type Platypus application elements Folder` on the wizard first step and click `Next`.
- Specify the name of the directory in the `Name` field and click `Finish` to create a directory, or click `Cancel` to cancel.

To navigate to the application element, if its identifier is known:

- Select `File Go to application element`, or use the `Ctrl Shift G` shortcut.
- In the dialog, specify the identifier of the application element in the `Provide application element id` field of the dialog.
- Click `OK` to navigate to the application element, or click `Cancel` to cancel.

To open an application element, select `Open` in the application element context menu, or double-click this element. The application element editor opens as a window in the Platypus Application Designer editors area.

To find out the identifier of an application element:

- Select an application element in the projects application elements tree.
- Select `File Application element info` menu item, or use the `Ctrl Shift I` shortcut.

3.5. Running and debugging

To run an application:

- Click the Run project button on the main toolbar to start a project's default application element or select Run context menu in an application element's such as a form, module or an JavaScript file.
- Select Run context menu in an application element's such as a form, module or an JavaScript file.

To debug an application:

- Set breakpoints in the JavaScript program.
- Click the Debug project button on the main toolbar or select the Debug item in an application element's context menu. The application will start and the debugger will be attached.
- After the debugger halts at the breakpoint, see the values of variables and the call stack. To continue the program running, click the Continue button on the main toolbar. Use the Step over button or the F8 key, Step into or the F7 key, Step out or the Ctrl F7 shortcut for step-by-step execution of the program.

If the default application run element is not explicitly specified in the project's settings the selection dialog will be displayed.

To debug an application running in Apache Tomcat, you should stop server instance if it is already launched and then start it in debug mode. After the server starts use Attach Debugger menu item on the Debug Project button on the main toolbar and specify the debugging port.

When launching the application in a J2EE server, Platypus Application Designer uses the `web`, `WEB-INF` and `META-INF` sub-directories, which are created automatically in the project directory. When launching web application theirs initial structure is created and libraries are copied. After initializing the directories, files responsible for the configuration (`WEB-INF/web.xml`, server specific configuration file `META-INF/context.xml`, and JavaScript file responsible for the application launching on the HTML page) are modified, but the libraries are not copied again.

Select the "Clean directories `web`, `WEB-INF` and Run" menu item in the project context menu, if it is necessary to update the libraries in the `web` and `WEB-INF` directories. The libraries will be removed they will be copied again from the platform's runtime directory. After that, application will be launched as usual.

3.6. Database connections

Define an application project's database connections and the default connection of the application. The default connection to be used when a connection is not explicitly referenced in application elements.

Add a new database connection:

- Open the Services panel.
- Select the New Connection menu item of the Databases node.
- In the New Connection dialog select the JDBC driver and provide the JDBC URL, database credentials, scheme and connection name. This name will be used as a string identifier to refer to the connection JNDI resource in the application.

A JDBC URL example for the H2 database server with a database located in the user's home directory db subdirectory: `jdbc:h2:tcp://localhost:9092/~/db`.

Specify the project's default database connection: go to the project's Properties and to the Running panel. Select the default connection from the Datasource combobox.

When opening the project, the application designer tries to connect to the database, in case of failure it switches to the limited functionality mode, and some editor tools are disabled.

Note

We recommend that a developer in the team working on the project creates and uses his/her own copy of the database for debugging and testing purposes. Additionally, a common reference database is created, and all modifications, which have passed the debugging stage at the developer's individual databases, are applied to this common one.

Use the developer's local database on the H2 database server, supplied with the platform.

To launch the built-in H2 database server:

- Open the Services panel.
- Select the Databases H2 node and enable the Start menu item.

After the database server is launched and becomes available via the network or locally, connect to this server by selecting the Connect to database item in the context menu of Databases node child node on the Services tab.

To disconnect, select the Disconnect from the same child node of Databases node on the Services tab.

3.7. Version control

During application development and further during the application life cycle, it is recommended to use a version control system to manage the source project files.

The application designer has built-in support of the following version control systems:

- Subversion
- Git
- Mercurial

To access options of these version control systems, use the Team item from the global menu and/or Versioning sub-menu of the project context menu.

Note

Refer to the documentation of the relevant version control system for details about this system usage.

Chapter 4. Database diagram

Database diagram is an application element responsible for representation of the database structure. For example, the diagram can specify some part of the knowledge domain. Generally, the project contains several database structure diagrams at the developer convenience.

A database structure diagram is a visual representation of the database structure, and it does not directly affect the application functionality.

The structure of the relational database is determined by the tables and links between them. Links between two tables are implemented through the foreign keys.

4.1. New diagram creation

To create a new database diagram, perform the following actions:

- Select the New item in the parent directory context menu, or select the parent directory and click New File in the main menu, or click the New File button on the toolbar, or use the hotkey.
- Select the Database structure diagram type in the context menu or select Choose file type Platypus application elements Database diagram on the wizard first step and click Next.
- Select the connection to database and database schema:
 - Select the default database; click the Default button or a connection to the external database; click the Specific button and select a specific database connection.
 - Select a schema in the database in the Schema drop-down list; click the Default button to select a default database user's schema.
- Click the Next button.
- Specify the name of the new database structure diagram in the Name field, and click the Finish button to create a new application element, or click Cancel to abort.

After creating the database structure diagram, fill it with the database tables. To do that, define the tables, their fields and their descriptions. After that define foreign key links between the tables.

4.2. Diagram visual editor

Diagram is a representation of some tables in the database, as well as the links between them. In general, one includes a part of the database overall structure, which is, for example, related to the certain segment of application functionality.

Visual editor tool is used for editing database structure diagrams.

Visual editor allows you to modify the database structure e.g. add or delete tables, links between tables, and indexes. The same table can be represented in several diagrams.

For navigation through a diagram, it is convenient to use the diagram inspector panel. In the inspector, tables and their fields are represented in the tree structure. When selecting a table or a field in the inspector, the same selection takes place in the diagram editor.

To add an existing table to the diagram, perform the following actions:

- Select the Add table menu item on the editor toolbar, or use the Ctrl Shift Insert shortcut.
- Select a table in the table selection dialog; if necessary, use the search function. To access it, click Find.
- Click OK to add the table, or click Cancel to cancel.
- If necessary, drag the table in the diagram to the desired location.
- Save the application element by clicking the Save All button on the Platypus Application Designer toolbar, or by pressing the Ctrl Shift S shortcut.

To create a new table and to add it to the diagram, perform the following actions:

- Select the Add table Create new table item in the menu on the editor toolbar.
- Specify the name of the new table in the dialog.
- Click OK to add the table, or click Cancel to cancel.
- If necessary, drag the table in the diagram to the desired location.
- Save the application element by clicking the Save All button on the Platypus Application Designer toolbar, or by pressing the Ctrl Shift S shortcut.

Note

A numeric primary key field will be automatically created for a new table.

To remove a table from the diagram, perform the following actions:

- Select a table in the diagram.
- Click the Delete button on the editor toolbar.
- In the confirmation dialog, click the Delete from diagram button to remove the table from the diagram (from the diagram only, not from the database). Click the Drop table button to remove the table from the database (physical destruction of the table), or click Cancel to cancel.
- Save the application element by clicking the Save All button on the Platypus Application Designer toolbar, or by pressing the Ctrl Shift S shortcut.

To add the table fields, perform the following actions:

- Select the table in the diagram.
- Click the Create new field/parameter button on the toolbar of the table fields editor tab. The new field dialog appears. Provide the new table field properties and click OK button to create the new field or Cancel to cancel the process.

Table field properties:

- name is the field's name in the table
- description is the field's description
- type is the field's data type
- type name is the data structure type name, this field is enabled if the `STRUCT` data type is selected
- size is the field length
- scale is the field scale or precision
- nullable determines if `NULL` values are allowed for the field.

| Type name | Description |
|-----------|-------------------------------------|
| NUMERIC | Number |
| DECIMAL | Decimal number |
| VARCHAR | String with limited length |
| TIMESTAMP | Date and time |
| DATE | Date |
| STRUCT | Structure |
| BLOB | Binary object with unlimited length |
| CLOB | String with unlimited length |

To edit the field, perform the following actions:

- Select the field node among the table daughter nodes in the data model inspector.
- Edit the field parameters in the Properties editor window.

To remove the field, perform the following actions:

- Select the table field in the diagram.
- Click Delete on the fields editor toolbar, or use the Ctrl Delete shortcut.

To edit the table indexes, use the inspector: open the node of the relevant table, and use the Indexes node.

To add a new table index, perform the following actions:

- Select the Add index item in the Indexes node context menu of the corresponding database table.
- In the table columns selection dialog, select necessary fields and click OK to add the table index, or click Cancel to cancel.
- If necessary, remove the field from the index using the Delete item from the index column context menu.

- If necessary, modify the order of the fields in the index using the Move up and Move down items from the index column context menu.
- If necessary, change the status of the Ascending checkbox on the properties panel for the index column, setting the ascending or descending sorting order.
- Set the index name in the Index name field on the index node properties panel.
- If necessary, check the Unique option on the index node properties panel to make the index unique or non-unique.
- If necessary, check the Clustered option on the index node properties panel to create a clustered index.
- If necessary, check the Hashed option on the index node properties panel to enable or disable hashing for this index.

To modify an table index, perform the following actions:

- Select the index in the table indexes list.
- Edit the index; to do that, follow the same steps as when adding a new index.

To delete an index, perform the following actions:

- Select the index among other child nodes of the relevant table in the inspector.
- Select the Delete item in the index node context menu.

To add a foreign key for the table, perform the following actions:

- Using the mouse, drag the field of one table to the primary key field of the other table.

After that, a foreign key will be created in the database; visually, the link will be represented by the line with arrow between the tables fields. * Save the application element by clicking the Save All button on the Platypus Application Designer toolbar, or by using the Ctrl Shift S shortcut.

Important

Data types of the fields connected by the foreign key link must be the same.

To build a hierarchical table structure (unary link), drag the table field to the primary key field of the same table using the mouse.

To remove the table foreign key, perform the following actions:

- Select the foreign key link using the mouse.
- Click the Delete button or use the Ctrl Delete shortcut.
- Save the application element by clicking the Save All button on the Platypus Application Designer toolbar, or by using the Ctrl Shift S shortcut.

To query the data from the table, perform the following actions:

- Select the table in the diagram.
- Click the Query Table Data button on the local toolbar. The data will be requested from the table, and the results will be displayed in the editor's output area.

To modify the size of the database structure diagram visual representation, perform the following actions:

- Click the Zoom In button to scale up, or Zoom out button to scale down the representation of the database structure in the editor.

To search through the diagram, perform the following actions:

- Click Find to open the diagram search dialog.
- Specify the search string.
- Select fields to be searched through: Datasets, Fields, Params, and check (uncheck) the following options: use the option Whole words to search for whole words and the Match case to perform a case-sensitive search.
- Click Next and Previous buttons to go to the next found entity.
- Click Close to close the search dialog.

Chapter 5. SQL query

Query is an application element which defines the SQL expression to be executed in database. A query's SQL text is preprocessed before execution.

Queries can solve several tasks:

- Requesting data from the database (`Select` queries).
- Definition of metadata for enabling implicit data modifications commands generation (`Select` queries).
- Performing explicit data manipulations (`Insert`, `Delete`, and `Update` queries).

Note

In most cases, data adding and updating tasks are carried out by the data model automatically when saving changes. To do that, you can just specify a query of the `Select` type.

Queries have the following characteristics:

- Queries support named and typed parameters.
- Sql clauses are re-used to enable inclusion of some queries into other queries without any duplication.
- You can edit queries in the visual tool and as Sql text form simultaneously.
- Query results are translated into entities which can be processed by JavaScript code in ORM style.
- Query allows you to define the pattern for processing data changes made while the application is running. It is possible to define a list of tables where the changes will be stored.

5.1. New query creation

To create a new query, perform the following actions:

- Select the `New` item in the parent directory context menu, or select the parent directory and select the `New File` item in the main menu, or click `New File` on the toolbar, or use the hotkey.
- Select the `Query` type in the context menu, or select `Choose file type Platypus application elements Query` on the wizard first step and click `Next`.
- Select the connections to the database and the schema:
 - Select the default database or click the `Default` button to choose project's default database to be used with new query.
 - Click `Next`.

- Specify the name of the new query in the Name field, and click Finish button to create the new application element, or click Cancel to cancel.

After the query creation wizard completes the steps, a new empty query is created.

5.2. Query editor

The special editor is used to edit a query Sql text and its support configuration files. This editor allows you to perform visual editing of the query and direct modification of the Sql text.

Full-featured editing using the visual editor is possible if the connection to the database is established. If there is no connection to the database, only the Sql source modification is possible.

To determine the general properties, use the query properties panel or add the relevant annotation to the query header manually:

- Select the root node in the query inspector.
- Edit the query properties on the Properties panel (if necessary, enable the panel in the Windows Properties global menu).
 - Check the public option to make the query accessible to remote invocation, e.g. on the server and using from the Platypus Client or browser data model.
 - Check the procedure option, if the query will be used to call the stored procedure.
 - Check the readonly option, if you don't want to accumulate changes of data from this query later in modules in corresponding data models.
 - Select the specific connection to a database if you want the query to be executed against this database. To assign a query to the default database connection, clear this field.

For navigation through the queries, it is convenient to use the query inspector panel. In the query inspector, parameters, tables, and sub-queries are represented as a tree nodes. Parameters and data fields are the leaves.

A table or sub-query can be selected both in the visual editor and in the query inspector.

You can start editing the Sql query from setting the query parameters (if necessary) or from using the visual editor.

To add a database table to the query, perform the following actions:

- Select the Sql designer tab in the query editor.
- Select the Add table/Add query Add table item on the editor toolbar, or use the Ctrl Shift Insert shortcut.
- Select the table from the list in the table selection dialog. If necessary, select the schema in the Schema drop-down list. The Default button sets the default schema for the application, if necessary, use the search function by clicking the Find button.

- Click OK to add the table, or click Cancel to cancel.
- If necessary, drag the table to the desired location in the query diagram.
- Save the application element by clicking the Save All button on the Platypus Application Designer toolbar, or by using the Ctrl Shift S shortcut.

To include the existing query as a sub-query into the query being edited, perform the following actions:

- Select the Add table/Add query Add query item in the menu on the editor toolbar.
- Select the Query application element type in the selection dialog.
- Click OK to add the query, or click Cancel to cancel.
- If necessary, drag the query to the desired location in the visual editor diagram.
- Save the application element by clicking the Save All button on the Platypus Application Designer toolbar, or by using the Ctrl Shift S shortcut.

Note

Drag the existing query from the application elements tree of the Projects panel onto the visual editor diagram in order to include it into the query being edited without opening the application elements selection dialog.

To assign the table or a sub-query an alias, just type it in the text editor or the query or perform the following actions:

- Select the table or sub-query in the query diagram.
- On the Properties panel, specify the value in the alias field.
- Save the application element by clicking the Save All button on the Platypus Application Designer toolbar, or by using the Ctrl Shift S shortcut.

To remove the table or sub-query from the query visual editor diagram, perform the following actions:

- Select the table or sub-query in the diagram or in the query inspector.
- Click the Delete button on the query editor toolbar to remove the table or sub-query from the diagram.
- Save the application element by clicking the Save All button on the Platypus Application Designer toolbar, or by using the Ctrl Shift S shortcut.

Note

If the Properties panel is not displayed, enable this panel; to do that, select the Window Properties item in the Platypus Application Designer main menu.

To add the query parameters, perform the following actions:

- Click the New field/parameter button on the fields editing tab toolbar to add a field.
- Modify the new parameter properties. To do that, select its node among the query parameters nodes in the inspector and edit the parameter properties in the Properties window.
- Save the application element by clicking the Save All button on the Platypus Application Designer toolbar, or by using the Ctrl Shift S shortcut.

Parameter field properties:

- Name is the parameter name.
- Description is the parameter description.
- Type is the parameter type, select in the drop-down list.
- Type Name is the data structure type name, this field is accessible when the Structure field type is selected.
- Size is the field length or precision.
- Mode defines this parameter mode, in the case the parameter will be used as the stored procedure parameter.

Stored procedure parameter modes:

| Value | Description |
|---------|-------------------------------------|
| in | IN operation mode |
| in/out | IN/OUT operation mode |
| out | OUT operation mode |
| unknown | Parameter operation mode is unknown |

To edit the query parameter, perform the following actions:

- Select the parameter node from the parameters nodes in the inspector.
- Edit the parameters. To do that, follow the same steps as when creating a parameter.
- Save the application element by clicking the Save All button on the Platypus Application Designer toolbar, or by using the Ctrl Shift S shortcut.

To remove the parameter, perform the following action:

- Select the parameter on the parameters panel.
- Click the Delete button on the parameters editing tab toolbar, or use the Delete shortcut.
- Save the application element by clicking the Save All button on the Platypus Application Designer toolbar, or by using the Ctrl Shift S shortcut.

The query parameter can be linked to a table or sub-query field, or to a sub-query parameter.

When linked to field, the parameter will be included into the Sql source and visually, the link will be displayed as a black arrow.

When the parameter is linked to a sub-query parameter, the parameters will be mapped in the query model, visually, this link will be displayed as a magenta arrow.

To add a link between the parameter and a field or sub-query parameter, perform the following actions:

- Using the mouse, drag the parameter to the table field or sub-query parameter to which the parameter should be linked. Visually, the link will be displayed as an arrow between tables and sub-queries fields.
- Save the application element by clicking the Save All button on the Platypus Application Designer toolbar, or by using the Ctrl Shift S shortcut.

To remove a link, perform the following actions:

- Select the link between a parameter and a table field or sub-query parameter.
- Click the Delete button or use the Delete shortcut.
- Save the application element by clicking the Save All button on the Platypus Application Designer toolbar, or by using the Ctrl Shift S shortcut.

Modifications of the SQL query made in the visual editor are displayed in the source text on the SQL Source panel, and vice versa.

Modify the Sql source text in the editor, for example, in order to add custom conditions, or write the Sql source text from scratch. Use the query inspector to drag the table fields and parameters from the inspector tree right into the query source text. For the tables fields names, use the Sql code auto-completion function.

If necessary, database specific Sql clause can be provided for the query.

Note

Use the database specific Sql only when it is really necessary, and only if there is no need to enable portability of applications to different databases.

Query execution output fields are determined automatically as a result of the Sql source text processing. Check this output field in the inspector's Output Fields node.

It is possible to change the output field type, as well as its description. To do that, perform the following actions:

- Select the output field among the Output Fields node children in the inspector, and edit its properties in the Properties editing window.
- Specify the output field type in the Type property by selecting it in the drop-down list.
- Specify the output field description in the Description property.

To execute a database Sql query in the database, perform the following actions:

- Select the application element and select the Execute item in the query context menu or in the SQL Source editor context menu. Execution results will be displayed in the application designer output window.
- If the query has parameters, specify them in the query execution dialog. If necessary, modify the query source in the same dialog.
- Click OK to execute the query, or click Cancel to cancel.

To change the size of the query diagram visual representation, perform the following actions:

- Press the Zoom In button to scale up, and press the Zoom out button to scale down the query diagram.

To use the search function for searching through the query diagram, perform the following actions:

- Click the Find button to open the search dialog for searching through the query diagram.
- Specify the search string, select fields to be searched through: Datasets, Fields, Params, and check (uncheck) the following options: Whole words to search for whole words, Match case to perform case-sensitive search.
- Click Next and Previous buttons to go to the next search result.
- Click Close to close the search dialog.

5.3. Sql source

Edit the query's Sql source on the Sql Source tab. Sql syntax must comply with the Sql-92 standard.

The Sql source text must begin with a special header, in a form of multiline Sql comment.

It is required to define a query name within the application in accordance with the requirements applicable to JavaScript identifiers. On creating a new query in Platypus Application Designer, its name will be generated according to the created files name, spaces will be replaced by underscores.

Specify the query name, for this use the @name annotation in the query header:

```
/**
 * Query header example
 * @name AllDocuments
 **/
SELECT *
FROM Document
```

@public annotation enables using this query in a remote client's data model, which fetches and writes data over network.

@procedure annotation enables using this query with database stored procedure.

Sql Select query can contain sampling of all fields using * symbol or only the required ones using explicit fields definition. If the first type of sampling is used, the names of the properties that will be accessible in the JavaScript code are defined by the table columns names, and can be uppercased or lowercased. To create the code compatible with various databases, it is recommended to use the

second option with explicit indication of the query output fields, for example `Select a, b, c From table`.

Platypus queries can contain named parameters. Every parameter must begin with `' : '` prefix: `:paramName`, where `paramName` is the name of the parameter.

Example of a SQL query source with the named parameters:

```
/**
 * Device log for period of time
 * @name Timelog
 **/
Select *
From TR_TRACKINGDEVICE_LOG trackingLog
Where trackingLog.DEVICE_ID = :deviceId
and trackingLog.TIME >= :timeFrom
and trackingLog.TIME <= :timeTo
Order by trackingLog.TIME asc
```

Queries can be used again in other queries. To use a query as the sub-query, include its name in the Sql source with `'#'` prefix: `#SubQuery`, where `SubQuery` is the name of the query to be used as a sub-query.

For example:

```
/**
 * Time log priority filter
 * @name Filter
 **/
Select *
From #Timelog timeLog
Where timeLog.PRIORITY > :priority
```

In the snippet above, a query named `Timelog` is used as the sub-query in the `Filter` query.

If the sub-query contains parameters, it is necessary to associate them with the parameters of the query into which it was embedded.

`Select` query type returns a data array which is loaded to the some data model and can be processed using the JavaScript code. Concrete data values of these dataset can be changed while the application is running. When enabled, this data changes can be automatically converted into the set of `Sql Insert` and `Update` commands when saving to the database. To make this mechanism work, the data array returned by the `Select` query must contain the primary keys of all relevant tables. This enables the ORM implementation to determine to which database table row write the changed data.

In order to specify, which tables mentioned in the query can be modified using this mechanism, use the following annotations: `@writable ...`. For this annotation, provide the list of tables, using spaces to delimit them.

If there is no `@writable` annotation, all tables mentioned in the query will become writable.

To disable writing to all tables mentioned in the query, add the `@readonly` annotation to the query header.

In the example below only the `Document` table is writable:

```

/**
 * @name docsCategories
 * @writable Document
 **/
Select *
From Document d
Inner Join Category c
on d.CategoryID = c.CATEGORY_ID

```

5.4. Sql dialect source

Enter database specific Sql source text at the Sql dialect source tab.

It is necessary to enter the correspondent source text in the Sql source field. This source text will be used for determination of the metadata for processing the query results.

If the specific Sql source text is provided, it will be used during the query execution, and the main Sql source text will be used to extract the metadata.

Note

Use the database specific Sql only when it is really necessary, and only if there is no need to enable portability of applications to the different databases.

An example of an Oracle database specific hierarchical query:

```

Select Level, ename "employee", empno, mgr "manager"
Form emp Start With mgr is null
Connect By Prior empno = mgr;

```

For the dialect query snippet above the main Sql source can be:

```

/**
 * Hierarchial employees query
 * @name Employees
 **/
Select * FROM emp

```

5.5. Security

Generally, access to data in the database must be differentiated for various user groups. In Platypus.js there is an embedded security mechanism which implements the constraints of access to the resources based on the roles of the logged in user who is performing the current operation.

To limit the access to the query for certain roles, add the `@rolesAllowed ...` annotation into the query header. For the added annotation, specify the list of roles delimiting them by spaces.

The roles listed in the `@rolesAllowed` annotation are granted with rights both for reading and writing data to the database. If more detailed definition of the data access policy is required, use the `@rolesAllowedRead` and `@rolesAllowedWrite` annotations.

Specify the list of roles, for which only data reading is allowed, in the `@rolesAllowedRead` annotation.

Specify the list of roles, for which only data writing is allowed, in the `@rolesAllowedWrite` annotation.

If none of the `@rolesAllowed`, `@rolesAllowedRead`, or `@rolesAllowedWrite` annotations are specified for the query, the database data manipulated by the query are readable and writable for any user.

An example of the query where reading and writing rights are granted to the `admin` role only:

```
/**
 * @name AllCategories
 * @rolesAllowed admin
 **/
Select *
From Category
```

Chapter 6. JavaScript modules

Module is a JavaScript file containing the constructor function for global module and `define()` call for AMD modules and some specific resources. Modules contain data model responsible for data access and `<ModuleName>.model` file contains its data model definition.

Modules can be executed both under JVM (in a JavaSE client and server) on Oracle Nashorn JavaScript engine or in a HTML5 compatible browser.

6.1. New module creation

To create a new module, perform the following actions:

- Select New in the parent directory context menu, or select the parent directory and click New File# in the main menu, or click New File on the toolbar, or use a corresponding shortcut.
- Select Module type in the context menu, or select Choose file type Platypus application elements Module on the wizard first step and click Next.
- Enter the name of a new application element in the Name field and click Finish to create it, or click Cancel to cancel.

6.2. JavaScript code editor

You can edit the module code in the JavaScript code editor. To open the application element editor, double-click an application element in the project tree.

To edit the JavaScript code:

- Open the Source tab of the module editor.
- Change text in the JavaScript code editor.
- Use the code completion for field names and functions of objects and modules.
- Use automatic transition to declarations of variables, functions, and to the functions of other modules; to do this, click a module name or function while holding down the Ctrl key.
- Use context menus and shortcuts to use built-in editor functions.
- Save the application element by clicking Save All on the Platypus Application Designer toolbar or by using the Ctrl S keyboard shortcut.

Note

Use the editor's context menu Format menu item to format the JavaScript code automatically.

If necessary, configure the code editor parameters; to do this:

- Select the following main menu items: Tools Options.

- In the Options properties dialog, select the Editor tab.

To configure auto completion modes, go to the Code Completion tab and enable or disable corresponding options.

6.3. Module system

Using modules allows you to manage the complexity of your application according to the object-oriented programming principles.

Module is an analog of a class in other programming languages, such as in Java or in C++.

Modules in Platypus.js can be either AMD [https://en.wikipedia.org/wiki/Asynchronous_module_definition] modules and global modules.

6.3.1. AMD Modules

Every AMD module contains strictly one call to a global function `define`. The `define` function should be used as follows:

```
/**
 * Module description goes here
 *
 * @rolesAllowed admin
 */
define('ModuleA', ['logger', 'other-super-module'], function(Logger, OtherModule){
    function ModuleConstructor(p) {
        ...
    }

    function otherFunction() {
        ...
    }
    return ModuleConstructor;
});
```

Define function call can have a header, which is represented as a comment in the JsDoc format and is located at the top of the module `define` call.

The first argument in three argument version of `define` function allows to assign a short name to the defined module. If this annotation is absent, module name will be formed as relative path from `app` directory in application project and without `.js` filename extension and without leading slash. So if you use two argument version of `define` in file `app/folder/module.js`, the module name will be `folder/module`.

The `define` function of the module is called only once per script global object (script space). So it is easy to implement such patterns as singleton and JavaScript class pattern.

The first argument of `define` function may be omitted if the module has no dependencies. Also, the first argument may be an empty array or a single string literal/variable.

Module names in dependencies list may be formed using filesystem reserved directories names (`../`, `../../`, `./`). So, if you have a module in file `app/folder/module.js` and it depends on module located in file `app/utility.js`, than `define` call in module `folder/module` may look like:

```
define(['../utility', 'other-super-module'], function(Utility, OtherModule){
  function ModuleConstructor(p) {
    ...
  }

  function otherFunction() {
    ...
  }
  return ModuleConstructor;
});
```

Typically, `define`'s callback returns module definition as JavaScript "class" constructor. This constructor will be used by depending code to create module's "class" instances. On the other hand, `define`'s callback is free to return plain JavaScript object and depending code will receive exactly this object regardless of how many times the module is required.

Create an instance of AMD module with the help of the `new` keyword, using a module constructor, for example:

```
require('ModuleA', function(ModuleA){
  var moduleInstance = new ModuleA();
});
```

where `ModuleA` is a module "class"'s constructor.

6.3.2. Global modules

Global module is a JavaScript file without `define` call. In general, such modules provide module constructor global function.

Constructor function can have a header, which is represented as a comment in the JsDoc format and is located at the top of the module constructor function definition.

Example of a module with a header:

```
/**
 * Module description goes here
 *
 * @constructor
 * @rolesAllowed admin
 *
 */
function ModuleConstructor(p) {
  ...
}

function otherFunction() {
  ...
}
```

If a JavaScript file contains exactly one top-level function, this function is considered as a module constructor, otherwise the module constructor must be marked with the `@constructor` annotation.

In addition to the `@constructor` annotation, a header may contain the module description, annotations for defining security constraints and other JsDoc annotations.

Create global module's "class" instance by the following ways:

- Create an instance of the module with the help of the `new` keyword, using a module constructor, for example:

```
var moduleInstance = new ModuleA();
```

where `ModuleA` is a module constructor.

- Create an instance of the module with the help of the `new` keyword using global object and its properties, for example:

```
var global = this; // Somewhere in global namespace
var moduleName = getPrincipalStartView(); // Some impersonate technique
var moduleInstance = new global[moduleName]();
```

where `moduleName` is the module constructor name, for example, "WebModule";

6.3.3. Modules instance functions and properties

Specify module instance methods:

```
function ModuleA() {
    this.somePublicMethod = function(p) { //instance method
        ...
    }
}
```

Add module scope methods and fields:

```
function ModuleB() {
    var a, b, c; //private `fields`

    this.somePublicMethod = function(p) { //instance method
        ...
    }

    function somePrivateMethod() { //scope function
        ...
    }
}
```

6.4. Dependencies of AMD modules resolving

Dependencies resolution for AMD modules is based on AMD specification.

6.5. Dependencies of global modules resolving

When executing the code on an application server or on a client, all application elements, on which initial application element depends, are loaded during the process of dependencies resolution.

Dependencies resolution for global modules in Platypus.js is automatic and works as follows:

- The source code is analyzed and expressions of the following types are searched for the following expressions:

```
new ModuleName()
```

```
new Rpc.Proxy("Implementation")
```

where `ModuleName` is the name of the module and `Implementation` is module name which is executed on the server side.

- Application elements with the specified names are loaded or server proxies for server modules are generated.
- The process continues recursively for the loaded modules, except for the server proxies.

If it is not necessary or not possible to resolve the dependency automatically, for example, if you want to determine the called module in a dynamic manner, you can use the manual dependencies resolving with global `require` function.

Use `require([param], callback)` function, where `param` is the module name (short name or relative module name, including `../`, `./` names parts), or an array of such elements, `callback` is a function, which will be called when all the specified modules are downloaded and executed. Both synchronous and asynchronous modes of `require` function calls are supported. If `callback` is omitted, then synchronous version of function is used.

Note

Don't use manual dependencies resolving against a server modules. It will lead to an attempt to download the module body on the client.

Example of using manual dependencies resolving is as follows:

```
require(['Module1', 'Module2'], function(Module1, Module2) {  
  var m1 = new Module1();  
  m1.bar();  
  var m2 = new Module2();  
  m2.foo();  
});
```

The following example shows how to use the `require` function for loading the module by its module name.

Relative modules names are counted off as relative path from the `app` directory of the Platypus application project.

The `require` function also has a synchronous version, which can be used in the server code. In this case, if you don't need to maintain compatibility with the client's code, the second parameter is optional:

```
require("localLib");  
// LibObject is defined in localLib.js
```

```
var obj = new LibObject();
```

The `require` function supports relative modules names for both synchronous and asynchronous variants:

```
require("./sublibs/sublib-a");
// SubLibObjectA is defined in sublib-a.js
var obja = new SubLibObjectA();
require("./sublibs/sublib-b", function(SubLibObjectB){
    // SubLibObjectB is defined in sublib-b.js
    var objb = new SubLibObjectB();
});
```

Note

The `require` global function acts with AMD and global modules in the same way and passes resolved modules to its callback function or returns them if callback is omitted. So, you can make a global module, but in depending code you may not use the corresponding global variables. In this case global dependencies resolution mechanism will not be used.

You should pay attention to the combination of automatic and manual dependencies resolution for global modules. For example, in the following snippet it is not necessary to call the `require` function:

```
var moduleName1 = "SampleModule1",
    moduleName2 = "SampleModule2";
require([moduleName1, moduleName2], function(SampleModule1, SampleModule2) {
    var m1 = new SampleModule1();
    m1.bar();
    var m2 = new SampleModule2();
    m2.foo();
});
```

This code leads to the automatic dependencies resolution regarding to the `SampleModule1` and `SampleModule2`, as calls of their constructors are global functions and automatic dependencies resolution will be performed.

In order to avoid automatic resolving of dependencies, even if required modules are global, explicitly specify module names in the form of string literals in the `require` function parameter:

```
require(["SampleModule1", "SampleModule2"], function(SampleModule1, SampleModule2) {
    var m1 = new SampleModule1();
    m1.bar();
    var m2 = new SampleModule2();
    m2.foo();
});
```

This method of calling the `require` function excludes these explicitly specified modules names in the first parameter from the automatic dependencies resolution. So, `SampleModule1` and `SampleModule2` will be loaded only when calling the `require` function, rather than before starting the application even if required modules are global modules.

6.6. Security

The executable module code is a resource, access to which can be restricted on the basis of the roles. When a user with no rights to execute some code tries to call it, a security exception is thrown.

In order to restrict access to the entire module code, add the `@rolesAllowed...` annotation to the module header (either in define call JsDoc section or global constructor's JsDoc section). Specify roles, allowed to access the module code execution, in the `@rolesAllowed` annotation, dividing them by spaces.

If the annotation is omitted, access to the module is granted to all users.

You can restrict access to the module code on the level of an particular function. To do this, add the `@rolesAllowed` annotation to the function's JsDoc. The restrictions on the function level have a higher priority than the module level restrictions. For example, only a user with the `role2` role from the following example will have access to the `f2`:

```
/**
 * @rolesAllowed role1 role2
 */
define(function(){
  function ModuleConstructor {
    var self = this;

    /**
     * @rolesAllowed role2
     */
    this.f2 = function() {
      //...
    }
  }
  return ModuleConstructor;
});
```

Use `security module` to get access to the information about the current user in the executable code. The module has `principal` property. The `principal` property is read-only. This is object of information about the user and contains the `name` property, i.e. the name of the current user, and the `hasRole()` method, which allows you to check if this user has any role:

```
Logger.info('Current user: ' + Security.principal.name);

if (Security.principal.hasRole('Manager')) {
  // Some operations allowed only to managers ...
}
```

Use `Security.principal.logout(onLoggedOut, onError)` function, where `onLoggedOut` is a function, which will be called after the session is terminated and `onError` is a function, which will be called if an error occur. Open forms will be closed and the user will see the login and password entering form.

6.7. Resources loading

The platform runtime enables loading of resources in the form of binary data and text. Resources may be loaded using their application paths or URLs. Application paths are counted off from the `app` root directory of the application project. Use the `resource` module for resource loading.

To download a resource, use the `Resource.load(path, callback)` method, where `path` is a application path or URL, `callback(obj)` is a function, which will be called after the resource is

loaded, `obj` is an array of bytes of the downloaded resource for the server code and Platypus Client or an object of the `ArrayBuffer` type for the HTML5 browser in the case of binary data and string in the case of text data:

```
require('resource', function(Resource){
    //Loads binary resource
    Resource.load("res/pict.bin", function(obj) {
        ...
    });
});
```

```
require('resource', function(Resource){
    //Loads text resource
    Resource.load("res/list.txt", function(obj) {
        ...
    });
});
```

You can use a synchronous version of this method with a single parameter in the server code or in the code, which is executed in the J2SE Client. In this case, the method itself will return an array of bytes of the downloaded resource:

```
//Loads binary resource synchronously
var Resource = require('resource');
var obj = Resource.load("res/pict.bin");
...
```

To get the absolute path to the app project directory, use the `Resource.applicationPath` read-only property:

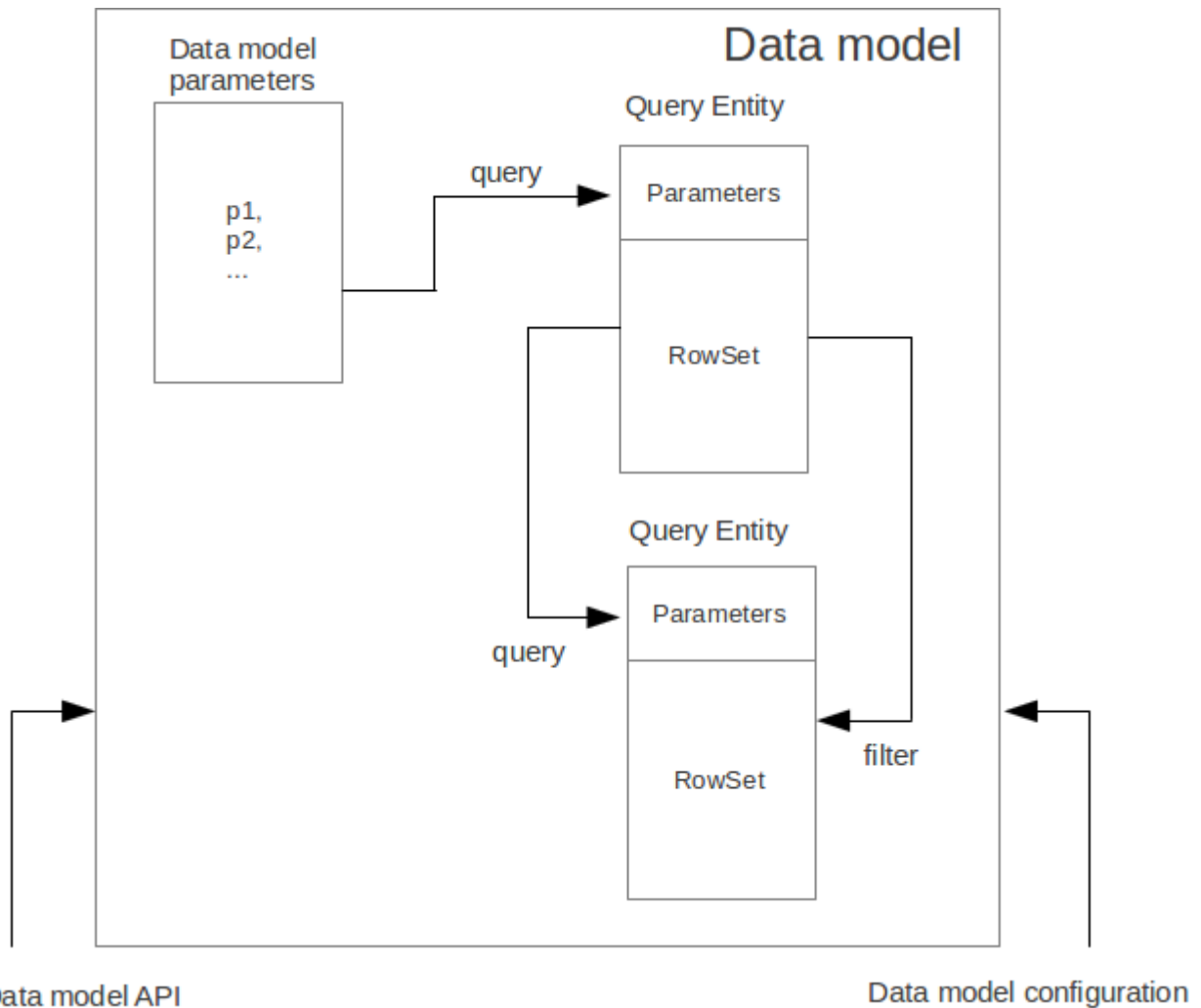
```
//Reads the application's path
Logger.info(Resource.applicationPath);
```

6.8. Data model

Data model is a module's persistence manager. It provides access to the data obtained from a relational database or any other data source. Data model allows you to perform the following tasks:

- Fetch data from the data source(s) to the entities data arrays.
- Automatically requery data, according to the inter-entities links.
- Save changes made to the entities data (insert, update and delete).
- Entities data change events handling with JavaScript.

Data model consists of entities and links and is configured using the visual editor.



Data is stored in the form of JavaScript objects within an entity's data array.

Entities are created using a module implements special datasource interface methods or a query application element.

Note

Table entity is a special query entity, which selects all data from the table. It is created automatically by runtime. A table entity can be used only in two-tier configurations with direct connection to a database.

Each entity can have parameters and contains a data array with predefined fields according to the data schema defined by the module or query, on the basis of which the entity is created.

In general, a data array comprised of objects, each of which corresponds to a tuple in the query results.

There is a cursor for each entity. The cursor can point to some element in the data array and determines the `current` item of this entity. Also the cursor can point to null. The entity cursor value can affect to the linked entities data.

Entity fields and parameters may be connected by links. The following link types are used in a data model:

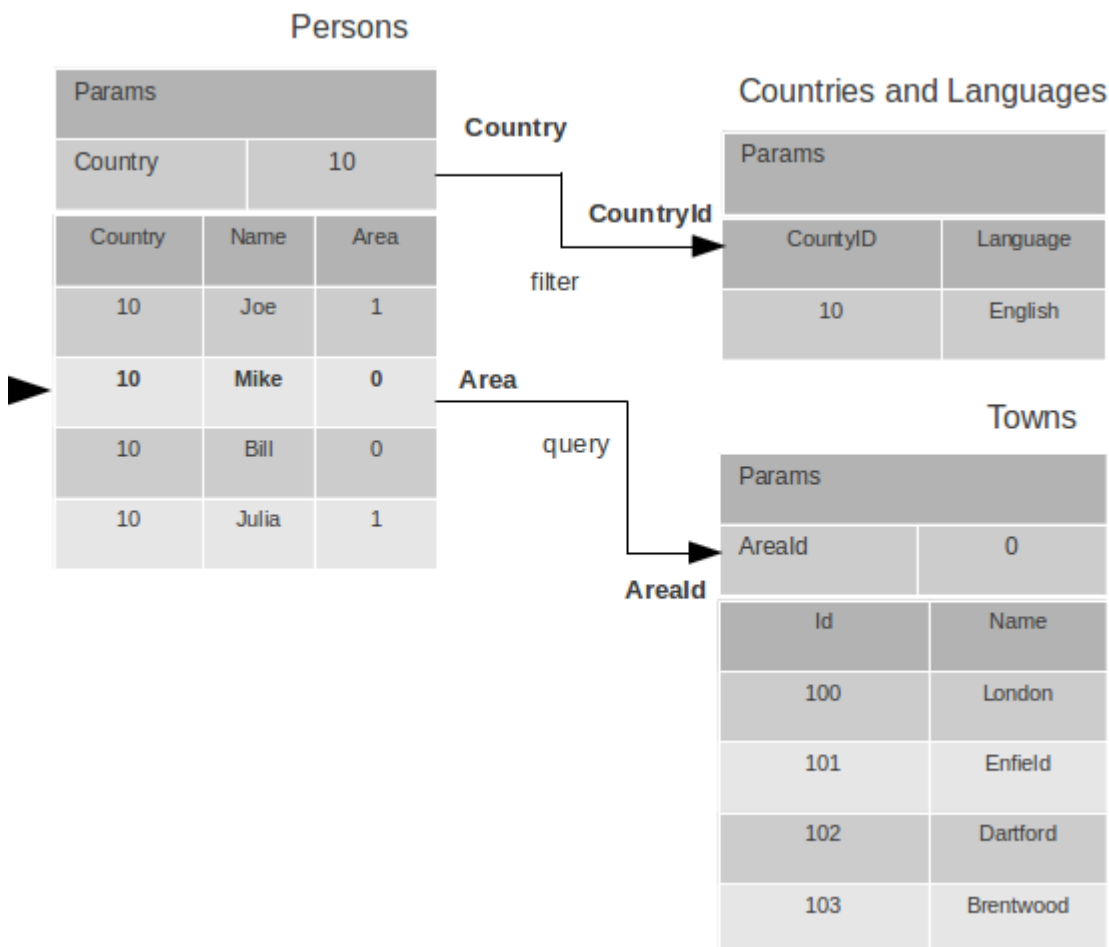
- Query link connects *source* field of one entity with another entity parameter as *target* field.
- Reference link defined by ORM on the basis of foreign keys derived from database/script datasource structure.

Query link requires the target entity's data array according to the parameter value change. The new parameter value is determined according to the source point of the link. Both entity's cursor property's value or a parameter value can be used. When the value at the link source changes, new data is requested from the database or application server and reloaded in the target entity data array.

Reference link is defined by a database table/script datasource structure foreign keys. This kind of link is created automatically, if a entity's schema contains fields included to such foreign key. This type of link does not affect the content of the data arrays and is used to generate inter-element connections between element of entities' data arrays. This is done via new properties, which are created while data fetching. The link of this type is visually shown as a dashed line on the data model diagram.

Note

To get inter-instance connections work, primary and foreign keys are required. Such keys may come from database structure definitions or from schema definitions in a JavaScript datasource module.



The figure shows an example of operation of query links for the three entities in the data model. In the **Persons** entity, a cursor is pointing to a string corresponding to a person named **Mike**.

When initializing a module, data corresponding to the input parameter values is loaded into the model by default, then every change of input parameters leads to a cascade update of all datasets, which are directly or indirectly associated with the modified parameter.

For any entity you can determine any number of incoming and outgoing links of both types. When building connections you should consider the following restrictions:

- Links must not create circular references.
- Linked fields and parameters of the source and the target entities must match by their type. The types of connected fields and parameters must allow the mutual conversion of values. For example, it is possible to connect field if there's a number specified for the connection on the source, and a string specified the connection on the target, it is quite possible, since there is a possibility of an unambiguous conversion of a number to a string, but not vice versa.

Added, deleted and changed objects of these entities objects are saved to the database or sent to the application server for subsequent saving when calling the save function of the data model object.

The data model object is represented in the module by the result of call to `Orm.loadModel(name)` function, where name is name of already loaded module.

Create a variable for the data model object and assign result of `P.loadModel()` to it. In the following code snippets we will use such variable:

```
define('ModuleD', 'orm', function(Orm, ModuleName){
  return function () {
    var model = Orm.loadModel(ModuleName);
    //...
  }
});
```

or as a global module:

```
function ModuleD(Orm) {
  var self = this;
  var model = Orm.loadModel(this.constructor.name);
  //...
}
```

- Set the data model parameters to update the data of the linked entities.
- Get access to data for data processing, analysis, and so on.
- Use inter-instances connections to process the data in ORM manner.
- Use the cursor as "current" data array element pointer.
- Specify entity event handler functions and write their JavaScript code.
- Alter, remove or add objects in the entity's data array and allow the data model to save the changes.
- Read entity schema (fields metadata) for special needs.

To force refetch of all data model entities' data arrays, call the `requery` function of the `model` object:

```
model.requery(onSuccess, onFailure)
```

where `onSuccess` is the handler function for refresh data on success event (optional), `onFailure` is the handler function for refresh data on failure event (optional).

6.8.1. Data model editor

Data model is configured using the visual editor.

For navigating to a data model elements, it is convenient to use a data model inspector panel. In the data model inspector, entity and model parameters are presented in the form of a tree structure. You can select an entity or a connection both in the visual editor and in the data model inspector. Mutual positioning of the model data inspector and its diagram is possible.

To add a table entity to the data model, perform the following steps:

- Select the Datamodel tab of the module's editor.
- Select the Add query / Add table Add table menu item on the editor toolbar, or use the Ctrl Shift Insert shortcut.
- Select the table from the list in the table selection dialog, if necessary select a schema from the drop-down Schema list; the Default button sets the default schema for the application; use the search option by clicking Find, if necessary.
- Click OK add the table or click Cancel to cancel.
- If necessary, move the table on the model diagram to the right place.
- Save the application element by clicking Save All on the main toolbar or by using the Ctrl Shift S keyboard shortcut.

To add an entity based on an existing query to the data model, perform the following actions:

- Select Add query / Add table Add query on the editor toolbar.
- Select an application element of the Query type in the dialog.
- Click OK to add the query or click Cancel to cancel.
- If necessary, move the query on the visual editor diagram to the right place.
- Save the application element by clicking Save All on the main toolbar or by using the Ctrl Shift S keyboard shortcut.

Note

Drag an existing query or a module from the application elements tree on the project panel to the visual editor diagram of the data model to include it into the editable data model.

An entity object and its data is available to module's JavaScript code. When you add a new entity, its name will be specified by default, according to the query, or module constructor name or a table name in the database. To change the name of the entity, perform the following steps:

- Go to the Datamodel tab.

- Select the corresponding entity on the data model diagram or in the data model inspector.
- In the Properties editing window specify the name value in the name field. Entity name is case-sensitive and must meet the requirements for the JavaScript identifiers.
- Save the application element by clicking Save All on the main toolbar or by using the Ctrl Shift S keyboard shortcut.

Note

If the Properties panel is not displayed, enable this panel. To do this, select Window Properties in the Platypus Application Designer main menu.

To delete an entity from the data model, perform the following actions:

- Select an entity in the data model inspector or on the diagram.
- Click Delete on the editor toolbar.
- Save the application element by clicking Save All on the main toolbar or by using the Ctrl Shift S keyboard shortcut.

To add a query link between two entities:

- Move the field or parameter to the parameter of an entity, with which you want to make dependent on the first entity. The connection will be displayed as a line with an arrow between parameters or field/parameter of these two entities.
- Save the application element by clicking Save All on the main toolbar or by using the Ctrl Shift S keyboard shortcut.

Note

Query link type in the visual editor is highlighted by purple. Reference link is highlighted by black with dashed style. The link target field is shown by an arrow.

To delete a link, perform the following actions:

- Select the link to remove by mouse click.
- Click Delete or use the Delete key.
- Save the application element by clicking Save All on the main toolbar or by using the Ctrl Shift S keyboard shortcut.

To edit a reference link properties, perform the following actions:

- Select a dashed link by mouse click.
- Select Scalar and collection properties menu item from the foreign key link context menu.
- In the dialog specify Scalar property name and Collection property name fields.
- Save the application element by clicking Save All on the main toolbar or by using the Ctrl Shift S keyboard shortcut.

To zoom-in or zoom-out the data model visual presentation:

- Click Zoom In to scale up the data model presentation in the editor; click Zoom out to scale it down.

To use the search function on the data model diagram:

- Click Find to open the search dialog in the data model editor.
- Enter the search line, select fields to be used for searching: Datasets, Fields, Params, and also check the necessary options: use the Whole words option to search for the whole words. Use the Match case option to perform the case-sensitive search.
- Click Next and Previous to go to the next or previous search result.
- Click Close to close the search dialog.

6.8.2. Entities

Data model entities are available as the data model object's properties: `model.entity1`, where `entity1` is the script presentation of an entity.

Entities may have its own parameters and can be updated independently from the other model entities.

To access entity parameters, use the `params` entity property:

```
var entityParams = model.entity1.params;
```

where `entity1` is an object of the corresponding entity.

To access the specific parameters, use properties of the `model.entity1.params` object with names, which match the entity parameter names:

```
var entityParam = model.entity1.params.param1;
```

where `entity1` is an entity object, `param1` is the property of the corresponding parameter.

To set the parameter value, assign a new value to it:

```
model.entity1.params.param1 = newValue;
```

where `newValue` is a new value of the parameter.

Setting a new value for a entity parameter doesn't result in automatic update of the data array.

To update entity data and related entities, use the `execute` function. New data will be loaded only if the entity parameter values were changed:

```
entity1.execute(onSuccess, onFailure);
```

where `entity1` is an entity object, `onSuccess` is the handler function for success event (optional) and `onFailure` is the handler function failure event (optional).

To force the update of entity data and related entities, use the `requery` function:

```
model.entity1.requery(onSuccess, onFailure);
```

where `entity1` is an entity object, `onSuccess` is the handler function for success event (optional), `onFailure` is the handler function failure event (optional). Callback functions are called when the database request is executed and its results come to the client over the network.

Handler of the `onRequeried` entity event will be called in any case, regardless of the method of calling the `requery` function.

To query new entity data, but leave entity's parameters, data array and related entities as is, use the `query` function:

```
model.entity1.query({param1: true, param2: 'some value'}, function(aNewData){
    //...
}, onFailure);
```

where `entity1` is an entity object, first argument is parameters values, represented as JavaScript object, second argument of `query` function is the handler function for success event (optional) and `onFailure` is the handler function failure event (optional). Callback functions are called when the database request is executed and its results come to the client over the network.

To append some new elements to existing data array without adding any changes into model's changelog, use `append` method of an entity:

```
model.entity1.append([{id:78, name: 'Mike'}, {id:79, name: 'Juke'}]);
```

After a data is appended to entity's data array, model is watching after it and accumulates changes made to appended items in its change log. This method might be used for example in a view with lazy tree widget.

To query some data and obtain sata array, wich is not watched by the model and not used as a replacement of entity's data array, use `query` method:

```
for(var i = 0; i < maxCount; i++){
    model.entity1.query({param1: i + 43, param2: 'Astralia'}, function(aFetchedData){
        // Some actions with fetched data
    }, function(aError){
        Logger.severe('Failed due to an error: ' + aError);
    });
}
```

Note

Update of entity data does not cancel the data changes made in the entity dataset earlier, so after saving the model these changes will be applied to the database. Data changes are reset only after saving the entire model or explicit call to ``revert`` method.

To access to the entity's data, refer to the entity data array as a regular JavaScript array:

```
var item = model.entity1[i];
```

where `entity1` is an entity, `i` is an index of the array element within the `0...length - 1` range.

The following example shows the process of enumerating document elements in the `documents` entity's data array:

```
var documents = model.documents;

// Logs all documents names
for (var i = 0; i < documents.length; i++) {
    Logger.info(documents[i].name);
}
```

If a reference link is established between two entities, you can get access to the data of the connected entity by using data instance property having the name configured earlier in properties of a link in the datamodel designer. These properties are generated during data fetch by Platypus.js ORM.

```
var propValue = model.entity1[i].referencedObject.someData;
```

where `entity1` is the name of an entity, which contains the external key reference, `i` is an index of the array element within the `0...length - 1` range, `entityName2` is an entity containing the field, which is referenced by the external key, `referencedObject` is a property of reference link configured as scalar and `someData` is some data field of referenced object. If the entity contains a field, which is referenced by the external key, the property contains an array of the connected entity objects:

```
var referees = model.referencedEntity[i].referees;
Logger.info("referees.length: " + referees.length);
```

where `referencedEntity` is an entity, which contains the external key reference, `i` is an index of the array element within the `0...length - 1`, range `referees` is a name of collection property name configured earlier in datamodel designer in reference link properties dialog.

Change for a foreign key link scalar and collection properties if required via reference link properties dialog in datamodel designer.

6.8.3. Cursor API

To get access to the entity's "current" data array element use the `model.entity1.cursor` property, for example:

```
var currentValue = model.entity1.cursor.price;
```

where `entity1` is a corresponding entity, `price` is a property of interest.

The cursor points to some object, or it can be null.

After loading data array the cursor points to the first entity's data array element.

6.8.4. Saving data

Data model provides automatic tracking of data changes. Data changes can be saved only as a part of entire model.

To edit, insert, or delete data, perform the following actions:

- Edit, insert, or delete an object from the entity data.
- Call the save method of the model.

To obtain access to the entity arbitrary objects, use the syntax of referring to an array element:

```
model.entity1[i].propName = 56;
```

where `entity1` is an entity, `entityName[i].propName` is an object property with the specified index in the entity data and `56` is an expression for the new value.

To change the appropriate property of the entity's cursor, use the following way:

```
model.entity1.cursor.propName = 56;
```

where `entity1` is an entity, `propName` is a property in the current cursor position in the entity data array, `56` is an expression for the new value.

To save changes the data model changes, use its save method:

```
model.save(onSuccess, onFailure);
```

where `onSuccess` is the handler function for an event of successful saving of data (optional) and `onFailure` is the handler function for a save data on failure event (optional).

To insert a new object to a data array and save it to datasource:

- Add a new object to entity data array by standard JavaScript array methods (push, unshift, splice).
- Call the save method of the data model.

If necessary, pass the JavaScript object, the property names of which match the names of properties in the entity objects, as a parameter to the function. Their values will be set as values of the new object properties:

```
model.entity1.push( {  
  propName: 'disks',  
  price: 89});
```

When using the push/unshift/splice function, the cursor will point to a new object.

After inserting, the new object will have the following properties:

- An identifying property gets the generated value, if a value was not explicitly assigned to this property when inserting.
- Properties belonging to the "key-value" get the transferred values.
- Other properties will be set to `null`.

Example of code for inserting a new object into the `documents` entity:

```
model.documents.push({id: 101, name: 'New document name'});  
model.save(function(){});
```

Use `elementClass` entity property to specify JavaScript constructor of entity's data array items.

Example of code that uses `elementClass` property of `documents` entity:

```
model.documents.elementClass = Document; // assume, that constructor function Document is  
model.documents.requery(function() {  
  model.documents.forEach(function(aDoc) {
```



```

    Logger.info('aDoc instanceof Document : ' + (aDoc instanceof Document));
  });
}, function(){});

```

Use `remove` function and pass the object to be deleted or pass an array of objects to be deleted as the parameter to avoid unnecessary iterations:

```

model.entity1.remove(toBeDeleted);
model.entity1.remove([toBeDeleted1, toBeDeleted2, toBeDeleted3]);

```

where `toBeDeleted` is the one of the data array elements.

Use the `splice` function to delete an object from the entity data by passing an index and a number of elements to be deleted as arguments:

```

model.entity1.splice(index, length);

```

where `entity1` is an entity, `index` is an index of the entity data array element. `index` can take on a value within the `0...length-1` range and `length` is a number of elements to be deleted.

Example of deleting the current object from the `documents` entity and from the database:

```

// Removes first element
model.documents.splice(0, 1);
model.save(function(){});

```

To remove all objects from the entity data, use the `deleteAll` entity function:

```

model.documents.splice(0, model.documents.length);

```

Example of deleting all objects from the `documents` entity and from the database:

```

// Removes all elements
model.documents.splice(0, model.documents.length);
model.save(function(){});

```

Calling `save` function results in saving changes and committing the transaction.

Calling `save` function may lead to an exception, for example, if saved data are inconsistent with the database schema. In this case data are not saved to the database. To handle this exception, use failure callback:

```

model.save(function(){} , function(){
  model.revert();
  Logger.severe('Data are not saved, due to an error: ' + e);
});

```

After handling the error, you can try to correct the cause of the problem and re-call the `save` function.

Use `model`'s `revert` method to revert model data changes. After this method call, no data changes are available for `save()` method, but the model still attempts to commit. Calling `save()` on unchanged model nevertheless leads to a commit even transaction will be empty.

6.8.5. Find API

Find operations can be performed after the data model loads its entities' data.

Search is performed in the model and doesn't send new requests to the database neither changes the data.

To find an object by its primary key, use the `findByKey` entity method by passing a key value to it:

```
var item = model.entity1.findByKey(aKey);
```

where `entity1` is an entity, `aKey` is an expression for the search key.

If nothing is found, the `findByKey` function returns the `null` value.

Example of code for searching for a document by its identifier and displaying its name in the log:

```
var documentId = 101;
var document = model.documents.findByKey(documentId);
if (document) {
    Logger.info('Document name is ' + document.name);
}
```

To perform search by arbitrary properties, use the `find` entity's function. Pass the "key-value" pairs corresponding to the property and search value as a JavaScript object to the `find` function. The search is performed by checking the equality of the entity object property values and values to search for.

```
var items = model.entity1.find({
    prop1: propValue1,
    prop2: propValue2//,
    //...
    //propN: propValueN
});
```

where `entity1` is an entity, `prop1` and `prop2` are an entity properties` and `propValue1` and `propValue2` are search keys values

Note

`findByKey` and `find` functions search for objects using prepared hash table by corresponding properties and don't enumerate the entity's data array each time. Therefore, it is recommended to logically separate the code for searching and changing data, as after any change of data prepared hashes are marked as obsolete, and are rebuilt when you attempt to perform the search next time.

This code snippet illustrates search documents by their names and by the set flag:

```
var documentName = 'Document 1';
var isChecked = true;
var documents = model.documents;
var foundDocuments = documents.find({
    name: documentName,
    checked: isChecked
});
foundDocuments.forEach(function(aFoundDocument) {
    Logger.info(foundDocument.desc);
});
```

6.8.6. Sort API

To sort entities' data arrays use standard JavaScript array `sort` function.

6.8.7. Entity events

To implement some logic to react to the data events specify entity events handlers functions. To create these handler functions assign functions to entities' properties.

Entity data events list is given in the table below:

| Event | Event type | Description |
|-------------|-------------|--|
| onRequeried | EntityEvent | Is called after re-requesting the entity's data array. |
| onDeleteed | DeleteEvent | Is called after removing an object from the entity's data array. |
| onInserted | InsertEvent | Is called after inserting a new object into the entity's data array. |
| onScrolled | ChangeEvent | Is called after changing the cursor in the entity's data array |

EntityEvent is a generic entity object and contains the following property:

| Property | Description |
|----------|----------------------|
| source | Event source object. |

Other entity events contain `source` property as in `EntityEvent`, as well as their own specific properties.

`ChangeEvent` object specific propeties are listed in the following table:

| Property | Description |
|--------------|--------------------------|
| propertyName | Changed property name. |
| oldValue | The value before change. |
| newValue | The value after change. |

`DeleteEvent` object specific propeties are listed in the following table:

| Property | Description |
|----------|----------------------|
| deleted | The deleted objects. |

`InsertEvent` object specific propeties are listed in the following table:

| Property | Description |
|----------|-----------------------|
| inserted | The inserted objects. |

6.8.8. Data schema

JavaScript code has access to an entity's fields metadata. It is possible to read types, names, descriptions of entity properties and parameters, and etc.

To read an entity's schema, use its `schema` property:

```
var entityMetadata = model.entity1.schema;
```

where `entity1` is an entity, which schema you are interested in.

To get access to the an entity's property metadata:

```
var propMetadata = model.entity1.schema.prop1;
```

where `entity1` is an entity, `prop1` is the name of the corresponding property.

Example of code, which checks if the `id` property of the `documents` entity is an object's key property.

```
if (model.documents.schema.id.pk) {
    Logger.info('id is key attribute of documents entity.');
```

The schema composed of the following properties:

| Property | Type | Description |
|--------------------------|---------|--|
| <code>pk</code> | Boolean | true, if the property is a key |
| <code>name</code> | String | Property name |
| <code>description</code> | String | Property description |
| <code>readonly</code> | Boolean | true, if the property is read-only |
| <code>size</code> | Number | Size of the property value |
| <code>nullable</code> | Boolean | true, if the property can take on the NULL value |

To get the number of properties in the entity, use the `length` property in the entity schema object:

```
model.entity.schema.length
```

Note

If some field will have name as `length`, than its name will have a priority and it will be impossible to determine length of `.schema` as in above example.

You can read the property's metadata by index as an array element:

```
model.entity1.schema[i]
```

where `entity1` is an entity, and `i` is within the range from 0 to `entityMetadata.length - 1`.

Below you can find an example of output all properties of the `documents` entity into the log:

```
for (var i = 0; i < model.documents.schema.length; i++) {
```

```
Logger.info(documents.md[i]);
}
```

To read the entity parameter metadata, use the `schema` property of the `params` object of an entity:

```
var paramsMetadata = model.entity1.params.schema;
```

You can read metadata composed of the following for the parameter:

| Property | Type | Description |
|--------------------------|---------|--|
| <code>modified</code> | Boolean | <code>true</code> , if the parameter was changed and <code>false</code> otherwise |
| <code>pk</code> | Boolean | <code>true</code> , if the parameter is a primary key and <code>false</code> otherwise |
| <code>name</code> | String | Name of the parameter |
| <code>description</code> | String | Description of the parameter |
| <code>readonly</code> | Boolean | <code>true</code> , if the parameter is read-only and <code>false</code> otherwise |
| <code>size</code> | Number | Size of the property value |
| <code>nullable</code> | Boolean | <code>true</code> , if the parameter is not mandatory and <code>false</code> otherwise |

To get the number of the entity parameters:

```
model.entity1.params.schema.length
```

where `entity1` is an entity.

Note

If some parameter will have name as `length`, than its name will have a priority and it will be impossible to determine length of `.schema` as in above example.

6.8.9. Dynamic entities

Use `model`'s `loadEntity(queryName)` method, where `queryName` is the name of the query to dynamically create an entity in the data model. The generated entity can be used to read, insert or modify objects:

```
var docEntity = model.loadEntity("Documents");
docEntity.requery(function() {}, function() {});

//Print all documents names
docEntity.forEach(function(doc) {
    Logger.info(doc.NAME);
});

//Change first document's name
docEntity[0] && docEntity[0].NAME = "New document";
```

```
model.save(function() {}, function() {});
```

Use model's `createEntity(sqlText, datasourceName)` method, where `sqlText` is arbitrary sql text and `datasourceName` the name of datasource accessible in your current environment. The generated entity can be used to read, insert or modify objects:

```
var docEntity = model.createEntity("select * from tr_documents", "testdb");
docEntity.requery(function() {}, function() {});

//Print all documents names
docEntity.forEach(function(doc) {
    Logger.info(doc.NAME);
});

//Change first document's name
docEntity[0] && docEntity[0].NAME = "New document";
model.save(function() {}, function() {});
```

Use `executeUpdate` entity method to execute the SQL code, which contains the `INSERT`, `UPDATE`, `DELETE` or `DDL` commands:

```
var e = model.createEntity("DELETE * FROM Document d WHERE d.DOC_TYPE = 1");
e.executeUpdate(function() {}, function() {});
```

Note

`createEntity` method may be used only in two-tier environment. E.g. in Java EE server, J2SE client or in Platypus TSA server.

6.8.10. Executing arbitrary SQL

In addition to using entities based on a query, data model allows to execute arbitrary SQL code. Using entities based on a query instance have a number of advantages, such as security management or ability to work with the client code. However, if necessary, you can execute arbitrary SQL.

SQL execution is available on a server or on a desktop client which has a direct connection to a database.

Use `executeSql(sqlClause, datasourceName, onSuccess, onFailure)` model's method to execute the SQL code, which contains the `INSERT`, `UPDATE`, `DELETE` commands, where `sqlClause` is the query text:

```
model.executeSql("DROP TABLE Document", "testdb", function() {}, function() {});
```

6.9. Server modules

This section provides information how to use special features of JavaScript modules running on an application server.

6.9.1. Stateful and stateless session modules

A module being created on server is stateful by default. Such module exists in the context of the current user session.

Mark a module with `@stateless` annotation if you want to make the module stateless. A new instance of stateless module is created every time the module is called via a RPC or via LPC.

6.9.2. Resident module

Use `@resident` annotation to make a server module resident. A resident modules are loaded and instantiated during server startup. Resident modules reside in the system session. They are can't be stateless.

6.9.3. Data validators

Use annotation `@validator data_source_name, ...`, where `data_source_name` is a data source name to enable server side validation. Implement validation logic in the instance method `validate(log, datasource, onSuccess, onFailure)`, where `log` is an array of changes representing the log of changes made by clients or server side data driven code to be applied, `datasource` is a datasource name mentioned in `@validator` annotation (relational datasource or script datasource module name), `onSuccess` is a success cakkback and `onFailure` is failure callback. The method returns `false` to stop validating process (e.g. break validators chain), nothing or true otherwise or calls a `onFailure` if validation fails.

A module with no data sources in `@validator` annotation is invoked for default application datasource.

Server-side validator example is as follows:

```
/**
 * @constructor
 * @validator DataSource1
 */
function ValidatorA(){
  var self = this;
  this.validate = function(log, datasource, onSuccess, onFailure) {
    return false;
  };
}
```

6.10. Scripting Java

Calling Java classes from JavaScript code is possible for applications, which are executed in the Platypus J2SE or on the application server in any configuration.

To access the Java packages and classes, use the Java global object as described in articles about integrating Nashorn and Java.

6.11. Remote procedure calls

To use a server module on client (browser or J2SE platypus client) via remote procedure call mechanism, create a proxy for the server module as follows:

```
var moduleProxy = new Rpc.Proxy("Processor");
```

where `Processor` is either short or relative server module name. The server module should be marked with the `@public` annotation to enable access via the network. Server modules, with is used only within application server don't need the `@public` annotation to be used with LPC.

To call the module's instance method, use the following structure, for example:

```
moduleInstance.getResult(10, function(aResult){
    var result = aResult;
});
```

6.12. Local procedure calls

Use local procedure calls (LPC) in JavaScript for tasks, which have to be executed in parallel manner. The LPC mechanism is available only in application server (both Platypus TSA server or J2EE server).

To run a JavaScript code in parallel, create server module containing some logic processing one task. Than use it multiple times in other module through LPC.

Imagine, that we have to compute tangent several times for different angles. Let's create a worker module, which will be executed multiple times in parallel:

```
/**
 * @constructor
 * @stateless
 */
define('Worker', [], function Worker(){
    var self = this;

    this.calc = function (aAngle) {
        return Math.tan(aAngle); // one of parallel operations here
    }
});
```

Now let's create session statefull module, serving user's request and performing all calculations:

```
define('Processor', 'rpc', function(Lpc){
    return function (){
        var self = this;
        this.process = function(aAngles, aOnSuccess){
            var results = [];
            var w = new Lpc.Proxy('Worker');
            var calced = 0;
            aAngles.forEach(function(aAngle){
                w.calc(aAngle, function(aTan){ // Call to LPC stub. Actual calc
                                                // function will be called by
                                                // Platypus.js runtime probably in
                                                // several concurrent threads.
                    results.push(aTan);
                    if(results.length === aAngles.length){
                        aOnSuccess(results);
                    }
                });
            });
        };
    };
});
```



```
});
```

Unlike HTML5 Workers, LPC mechanism in Platypus.js uses standard container's thread pool and so, maximum number of concurrent threads is less or equal to container's thread pool `maxThreads` configuration parameter.

Note

Platypus.js supports asynchronous IO model and so `maxThreads` parameter in most cases should be configured as number of processors/cores of the computer + 1.

There are three levels of parallel execution in Platypus.js server environment:

- Resident modules level.
- Session modules level.
- Stateless modules level.

Each level of parallel execution considers its own script spaces (script context and global object) magaging policy. All resident modules own a single script space and all calls to arbitrary resident modules are added to the same queue.

Session statefull modules level considers the following: Each user's session has its own script space and all calls to arbitrary session statefull modules are added to the session's queue.

Stateless modules level considers the following: Each instance of stateless module creates its own script space and a call to the module and all calls to its callbacks are added to its own queue.

LPC allows one module from one level to make calls to another module from another level of parallel execution and pass some arguments to them and obtain results of such calls. To avoid concurrency in using JavaScript engine, Platypus.js runtime uses asynchronous IO and callbacks mechanism. Also, it uses structured copy algorithm [<http://www.w3.org/TR/html5/infrastructure.html#safe-passing-of-structured-data>] while passing arguments and while retrieving results.

6.13. WebSocket in platypus.js applications

Platypus.js applications can handle WebSocket messages. Regular server modules can be used as WebSocket endpoints. Websocket endpoint server modules are subject of security checks as well as other server modules. Note, that each WebSocket client uses its own network session and so, session server modules are created in context of each WebSocket client object. So, if you want to account multiple WebSocket clients, then you need a resident module to hold accounting data structure.

Example of WebSocket messages handling with cross sessions client endpoints is shown in the the following examples.

This example shows resident module, that holds information on currently connected WebSocket clients.

```
/**
```

```

* Assume this server module has file driven module name - WebSocket/ChatAccounter
* @resident
*/
define(function(){
    var sessions = {};
    function mc(){
        this.add = function(aSessionId, aOnMessage){
            sessions[aSessionId] = aOnMessage;
        };
        this.remove = function(aSessionId){
            delete sessions[aSessionId];
        };
        this.broadcast = function(aData){
            for(var s in sessions){
                sessions[s](aData);
            }
        };
    }
    return mc;
});

```

The server WebSocket endpoint may be implemented as:

```

/**
 * @public
 * @stateless
 */
define('ChatEndpoint', ['rpc'], function (Lpc) {
    function mc() {
        var accounter = new Lpc.Proxy('WebSocket/ChatAccounter');

        this.onopen = function (session) {
            // The second parameter actually is onSuccess callback of Platypus.js Lpc me
            accounter.add(session.id, function(aData){
                session.send(aData);
            });
        };
        this.onclose = function (evt) {
            // evt.id - Session id
            // evt.wasClean - True if session was closed without an error
            // evt.code - Session close code
            // evt.reason - Description of session close reason
            accounter.remove(evt.id);
        };
        this.onmessage = function (evt) {
            // evt.id - Session id
            // evt.data - Text data recieved from other (client) endpoint
            accounter.broadcast(evt.data);
        };
        this.onerror = function (evt) {
            // evt.id - Session id
            // evt.message - Error message from container's exception
        };
    }
    return mc;
});

```

The following example shows browser client for *ChatEndpoint* WebSocket server module.

```

define(['logger'], function(Logger){

```

```

function mc(){
  var wsProtocol = "ws:";
  if (window.location.protocol == 'https:')
    wsProtocol = "wss:";

  var websocket = new WebSocket(wsProtocol + "://" + window.location.host + window.

  websocket.onopen = function () {
    Logger.info("onOpen");
  };
  websocket.onerror = function () {
    Logger.info("onError");
  };
  websocket.onmessage = function (evt) {
    Logger.info("onMessage");
  };
  websocket.onclose = function () {
    Logger.info("onClose");
  };
}
return mc;
});

```

Note

Unfortunately, only one word WebSocket modules names are allowed. E.g. WebSocket endpoint but 'Websocket/SampleEndpoint' is not.

6.14. REST services in platypus.js applications

Platypus.js applications can handle REST requests via HTTP. Regular server modules can be used as REST endpoints. REST endpoint server modules are subject of security checks as well as other server modules. To handle a HTTP request by Platypus.js application module, just add one of the following annotations: `@get /path-parameters`, `@post /path-parameters`, `@put /path-parameters`, `@delete /path-parameters` to one of server module function properties, according to which HTTP method is under consideration.

Example REST service may be implemented with Platypus.js as follows:

```

/**
 * @public
 */
define('PetsSource', ['logger'], function (Logger, ModuleName) {

  var pets = [
    {name: 'Pick', from: new Date(), to: null, paid: true},
    {name: 'Tom', from: new Date(), to: null, paid: true},
    {name: 'Vaska', from: new Date(), to: null, paid: true},
    {name: 'Pushok', from: new Date(), to: null, paid: true},
    {name: 'Snezhok', from: new Date(), to: null, paid: true},
    {name: 'Murka', from: new Date(), to: null, paid: true},
    {name: 'Zorka', from: new Date(), to: null, paid: true}
  ];

  function RestAcceptor() {

```

```

    var self = this;

    /**
     * @get /pets
     */
    this.pets = function () {
        return pets;
    };

    /**
     * @delete /pets
     */
    this.remove = function (aPetName) {
        for (var i = 0; i < pets.length; i++) {
            if (pets[i].name === aPetName) {
                return pets.splice(i, 1);
            }
        }
        return pets;
    };
}
return RestAcceptor;
});

```

In this example `/pets` URI part is used, but actual HTTP request can have an URI that is much longer, for example `/pets/Tom` and so on. The tail of the request's URI is passed as a first argument to handler function. And only after this argument, `onSuccess` and `onFailure` callback are passed to handler function.

Note

Note, that each HTTP request must be handled by `Platypus.js` servlet at lower level to read. So, requests' urls have to be prefixed with `'/context-path/application/'` to be processed.

6.15. Logging

The logging subsystem is built on the base of the Java Logging infrastructure.

To write into the log, use the `logger` module, which is a facade for the `java.util.logging.Logger` class. The `Logger` object is also available in the HTML5 web browser client.

Example of using the `Logger` object:

```

require('logger', function(Logger){
    Logger.info("info text");
    Logger.warning("warning text");
    Logger.severe("severe error");
});

```

Check the Administration Guide and Java SE documentation for information about configuring logging subsystem.

6.16. Filesystem I/O

To read and write files, use Java API from the `java.io.*` and other dedicated packages.

To read and write strings, use `read(path, encoding)`, and `write(path, text, encoding)` functions from module `files`, where `path` is a path to the file, `text` is a string, `encoding` is the name of encoding. The `encoding` parameter in both functions is optional and by default is set for the utf-8 encoding.

Example of using functions for reading and writing strings to a file:

```
require('files', function(File){
  //Read from one text file and write to another
  var str = File.read('/home/user1/Documents/doc1.txt');
  File.write('/home/user1/Documents/doc2.txt', str);
});
```

6.17. Miscellaneous

There are some useful functions for executing JavaScript code in unusual manner. Some JavaScript call might be enqueued for later execution via the `invoke` module and its `later(callback)` function.

Example of using `later(callback)` function to avoid unnecessary work on a couple of the similar events:

```
require(['invoke', 'logger'], function(Invoke, Logger){
  var processed = false;
  for(var i = 0; i < similarEvents.length; i++){
    Invoke.later(function(){
      if(!processed){
        // Some processing logic
        processed = true;
        Logger.info('All events have been processed');
      }
    });
  }
});
```

Also, some JavaScript code execution might be delayed for a particular timeout via the `delayed(timeout, callback)` function of the same module.

Example of using `delayed(timeout, callback)` function to implement a periodic task:

```
require(['invoke'], function(Invoke){
  function doWork(){
    //...
    // Some work
    //...
    // Rescheduling the task...
    Invoke.delayed(100, doWork);
  }
  doWork();// First time execution of the periodic task
});
```

Chapter 7. User interface guide

7.1. Form

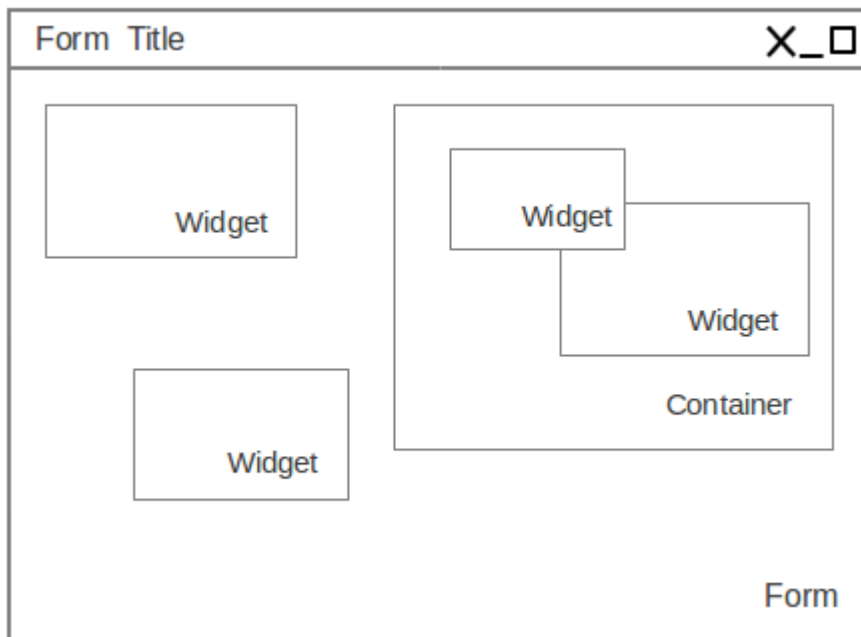
Form is a user interface building block which can be represented as a top-level window with a title and a decorations or can be build-in on a panel or on another form.

A form is a regular JavaScript module with visual widgets. Any form can be displayed both in J2SE client as well in HTML5 web-browser.

Form by default includes a top-level container, which holds widgets and other containers and usually has `view` name.

A widget is a widget, which has a visual representation. A container is a widget, which holds widgets and other containers.

Each widget, as well as the form itself, has a set of properties, which defines the widget appearance and behavior, and a set of events (e.g. user actions, for which you can define handlers).



In the J2SE client, forms are displayed in separate windows, can be minimized or expanded to the full screen, displayed in other forms as built-in elements (frames) and as internal windows in the DesktopPane widget. In the HTML5 browser client, forms are displayed in the same way, but within a browser page.

7.2. New form creation

To create a new form layout and JavaScript code in the IDE, perform the following actions:

- Select New in the parent directory context menu, or select the parent directory and click New File in the main menu, or click New File on the main toolbar, or use a corresponding keyboard shortcut.

- Select Form type of the Platypus application element in the context menu, or select Choose file type Platypus application elements on the wizard first step and click Next.
- Enter the name for the new application element in the Name field and click Finish to create it, or click Cancel to cancel.

7.3. Visual UI editor

Edit form widgets layout using the visual form editor. To open the editor double-click the application element in the project tree.

To edit the form:

- Open the Design tab of the module editor.
- Drag a widget, a container or a menu from the widgets palette onto the form surface.
- Arrange the widgets on the form.
- Set the general properties of the form and properties of each widget on the Properties panel, e.g. text, font, foreground and background colors.
- Specify handlers functions of the form and widgets. To do that write the event handlers code in the JavaScript editor.
- Configure the form's data model and write code responsible for data manipulations.
- Save the form by clicking Save All on the Platypus Application Designer tool bar or by pressing Ctrl S shortcut.

Note

A form should contain JavaScript code, responsible for user interface. Business logic in most cases should be implemented in server modules.

Form's structure is presented as a tree in the form inspector panel. Use the inspector to select a widget, a container or a menu, to move a widget from one container to another, and to select the container layout.

Drag widgets up or down in the inspector tree or activate the Move Up, Move Down, and Change Order context menu items to set the order along the Z axis.

To run a quick preview of the form, click Preview design on the visual editor tool bar. The preview window opens, showing a visual representation of the form, which is identical to its look in runtime.

The anchors layout is enabled for all form's containers by default. To choose some other layout for the specific container, select the layout menu item in the Set Layout submenu from the container's context menu in the inspector widget tree.

Add a widget from the palette using the visual editor, anchors are attached for the nearest container's sides and width and height values are automatically set.

Change dimensions of the widget and its location by using the mouse or arrows keys. When you move a widget using arrows keys, the position of the widget is tied to the grid. Hold down the Ctrl to move the widget smoothly. Hold down the Shift key to expand the widget.

Note

To define form's editor settings, use the properties setting dialog: Tools Options Miscellaneous GUI Builder.

To enable or disable an anchor, use anchors buttons on the form editor toolbar.

Specify values for anchors and dimensions explicitly, changing the values of the widget's properties panel in the Layout properties group: Left, Top, Right, Bottom, Left, Width, and Height.

Anchors properties values are specified as a strings together with the indication of measurement units: pixels or percentages. If measurement units are not specified, pixels are used. If a value is defined as a percentage, this anchor and dimension will be changed while maintaining the defined value when changing dimensions of the container, for example : 60px, 30%, 40.

Use the widget alignment control buttons on the form editor tool bar to align widgets in relation to each other. Alignment buttons become active when you select multiple widgets. To select multiple widgets, click them while holding down the Ctrl key.

Specify a widget's the properties and event handlers:

- Click a form area, which is free from other widgets, or select a form node in the widget inspector.
- Change properties of the form on the Properties panel.
- Write code of the handlers in the JavaScript editor.

7.4. Form API

Create a form instance in client JavaScript as follows:

```
define('forms', function(Forms){
    var form = Forms.loadForm(ModuleName);
});
```

To make a form visible use the `show` method:

```
form.show();
```

An application supports a registry of its shown forms. For every form an identifier can be specified to refer to the shown form in this registry, to do this use form's instance `formKey` property. By default a form's key set to its module's name.

Use the `Form.getShownForm()` method, where `formKey` is a form's key to get the shown form by its key.

```
define('FormB', ['forms', 'forms/form'], function(Forms){});
```



```
define('FormA', ['forms', 'forms/form'], function(Forms){
    var formA = Forms.loadForm(ModuleName);
    var formB = Forms.loadForm('FormB');
    formA.formKey = 'A1';
    formB.formKey = 'B1';
    formA.show();
    formB.show();
    Form.getShownForm('A1').visible = false;
});
```

Get the array of the application's shown forms registry using `Form` object `shown` property:

```
for(var i=0;i < Form.shown.length;i++) {
    Logger.info(shownForms[i].title);
}
```

Explicitly provide form keys before using `Form.shown` because the shown forms registry uses this keys as identifiers.

Add a handler function to the shown form's registry change event. Use the `Form` object `onChange` property:

```
Form.onChange = function(e) {
    Logger.info(e.source.formKey);
    Logger.info(e.source.visible);
};
```

The form properties are listed in the following table:

| Property | Description |
|---------------------------------|--|
| <code>title</code> | Form's title text. |
| <code>top</code> | The distance from the parent container top side. |
| <code>left</code> | The distance from the parent container left side. |
| <code>width</code> | The form's width. |
| <code>height</code> | The form's height. |
| <code>formKey</code> | The form's identifier in the open forms registry. |
| <code>icon</code> | The form's Icon. |
| <code>locationByPlatform</code> | <code>true</code> if form should appear at the default location for the native windowing system or at the current location and <code>false</code> otherwise. |
| <code>opacity</code> | Opacity of the form, Number in the range of 0..1: 0 when it is completely transparent, 1 when form is completely opaque. |
| <code>resizable</code> | <code>true</code> if it is allowed changing of the form dimensions and <code>false</code> otherwise. |
| <code>undecorated</code> | <code>true</code> to enable displaying of the system borders and form buttons and <code>false</code> otherwise. |
| <code>minimizable</code> | <code>true</code> if the form is minimizable, and <code>false</code> otherwise. |

| Property | Description |
|--------------------------|---|
| <code>maximizable</code> | true if the form is maximizable, and false otherwise. |
| <code>minimized</code> | true if the form is minimized, and false otherwise (read-only). |
| <code>maximized</code> | true if the form is maximized, and false otherwise (read-only). |

The form methods are listed in the following table:

| Method | Description |
|---|--|
| <code>show()</code> | Displays the form. |
| <code>showInternalFrame(desktopPane)</code> | Displays the form within the <code>DesktopPane</code> container provided as a <code>desktopPane</code> parameter. |
| <code>showModal(callback)</code> | Displays the form as a confirmation dialog. If <code>form.close(param)</code> method is used to close the dialog form, then <code>callback</code> function is invoked with a <code>param</code> passed as an argument. |
| <code>close(selected)</code> | Closes the form. This method may be used to return a value, selected using the dialog. If the <code>selected</code> parameter is specified, it will be passed as the <code>callback</code> argument of the function, which is passed in turn as a parameter to the <code>showModal()</code> method of the parent form. If the <code>selected</code> parameter has the <code>null</code> value, the <code>callback</code> function will still be called. If the <code>selected</code> parameter is not passed at all, the <code>callback</code> function won't be called. |
| <code>minimize()</code> | Minimizes the form. |
| <code>maximize()</code> | Maximizes the form. |
| <code>restore()</code> | Restores the previous state of the form. |
| <code>ToFront()</code> | Brings the form to the forefront. |

Form events are listed in the following table:

| Event | Event type | Description |
|----------------------------------|--------------------------|--|
| <code>onWindowActivated</code> | <code>WindowEvent</code> | Is called after the window activation. |
| <code>onWindowDeactivated</code> | <code>WindowEvent</code> | Is called after another window activation. |
| <code>onWindowClosed</code> | <code>WindowEvent</code> | Is called after closing the form window. |
| <code>onWindowClosing</code> | <code>WindowEvent</code> | Is called before closing the form window. |

| Event | Event type | Description |
|-------------------|-------------|---|
| onWindowRestored | WindowEvent | Is called after deactivating the form window. |
| onWindowMinimized | WindowEvent | Is called after minimizing the form. |
| onWindowMaximized | WindowEvent | Is called after maximizing the form. |
| onWindowOpened | WindowEvent | Is called after opening the form window. |

The `windowClosing` event is cancelable. This event is useful for invoking a dialog to confirm the window closing. If the handler returns `false`, the form won't be closed:

```
//Handles windowClosing event
form.onWindowClosing = function(evt) {
    return confirm("Close the window?");
}
```

To get access to the properties and events of the form from JavaScript code, use the corresponding property:

```
//Sets form's title
form.title = "Document form";

//Handles onWindowClosing event
form.onWindowClosing = function() {
    return confirm("Close the window?");
}
```

Typically the top-level container has the `view` name and form has same property:

```
//Sets the veiw's background
form.view.background = Color.BLACK;
```

7.5. Widgets events

Note

Widget events are not propagated to the its parent in J2SE client.

The base `ComponentEvent` object contains `source` property that contains the event's source widget.

Use an event handler function as follows:

```
form.btnConnect.onEventHandler = function(evt) {
    evt.source.background = Color.WHITE;
}
```

The specific event objects also contain `source` property, as well as their own specific properties. The following types of specific events are defined: `ContainerEvent`, `KeyboardEvent` and `MouseEvent`.

`ContainerEvent` event object represents an event that is called when something happens with the container, e.g. a widget added or removed, its specific propeties are listed in the following table:

| Property | Description |
|----------|---|
| child | Child widget container operation is performed on. |

`KeyEvent` event object contains information about a keyboard event, e.g. a key pressed or released, its specific properties are listed in the following table:

| Property | Description |
|-------------|--|
| key | Key code associated with this event. |
| altDown | true if Alt key is down on this event and false otherwise. |
| controlDown | true if Ctrl key is down on this event and false otherwise. |
| shiftDown | true if Shift key is down on this event and false otherwise. |
| metaDown | true if Meta key is down on this event and false otherwise. |

`MouseEvent` event object contains information about a mouse event, e.g. a mouse moved or a mouse key is clicked, its specific properties are listed in the following table:

| Property | Description |
|-------------|---|
| x | The x coordinate of mouse pointer in evt.source space. |
| y | The y coordinate of mouse pointer in evt.source space. |
| button | true if Ctrl key is down on this event and false otherwise. One of the following Number values: 0 for no button, 1 for the button 1, 2 for the button 2 and 3 for the button 3. |
| clickCount | The number of mouse clicks associated with this event. |
| altDown | true if Alt key is down on this event and false otherwise. |
| controlDown | true if Ctrl key is down on this event and false otherwise. |
| shiftDown | true if Shift key is down on this event and false otherwise. |
| metaDown | true if Meta key is down on this event and false otherwise. |

7.6. Standard widgets

Standard widgets are simple widgets intended to organize application's user interface.

To specify visual presentation of the widget, set its properties and event handlers in the visual editor or in JavaScript code.

Standard widgets have a set of common properties and events as well as specific properties and events.

The common properties for all widgets are listed in the following table:

| Property | Description |
|--------------------|---|
| visible | true if the widget is visible and false otherwise |
| background | Background color |
| font | Font |
| componentPopupMenu | Popup menu |
| foreground | Color |
| toolTipText | Text, which is shown when hovering a cursor over the widget |
| cursor | Cursor above the widget |
| enabled | true if the widget is enabled and false otherwise |
| focusable | true if it is allowed for the widget to get keyboard focus and false otherwise |
| opaque | true if the widget's background is opaque and false otherwise |
| error | Error message of this widget. Validation procedure may set this property and subsequent focus lost event will clear it. |

Common events for all widgets are listed in the following table:

| Event | Handler parameters | Description |
|--------------------|--------------------|--|
| onActionPerformed | ComponentEvent | Is called when main action performed |
| onComponentAdded | ComponentEvent | Is called after adding the widget |
| onComponentHidden | ComponentEvent | Is called after hiding the widget |
| onComponentMoved | ComponentEvent | Is called after moving the widget |
| onComponentRemoved | ComponentEvent | Is called after removing the widget from its container |
| onComponentResized | ComponentEvent | Is called after changing the widget size |
| onComponentShown | ComponentEvent | Is called after displaying the widget |
| onFocusGained | FocusEvent | Is called after getting the keyboard focus |

| Event | Handler parameters | Description |
|--------------------------------|------------------------------|---|
| <code>onFocusLost</code> | <code>FocusEvent</code> | Is called after losing the keyboard focus |
| <code>onKeyPressed</code> | <code>KeyEvent</code> | Is called after pressing the keyboard key |
| <code>onKeyReleased</code> | <code>KeyEvent</code> | Is called after releasing the keyboard key |
| <code>onKeyTyped</code> | <code>KeyEvent</code> | Is called after pressing the keyboard key |
| <code>onMouseClicked</code> | <code>MouseEvent</code> | Mouse key is pressed and released |
| <code>onMouseDragged</code> | <code>MouseEvent</code> | Widget is dragged by the mouse |
| <code>onMouseEntered</code> | <code>MouseEvent</code> | Mouse cursor has entered the widget rectangle |
| <code>onMouseExited</code> | <code>MouseEvent</code> | Mouse cursor has left the widget rectangle |
| <code>onMouseMoved</code> | <code>MouseEvent</code> | Mouse cursor has changed its position |
| <code>onMousePressed</code> | <code>MouseEvent</code> | Mouse key is pressed |
| <code>onMouseReleased</code> | <code>MouseEvent</code> | Mouse key is released |
| <code>onMouseWheelMoved</code> | <code>MouseWheelEvent</code> | Mouse wheel is rotated |

7.6.1. Label

`Label` is a widget with a short piece of text, image or text with an image. The label does not respond to keyboard input events and can't get the keyboard focus.

The specific properties of this widget are listed in the following table:

| Property | Description |
|------------------------------------|--|
| <code>text</code> | Text |
| <code>icon</code> | Icon |
| <code>iconTextGap</code> | Gap between the text and the icon, in pixels |
| <code>horizontalTextPositon</code> | Horizontal position of the text in relation to the icon, one of the following: <code>HorizontalPosition.RIGHT</code> , <code>HorizontalPosition.LEFT</code> , <code>HorizontalPosition.CENTER</code> |
| <code>horizontalAlignment</code> | Horizontal position of the text with the icon relative to the widget's size, one of the following: <code>HorizontalPosition.RIGHT</code> , <code>HorizontalPosition.LEFT</code> , <code>HorizontalPosition.CENTER</code> . |

| Property | Description |
|----------------------------------|--|
| <code>verticalTextPositon</code> | Vertical position of the text relative to the icon, one of the following: <code>VerticalPosition.TOP</code> , <code>VerticalPosition.BOTTOM</code> , <code>VerticalPosition.CENTER</code> |
| <code>verticalAlignment</code> | Vertical position of the text with the icon relative to the widget's size, one of the following: <code>VerticalPosition.TOP</code> , <code>VerticalPosition.BOTTOM</code> , <code>VerticalPosition.CENTER</code> . |

To create a widget of this type by program means, use the `Label` constructor, which can be called with a different number of parameters:

```
var label = new Label(text, icon, iconTextGap);
```

where `text` is the text (optional), `icon` is an icon (optional), `iconTextGap` is a gap between the icon and text (optional).

After creating, if necessary, set the properties and widget event handlers and add the widget to the container:

```
label.text = "Message text";
form.view.add(label, ...);
```

Note

It is useful, to manipulate with property `opaque` of `Label` widget. If `opaque` property is set to true, than background of the widget is filled and it is not filled otherwise. So you may use the `opaque` property as a switcher of label's background.

7.6.2. Button

`Button` is a simple button, which responds to the click action.

The properties of this widget are listed in the following table:

| Property | Description |
|------------------------------------|--|
| <code>icon</code> | Icon attached to <code>Button</code> . |
| <code>text</code> | Widget's text. |
| <code>iconTextGap</code> | Gap between the text and the icon, in pixels. |
| <code>horizontalTextPositon</code> | Horizontal position of the text in relation to the icon: <code>HorizontalPosition.RIGHT</code> , <code>HorizontalPosition.LEFT</code> , <code>HorizontalPosition.CENTER</code> |
| <code>verticalTextPosition</code> | Vertical position of the text in relation to the icon: <code>VerticalPosition.BOTTOM</code> , |

| Property | Description |
|----------|--|
| | VerticalPosition.TOP, VerticalPosition.CENTER |

The specific widget events are listed in the following table:

| Event | Handler parameters | Description |
|-------------------|--------------------|--------------------|
| onActionPerformed | ActionEvent | Button click event |

To create a widget of this type by program means, use the `Button`, which can be called with a different number of parameters:

```
var btn5 = new Button(text, icon, iconTextGap, actionPerformed);
```

where `text` is text (optional), `icon` is an icon (optional), `iconTextGap` is a gap between the icon and text (optional), `actionPerformed` is a handler of the button clicking event (optional).

After creating, if necessary, set the properties and widget event handlers and add the widget to the container:

```
btn5.text = "Click me";
btn5.onActionPerformed = function() {
    alert("Clicked!");
}
form.view.add(btn1, ...);
```

7.6.3. ToggleButton

`ToggleButton` is a button with two states: selected and not selected.

This widget looks like a standard button, but after a click action it and it will stay in a toggled state. You can use this widget, for example, when it is necessary to choose from the two options, but flags or switches are not suitable.

The list of `ToggleButton` widget properties is identical to the `Button` widget properties, with the the following specific properties:

| Property | Description |
|-------------|--|
| buttonGroup | The button group this button belongs |
| selected | true if the button is selected and false otherwise |

The specific widget events:

| Event | Handler parameters | Description |
|-------------------|--------------------|-----------------------------------|
| onActionPerformed | ActionEvent | The widget user interaction event |

| Event | Handler parameters | Description |
|---------------|--------------------|---------------------------------|
| onValueChange | ValueChangeEvent | ToggleButton value change event |

To create a widget of this type by program means, use the `ToggleButton` constructor, which can be called with a different number of parameters:

```
var btn1 = new ToggleButton(text, icon, selected, iconTextGap, actionPerformed);
```

where `text` is text, `icon` is an icon (optional), `selected` is set to `true` if the button is selected and `false` otherwise (optional), `iconTextGap` is a gap between the icon and text, `actionPerformed` is a handler function of the button clicking event (optional).

After creating, if necessary, set the properties and widget event handlers and add the widget to the container:

```
btn1.text = "Turn me on!";
btn1.onActionPerformed = function(evt) {
    if(btn.selected)
        btn1.text = "Turn me off.";
    else
        btn1.text = "Turn me on!";
}
form.view.add(btn1, ...);
```

7.6.4. CheckBox

`CheckBox` is a widget with two states: selected/not selected.

The specific widget events are listed in the following table:

| Event | Handler parameters | Description |
|-------------------|--------------------|-----------------------------------|
| onActionPerformed | ActionEvent | The widget user interaction event |
| onValueChange | ValueChangeEvent | CheckBox value change event |

To create a widget of this type by program means, use the `CheckBox` constructor, which can be called with a different number of parameters:

```
var cb = new CheckBox(text, selected, actionPerformed);
```

where `text` is text (optional), `selected` is set to `true`, when the check box is selected and `false` otherwise (optional), `actionPerformed` is a handler function of the check box switching event (optional).

After creating, if necessary, set the properties and widget event handlers and add the widget to the container:

```
cb1.text = "Check box 1";
cb1.selected = true;
cb1.onValueChange = function(evt) {
    alert("Value of check box 1 changed!");
}
```

```
}
form.view.add(cb1, ...);
```

7.6.5. RadioButton

`RadioButton` is a widget with two states: selected/not selected. Widgets of this type can be joined into groups. Only one widget of this type can be selected in one group.

The list of `RadioButton` widget properties is identical to the `Button` widget properties, but it includes the following specific properties:

| Property | Description |
|--------------------------|--|
| <code>buttonGroup</code> | The button group this button belongs |
| <code>icon</code> | The <code>Icon</code> for the widget |
| <code>selected</code> | true if the button is selected and false otherwise |

See the description of the `Button` widget for the list of `RadioButton` widget properties.

| Event | Handler parameters | Description |
|--------------------------------|-------------------------------|-----------------------------------|
| <code>onActionPerformed</code> | <code>ActionEvent</code> | The widget user interaction event |
| <code>onValueChange</code> | <code>ValueChangeEvent</code> | Radio button value change event |

To create a widget of this type by program means, use the `RadioButton` constructor, which can be called with a different number of parameters:

```
var rb1 = new RadioButton(text, selected, actionPerformed);
```

where `text` is text (optional), `selected` is set to `true` when the radio button is selected and `false` otherwise (optional), `actionPerformed` is the user interaction handler function (optional).

After creating, if necessary, set the properties and widget event handlers and add the widget to the container:

```
rb1.text = "Radio button 1";
rb1.selected = true;
rb1.onActionPerformed = function(evt) {
    rb1.selected && alert("Radio button 1 selected!");
}
view.add(rb1, ...);
```

7.6.6. ButtonGroup

`ButtonGroup` is a special kind of a widget without its own visual representation. After adding to the form, the button group widget will be added to the Other widgets tree node on the inspector panel.

The group of buttons enables the simultaneous selection of only one of widgets of `ToggleButton`, `RadioButton`, and `RadioMenuItem` types, for which the same button group is assigned. When you select one of the widgets in the group, the other widgets will be reset.

Widget's specific events:

| Event | Event type | Description |
|----------------|------------|----------------------|
| onItemSelected | ItemEvent | Item switching event |

Set the `buttonGroup` property for the supported widgets types. To do this, select the appropriate button group from the property field list on the properties panel.

Use `ButtonGroup` constructor in your program:

```
var buttonGroup = new P.ButtonGroup();
```

To specify a `ButtonGroup` for a exclusive buttons, use widget's `buttonGroup` property:

```
radioButton.buttonGroup = buttonGroup;
```

As an alternative method to add child buttons to the `ButtonGroup`, use the `add` method:

```
buttonGroup.add(widget);
```

where `widget` is a button widget to add.

After creating, add button widgets to the group:

```
var rbA = new RadioButton("A", true);
var rbB = new RadioButton("B", false);
rbA.buttonGroup = buttonGroup;
rbB.buttonGroup = buttonGroup;
```

7.6.7. TextField

`TextField` is a simple widget, which allows you to edit single line of text.

The properties of this widget are listed in the following table:

| Property | Description |
|------------------------|---|
| <code>text</code> | The text for the widget. |
| <code>emptyText</code> | The text displayed when the actual value is absent. |

The specific widget events are listed in the following table:

| Event | Handler parameters | Description |
|--------------------------------|-------------------------------|--|
| <code>onActionPerformed</code> | <code>ActionEvent</code> | User interaction event firing when user changes the text |
| <code>onValueChange</code> | <code>ValueChangeEvent</code> | Text field value change event |

To create a widget of this type by program means, use the `TextField` constructor, which can be called with a different number of parameters:

```
var tf1 = new TextField(text);
```

where `text` is the field text (optional).

After creating, if necessary, set the properties and event handlers and add the widget to the container:

```
tf1.emptyText = "Enter your name...";
view.add(tf1, ...);
```

7.6.8. Slider

`Slider` is a widget, which allows you to visually select a value by moving the slider lever within the specified interval.

The properties of this widget are listed in the following table:

| Property | Description |
|----------------------|---------------|
| <code>maximum</code> | Maximum value |
| <code>minimum</code> | Minimum value |
| <code>value</code> | Value |

The specific widget events are listed in the following table:

| Event | Handler parameters | Description |
|--------------------------------|-------------------------------|-----------------------------------|
| <code>onActionPerformed</code> | <code>ComponentEvent</code> | Slider movement termination event |
| <code>onValueChange</code> | <code>ValueChangeEvent</code> | Slider value change event |

To create a widget of this type by program means, use the `Slider` constructor, which can be called with a different number of parameters:

```
var sl = new Slider(min, max, value);
```

where `min` is a minimum value (optional), `max` is a maximum value (optional), `value` is the current value (optional).

After creating, if necessary, set the properties and widget event handlers and add the widget to the container:

```
var sl1 = new Slider();
sl1.minimum = 0;
sl1.maximum = 100;
sl1.value = 50;
sl1.onActionPerformed = function(evt) {
    P.Logger.info("Slider moved.");
}
view.add(sl1, ...);
```

7.6.9. ProgressBar

`ProgressBar` is a widget, which visually shows the progress of some task.

For example, during the execution of a task the percentage of its completion may be displayed. In this case, set the minimum property value to 0, maximum set the maximum property value to 100 and specify the value when receiving new data on the progress of this task.

If you have no information about the current task progress or such data can't be obtained, use the uncertainty mode, in which the indicator will show that the task was started but is not completed yet instead of its progress.

The specific properties of this widget are listed in the following table:

| Property | Description |
|----------|--------------------------------------|
| maximum | Maximum value |
| minimum | Minimum value |
| value | Value of progress |
| text | Text displayed inside a progress bar |

To create a widget of this type, use the `ProgressBar` constructor, which can be called with a different number of parameters:

```
var pb = new ProgressBar(min, max);
```

where `min` is a minimum value (optional), `max` is a maximum value (optional).

After creating, if necessary, set the properties and widget event handlers and add the widget to the container:

```
var pb1 = new ProgressBar();
pb1.minimum = 0;
pb1.maximum = 100;
view.add(pb1, ...);
```

7.6.10. FormattedField

`FormattedField` is a widget, which allows you to edit value of some specific type as the text. So, a user sees just text and a program sees a value of specific type e.g. date, number, boolean, string and etc. Specify the value type which will be managed by this field. Provide the value's format according to value type and the widget's value. The value is converted into the text of the required format before displaying.

You can configure the widget to enter some date in some predefined formats, and also set the custom format to enter strings.

The `FormattedField` properties is identical to the `TextField` widget properties, but it includes the following specific properties:

| Property | Description |
|-----------|--|
| valueType | Type of value, managed by this field. |
| format | Format string, specific for each value type. |

The formatted field is intended to display and enter values of a particular type. The format of displaying and editing can vary only within a given type. Therefore, when you programmatically create this widget, you should specify a value type before defining the format. After determining the value type, the format can be changed if the new format will be suitable for displaying and editing the values of this type.

Use the format setting dialog to specify the format string in the visual editor. Click the button in the format property field. Select a category from the following: number, date, time, percentage, currency, and mask. Select a predefined format for the selected category or specify the custom one in the Format field.

The specific widget events are listed in the following table:

| Event | Handler parameters | Description |
|-------------------|--------------------|--|
| onActionPerformed | ComponentEvent | User interaction event: pressing the Enter key. |
| onValueChange | ValueChangeEvent | Formatted field value change event: value property assignment from script, focus loose or pressing the Enter key |

To create a widget of this type by program means, use the `FormattedField` constructor, which can be called with a different number of parameters:

```
var ff = new FormattedField();
```

After creating, if necessary, set the properties and widget event handlers and add the widget to the container:

```
var ff = new FormattedField();
ff.valueType = Date;
ff.format = "dd.MM.yyyy HH:mm:ss";
ff.value = new Date();
```

7.6.11. PasswordField

`PasswordField` is a simple input widget, which allows you to edit single line of text. It displays placeholders instead of actual characters.

The properties and events of `PasswordField` are identical to the `TextField` widget.

To create a widget of this type in JavaScript code, use `PasswordField` constructor, which can be called with a different number of parameters:

```
var pf = new PasswordField(text);
```

where `text` is text (optional).

After creating, if necessary, set the properties and widget event handlers and add the widget to the container:

```
var pf = new PasswordField();
```

```
view.add(pf, ...);
```

7.6.12. TextArea

`TextArea` is the text widget for editing and displaying multiline text.

The properties and events of `TextArea` are identical to the `TextField` widget.

To create a widget of this type in JavaScript code, use `TextArea` constructor, which can be called with a different number of parameters:

```
var textArea = new TextArea(text);
```

where `text` is text (optional).

```
var textArea = new TextArea();  
view.add(textArea, ...);
```

7.6.13. HtmlArea

`HtmlArea` is a widget for editing and displaying HTML documents. It is a WYSIWYG html editor.

When showing a form in web-browser, the editor area is displayed as HTML WYSIWYG editor.

The properties and events of `HtmlArea` are identical to the `TextField` widget.

To create a widget of this type in JavaScript code, use `HtmlArea` constructor, which can be called with a different number of parameters:

```
var textArea = new HtmlArea(text);
```

where `text` is text (optional).

```
var htmlArea = new HtmlArea();  
htmlArea.text = "<p>Sample text</p>";  
view.add(htmlArea, ...);
```

7.7. Model widgets

Model widgets are widgets, which can be binded with JavaScript objects.

You can bind a model widgets to any JavaScript object. This object will change in response to the user actions on the widgets and its changes will lead to automatic update of data displayed on all bound widgets.

Configure specific properties for binding to JavaScript object, using properties in the Model binding category.

Scalar model widgets represent a single JavaScript object and its specific field. `field` here means some data accessible by some property path begining with bound object. Property path is a string like a `cursor.customer.name`. Only dot separated property paths are supported. Other more complex model widget - `ModelGrid` can represent a JavaScript array.

Scalar model widgets have the following common properties:

| Property | Description |
|-----------------------|---|
| <code>data</code> | Bound JavaScript object. |
| <code>field</code> | Bound property path within a <code>data</code> object. |
| <code>value</code> | The current value for the widget. |
| <code>nullable</code> | Nullable flag indicating, that clear button will be shown to the right of the widget. |

Scalar model widgets common events are listed in the following table:

| Event | Handler parameter | Description |
|-----------------------|---|---|
| <code>onSelect</code> | The <code>aEditor</code> object is the source widget, is passed to the event handler as a parameter, specify the value of the widget by setting its properties. | Occurs when the select button, located next to the widget, is clicked. The select button is displayed only if the handler is defined. |
| <code>onRender</code> | <code>RenderEvent</code> | Occurs when preparing the widget for displaying (both when it is used independently or as a <code>ModelGrid</code> widget cell). |

Any model widget can be presented as an independent widget and as a `ModelGrid` cell's widget. There is an "abstract" cell in each model widget. It is available in the `onRender` event handlers.

`RenderEvent` object specific properties are listed in the following table:

| Property | Description |
|---------------------|---------------------------------|
| <code>object</code> | The data object being rendered. |
| <code>cell</code> | The "abstract" cell. |
| <code>column</code> | The grid's column node. |

For such a `cell`, the following properties are defined:

- `display` is the displayed text.
- `data` is the value of the cell.

Model widgets also have the same basic properties and events as standard widgets. It is not recommended to specify handlers of low-level events (keyboard, mouse movement events, etc.) for model widgets.

The following example illustrates how to use `onSelect` event:

```
/**
 * Shows custom selector dialog and sets
 * the cell's editor's value.
```



```

*
*/
form.button.onSelect = function(aEditor) {
  var selector = new PetSelector();
  selector.showModal(function(){
    aEditor.value = selector.pet;
  });
}

```

onRender event usage example is as follows:

```

/**
 * Renders a cell with complex data
 */
form.cbCategory.onRender = function(evt) {
  var txt = '';
  categories.find(categories.schema.CAT_ID, evt.id)
    .forEach(function(aDoc) {
      if(txt.length > 0) {
        txt += ' ';
      }
      txt += aCat.NAME ? aDoc.NAME : '';
    });
  evt.cell.display = txt;
}

```

7.7.1. ModelCheckBox

ModelCheckBox is a scalar model widget representing a check box, the state of which is linked to an entity's field of a Boolean, Number, or String type.

The data of various types is displayed as boolean data by this widget. Data types conversion rules are as follows:

- Widget's value is displayed as `true` when actual data is the following values: Boolean type: `true`, Number type: any number other than 0, String type: any string other than empty.
- Widget's `true` value is converted to various types as follows: Boolean: `true`, Number type: 1, String type: `'true'`.
- Widget's `false` value is converted to various types as follows: Boolean type: `false`, Number type: 0, String type: an empty string.

To configure the widget binding specify the data and field properties for the widget.

To create a widget of this type by program means, use the ModelCheckBox constructor:

```
var modelCheck = new ModelCheckBox();
```

After creating, if necessary, set the properties and widget event handlers and add the widget to the container:

```

modelCheck.data = model.entityA.cursor;
modelCheck.field = 'fieldA';
view.add(modelCheck, ...);

```

7.7.2. ModelCombo

`ModelCombo` is a scalar model widget representing a lookup box that is bound to some data object and its property path. It holds and edits one value and displays some other looked up value. It allows you to select a value from a list or form a selection form. List items are also looked up while displaying.

`ModelCombo` widget has the following specific properties:

| Property | Description |
|---------------------------|--|
| <code>displayField</code> | Property path inside value or list items to be used to obtain data to be displayed. |
| <code>displayList</code> | Object to be used as lookup list. |
| <code>list</code> | <code>true</code> to allow selection from drop-down list and <code>false</code> otherwise. |

To configure the widget's model binding:

- Specify the data property for the widget.
- Specify the field property for the widget.
- Specify the `displayList` property.
- Specify the `displayField` property.
- To allow selection of value from the list, enable the list property checkbox.
- To allow a customized selection of the widget's value, specify `onSelect` event handler.

To create a widget of this type by program means, use the `ModelCombo` constructor:

```
var modelCombo = new ModelCombo();
```

After creating, if necessary, set the properties and widget event handlers and add the widget to the container:

```
//Specify value field as a model parameter:
modelCombo.data = model.pets;
modelCombo.field = 'cursor.owner';

//Lookup fields:
modelCombo.displayList = model.owners;
modelCombo.displayField = 'ownerName';

view.add(modelCombo, ...);
```

7.7.3. ModelDate

`ModelDate` is a scalar model widget representing a timestamp and bound to some date or timestamp in some object.

ModelDate widget has the following specific properties:

| Property | Description |
|------------|---|
| editable | true if the date is editable and false otherwise. |
| datePicker | true if the date part is editable by popup window of date picker and false otherwise. |
| timePicker | true if the time part is editable by popup window of time picker and false otherwise. |

To configure the widget model binding:

- Specify the data property for the widget.
- Specify the field property for the widget.
- Specify the date and time format. E.g.
- Enable the datePicker flag to display the calendar button on the right side of the widget.
- Enable the timePicker flag to display the clock button on the right side of the widget.

To create a widget of this type by program means, use the ModelDate constructor:

```
var modelDate = new ModelDate();
```

After creating, if necessary, set the properties and widget event handlers and add the widget to the container:

```
modelDate.data = model.pets;
modelDate.field = 'cursor.dateOfBirth';
modelDate.format = 'dd.MM.yyyy';
modelDate.datePicker = true;
modelDate.timePicker = false;
modelDate.editable = true;
view.add(modelDate, ...);
```

7.7.4. ModelGrid

ModelGrid model widget is a powerful widget to display and enter data, which is presented in a tabular form and as a tree.

ModelGrid widget has the following features:

- Array's data presentation as a cell view.
- Data cells editing, inserting new and deleting rows.
- Frozen non-scrollable rows and/or columns.
- Service columns with the cursor pointer, checkboxes and radiobuttons.
- Multiple service column at a time.

- Governing of data object cursor property while scrolling and user selection actions.
- Tree view of rows with multiple columns as well.

ModelGrid widget has the following specific properties:

| Property | Description |
|-------------------------|--|
| frozenColumns | The number of the non-scrollable grid columns. |
| frozenRows | The number of the non-scrollable grid rows. |
| gridColor | The Color of the grid. |
| oddRowsColor | The Color of the grid's odd rows. |
| rowsHeight | The height of the grid's rows. |
| showHorizontalLines | true to show horizontal lines and false otherwise. |
| showVerticalLines | true to show vertical lines and false otherwise. |
| showOddRowsInOtherColor | true to show odd rows in the different color and false otherwise. |
| deletable | true to enable rows delete operation for the grid and false otherwise. |
| editable | true to enable cells edit operation for the grid and false otherwise. |
| insertable | true to enable rows insert operation for the grid and false otherwise. |
| data | The bounded object/array for the grid rows. |
| field | Property path within data object to object/array for the grid rows. It might be omitted if data property points to actual grid's rows array. |
| childrenField | See tree option. |
| parentField | See tree option. |
| selected | All selected in grid elements of data array as an array. |

ModelGrid widget has the following specific methods:

| Method | Parameters | Description |
|----------------|------------|---|
| select | (aObject) | Selects the specified grid's data array element. |
| unselect | (aObject) | Deselects the specified grid's data array element. |
| clearSelection | () | Deselects all selected grid's data array elements. E.g. clears the selection. |

| Method | Parameters | Description |
|------------------|-------------------------|--|
| find | () | Opens find dialog |
| makeVisible | (aObject, needToSelect) | Scrolls a ModelGrid's view to show grid's row of the specified element in visible area. |
| unsort | () | Cancels all sorting in the ModelGrid. |
| redraw | () | Redraws in J2SE client and regenerates all inner ModelGrid's markup in browser client. |
| removeColumnNode | (aColumn) | Removes the specified column from ModelGrid's header and columns collection. |
| addColumnNode | (aColumn) | Adds the specified column to ModelGrid's header and columns collection at the end. |
| insertColumnNode | (aIndex, aColumnFacade) | Adds the specified column to ModelGrid's header and columns collection at the specified index. |

ModelGrid widget has the following specific events:

| Event | Handler parameter | Description |
|----------------|-------------------|---|
| onItemSelected | ItemEvent | Selection lead of the grid change event. |
| onCollapse | ItemEvent | Event handler, which will be called when user collapses a grid's row. |
| onExpand | ItemEvent | Event handler, which will be called when user expands a grid's row. |
| onRender | RenderEvent | Event handler, which will be called for each data grid cell, if a similar handler was not defined for theirs columns. |

To configure ModelGrid properties:

- Use the frozenColumns and frozenRows properties in the Appearance properties group to freeze the required number of columns on the left and/or rows on the top of the grid.
- Use service columns from designer's palette. There are service columns of the following types:
 - Ordinary service column is displayed with the cursor icon.

- Service column with check boxes allows you to select multiple rows
- Service column with radio buttons allows you to select only one row of the grid.
- Use the `onRender` event handler, which will be called for each data grid cell, if a similar handler was not defined for their columns.
- If you want to make a hierarchical view of rows, then you need to configure `parentField` and `childrenField` properties. They will be used to discover children rows of a particular row and to determine what is the parent row of the row.

`ModelGridColumn` has the following properties:

| Property | Description |
|-----------------------------|---|
| <code>title</code> | The column's title string. |
| <code>visible</code> | <code>true</code> the column is visible and <code>false</code> otherwise. |
| <code>background</code> | The header style background color. |
| <code>foreground</code> | The header style foreground color. |
| <code>font</code> | The header font. |
| <code>maxWidth</code> | The maximum width of the column. |
| <code>minWidth</code> | The minimum width of the column. |
| <code>preferredWidth</code> | The preferred width of the column. |
| <code>width</code> | Readonly property, calculated by the grid according to columns widths automatic distribution algorithm. |
| <code>movable</code> | Flag indicating that column can be moved by user. |
| <code>resizable</code> | <code>true</code> if the column can be resized by user and <code>false</code> otherwise. |
| <code>field</code> | Property path of rendered and edited value of the cell. Property path is accounted against data object of grid's row. |
| <code>sortable</code> | <code>true</code> if the grid's rows can be sorted by the column cells values and <code>false</code> otherwise. |
| <code>sortField</code> | Property path within data object of grid's row to be used as sorting keys source while sorting by the column. |
| <code>readonly</code> | <code>true</code> if the column's cells is in a read-only mode and <code>false</code> otherwise. |
| <code>onRender</code> | Event handler, which will be called for each data grid cell within the column. |
| <code>onSelect</code> | Value selection handler, which will be called while user clicks on select button on the right side of edited cell. |

‘ModelGrid` has ability to change it’s cells’ display style and to select values using custom editors while editing cells. In order to use these features, define `onRender` and `onSelect` event handlers in particular columns. If `onRender` event handler is defined on a column, it will be invoked rather than similar event handler, defined on `ModelGrid`. Refer to Model Widgets [#mwidgets] section to read about how to deal with `onRender` and `onSelect` event handlers.

Use the form inspector: the inspector displays the grid’s columns node as children of `ModelGrid` widget node and allows you to edit them.

To add, remove and configure grid columns:

- To fill all ‘ModelGrid` columns corresponding to the fields of the linked data model entity, select Fill columns. In this case, columns’ binding will be performed automatically.
- To manually add a column to `ModelGrid` drag it from the widgets palette or add it using Add from palette context menu in form inspector.
- To add a column as a child to another column use parent column’s node Add from palette of from context menu in form inspector.
- Move the selected columns up and down using the Move up, Move down or Change Order context menu items or by dragging it by mouse.

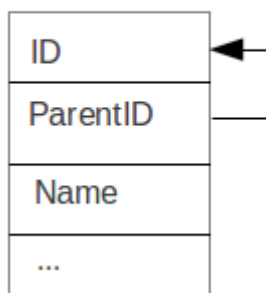
To configure bind a column to data:

- Specify the field property, to which the column should be bound. To do this, use the field property and select a field from the bound entity.
- Define a widget, which will be used for displaying in the column cells. Select its type from the view context menu of the column’s node in the inspector. The choices will be compatible with the type of the linked entity field. Set the properties of the corresponding widget (see the corresponding sections for the description of the model widget setting procedure).

`ModelGrid` widget can be configured to display a tree structure in the first column on the left (next to the service column). Other columns in this grid are displayed as usual.

To show a tree we need an entity, which contains a field referring to some other field, thus forming a hierarchical data structure.

Tree



Create and use `ModelGrid` within your JavaScript programs as follows:

```

var g = new ModelGrid();
g.data = model.allcustomers;
var colService = new ServiceGridColumn();
g.addColumnNode(colService);
var colName = new ModelGridColumn();
colName.field = 'name';
colName.title = 'just added name column'
g.addColumnNode(colName);
form.view.add(g, {left: '300px', top: '10px', right: '9px', bottom: '48px'});

```

7.7.5. ModelFormattedField

ModelFormattedField is the same widget as FormattedField widget with ability of binding. See FormattedField widget

To create a widget of this type by program means, use the ModelFormattedField constructor:

```
var mff = new ModelFormattedField();
```

After creating, if necessary, set the properties and widget event handlers and add the widget to a container:

```

mff.data = model.entityA;
mff.field = 'cursor.timeOfDeath';
mff.format = "dd.MM.yyyy HH:mm:ss";
view.add(mff);

```

7.7.6. ModelTextArea

ModelTextArea is a scalar model widget, the state of which is linked to a field of the data model of string or number type. The widget can be used to display and enter text.

ModelTextArea widget has the following specific properties:

| Property | Description |
|----------|---|
| editable | true if the text is editable and false otherwise. |

To configure the widget:

- Set the entity property for the widget, using the field property on the properties panel; select the data model parameter or data model entity property in the dialog.
- If necessary, set handlers for selection and data changing events.

To create a widget of this type by program means, use the ModelTextArea constructor:

```
var mta = new ModelTextArea();
```

After creating, if necessary, set the properties and widget event handlers and add the widget to the container:

```

mta.field = model.entityB.schema.textField;
view.add(mta);

```


7.7.7. ModelSpin

`ModelSpin` is a scalar model widget, the state of which is linked to a value of number type. One can input numbers either from the keyboard or using buttons to increase/decrease values.

`ModelSpin` widget has the following specific properties:

| Property | Description |
|------------------------|---|
| <code>editable</code> | <code>true</code> if the widget is editable and <code>false</code> otherwise. |
| <code>min</code> | Determines the lower bound of spinner's value. If it's <code>null</code> , value is unlimited at lower bound. |
| <code>max</code> | The upper bound of spinner's value. If it's <code>null</code> , value is unlimited at upper bound. |
| <code>step</code> | The spinner's value change step. Can't be <code>null</code> . |
| <code>emptyText</code> | The text displayed when the actual value is absent. |

To create a widget of this type by program means, use the `ModelSpin` constructor:

```
var modelSpin = new ModelSpin();
```

After creating, if necessary, set the properties and widget event handlers and add the widget to the container:

```
modelSpin.data = model.entityC;
modelSpin.field = 'cursor.count';
view.add(modelSpin, ...);
```

7.8. Containers

Containers are widgets, which can contain other widgets e.g. widgets or other containers and control their child widgets size and location.

In the visual editor Containers are represented as panel widget with specific layout.

The layout of a panel can be changed using the editor. At runtime, panel with particular layout will be replaced by the corresponding container.

Containers have a set of properties and events common for all widgets as well as their own specific properties and events.

The common methods for all containers:

| Method | Description |
|-----------------------------|---|
| <code>remove(widget)</code> | Removes a child widget |
| <code>child(index)</code> | Returns a child widget by its numeric index |
| <code>children()</code> | Returns a array of a child widgets |

| Method | Description |
|----------------------|---------------------------|
| <code>clear()</code> | Removes all child widgets |

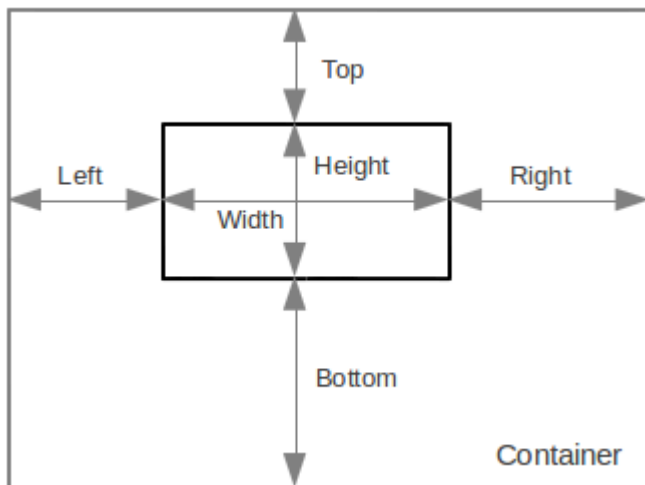
The common property of all containers:

| Property | Description |
|--------------------|---|
| <code>count</code> | The number of child widgets (read-only) |

7.8.1. AnchorsPane

`AnchorsPane` is a lightweight container with the anchors layout.

Anchors layout provides a simple, flexible yet powerful layout algorithm, which allows you to build complex user interfaces.



Configure the position and behavior of a widget in the container by defining `Left`, `Top`, `Right`, `Bottom` anchors and `Width` and `Height` settings of the widget. You can specify two of the three properties by the horizontal and vertical axis.

At the same time can be set two anchors or one anchor and one dimension values. The set properties are fixed and maintained when changing dimensions of the container. If the property is not defined, it is stretched along with the dimensions of the container.

Use `AnchorsPane` constructor in form's JavaScript code:

```
var pane = new AnchorsPane();
```

To add child widgets to the container, use the `add` method and pass a child widget and object of the `Anchors` type as parameters to this method.

```
pane.add(widget, anchors);
```

where `widget` is a widget to add, `anchors` is an object of the `Anchors` type.

```
var pane = new AnchorsPane();
var comp = new Button("Sample");
pane.add(comp, {left: 12, right: 14, top: 22, bottom: 24});
```

In the above example a button with the specified Left, Right, Top, and Bottom anchors is added to the anchor pane.

The object in second argument defines widget's binding anchors in a container with anchors layout.

Each anchor can be specified in pixels. To do this, define an anchor using a number or string with the "px" symbols added. For example: 100, "100px" mean the same anchor. To specify an anchor in percents, define an anchor using a string with the "%" symbol added, for example: "30%".

According to the rules of anchor layout, you can define two anchor values per coordinate.

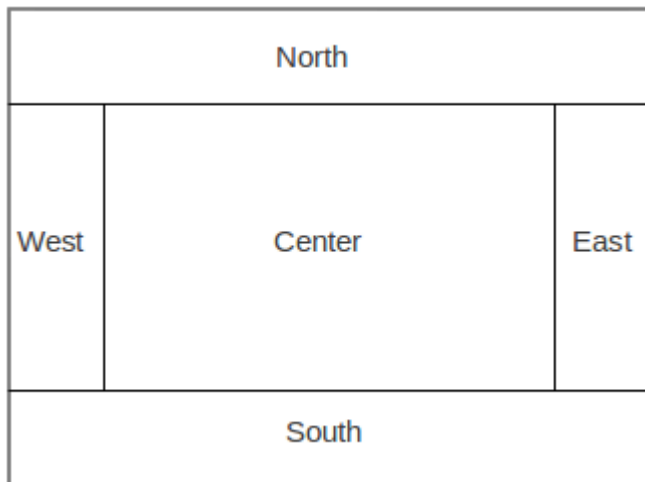
If the anchor value is not set, pass the null value to the corresponding parameter, for example:

```
var panel = new AnchorsPane();
panel.add(new Label("Test"), {left: 100, width: 200, top: 100, height: 100});
```

7.8.2. BorderLayout

BorderPane is a lightweight container with the border layout.

Border layout is a simple way of arranging widgets, when a container changes the position and dimensions of its widgets to the fit five regions: northern, southern, western, eastern and center. Each area can contain only one widget, which is determined by one of the following constants: North, South, East, West, Center.



Explicitly set the value of the property, which controls the position of the widget in the container. To do this, change widget Direction property fields at the Layout property group, by selecting one of the values from the drop-down list.

Use BorderLayout constructor to create this container in JavaScript code:

```
var pane = new BorderLayout(hgap, vgap);
```

where `hgap` is the horizontal gap (optional) and `vgap` is the vertical gap (optional).

To add child widgets to the container, use add instance method:

```
pane.add(widget, place, size);
```

where `widget` is a widget to add, `place` is an instance of a `HorizontalPosition` or `VerticalPosition` constants, determining the region (optional) and `size` is the size of the widget by the provided `place` direction (optional).

The following example shows how to create a `BorderPane` container and add to this container two child widgets:

```
require('ui', function(Ui){
  var pane = new BorderPane();
  var topComp = new Button("Top");
  pane.add(topComp, Ui.VerticalPosition.TOP);
  var bottomComp = new Button("Bottom");
  pane.add(bottomComp, Ui.VerticalPosition.BOTTOM);
});
```

7.8.3. GridPane

`GridPane` is a lightweight container with the grid layout. It is intended for static UI designs.

`GridPane` lays widgets out by the grid, all columns must have the same width and all rows must have the same height.

| | | |
|----------|----------|----------|
| Widget 0 | Widget 1 | Widget 2 |
| Widget 3 | Widget 4 | Widget 5 |
| Widget 6 | Widget 7 | Widget 8 |

To set the number of columns and rows and the vertical and horizontal interval between cells, select the `GridLayout` node in the widget tree of the inspector and change the corresponding values on the properties panel.

If you set a value other than zero for the number of columns and rows, column number setting is ignored. Instead of this, the number of columns is determined by the number of rows and the total number of widgets in the container.

Use `GridPane` constructor to create this container in JavaScript code:

```
var pane = new GridPane(rows, cols, hgap, vgap);
```

Where `rows` is the number of grid rows, `cols` is the number of grid columns, `hgap` is the horizontal gap (optional) and `vgap` is the vertical gap (optional).

To add child widgets to the container, use `add` instance method, which adds a widget to the next available position:

```
pane.add(widget, row, column);
```

where `widget` is a widget to add, `row` is the vertical position, the widget to added to and `column` is the horizontal position.

Use `child` method to get an child widget at the specified row and column, if the target position is empty the method will return `null`:

```
var comp = pane.child(row, column);
```

where `row` is the row of the widget and `column` is the column of the grid position.

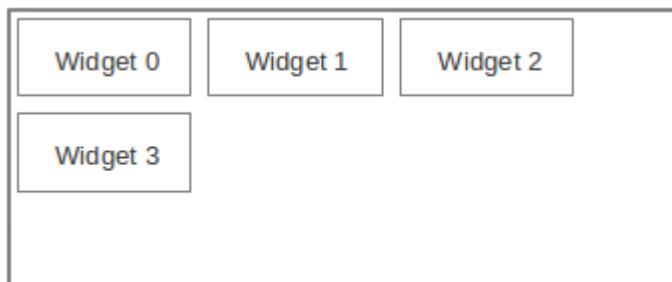
The following example shows how to create an `GridPane` container by program means:

```
require(['forms/button', 'forms/grid-pane'], function(Button, GridPane){
  var pane = new GridPane(3, 1);
  var comp1 = new Button("1");
  var comp2 = new Button("2");
  var comp3 = new Button("3");
  pane.add(comp1, 0, 0);
  pane.add(comp2, 1, 0);
  pane.add(comp3, 2, 0);
});
```

7.8.4. FlowPane

`FlowPane` is a lightweight container with the flow layout.

Flow layout aligns widgets into a row/line. Dimensions of the widgets are calculated according to their content (widget preferences). If the widget doesn't fit into a row, it is transferred to the next line.



Use `FlowPane` constructor to create this container in JavaScript code:

```
var pane = new FlowPane(hgap, vgap);
```

Where `hgap` is the horizontal gap (optional) and `vgap` the vertical gap (optional).

To add child widgets to the container, use `add` instance method:

```
pane.add(widget);
```

where `widget` is a widget to add.

The following example shows how to create an `FlowPane` container and add this container to its parent container:

```
require(['forms/button', 'forms/flow-pane'], function(Button, FlowPane){
  var pane = new FlowPane();
  var comp = new Button("Sample");
  pane.add(comp);
});
```

7.8.5. CardPane

`CardPane` is a lightweight container with the card layout.

Card layout allows you to arrange widgets as a stack of cards, one above the other. Only the top widget is visible. This layout manager is usually used to create a step-by-step wizards.

Each widget has an assigned card name, which can be set on the widget properties panel in the Card Name field of the Layout properties group. This name can be used later to select a visible widget.

To select a visible widget, use `show(cardName)` method, where `cardName` is the card name.

Use `CardPane` constructor to create this container in JavaScript code:

```
var pane = new CardPane(hgap, vgap);
```

Where `hgap` is the horizontal gap (optional) and `vgap` the vertical gap (optional).

To add child widgets to the container, use `add` instance method:

```
pane.add(widget, cardName);
```

where `widget` is a widget to add and `cardName` is the name of the card.

The following example shows how to create an `FlowPane` container and add this container to the widgets tree:

```
require(['forms/button', 'forms/card-pane'], function(Button, CardPane){
    var pane = new CardPane();
    var compA = new Button("SampleA");
    pane.add(comp, "A");
    var compB = new Button("SampleB");
    pane.add(comp, "B");
    var compC = new Button("SampleC");
    pane.add(comp, "C");

    pane.show("B");//Shows the SampleB button
});
```

7.8.6. BoxPane

`BoxPane` is a lightweight container with the vertical or horizontal box layout.

The box layout arranges widgets in the order, in which they were added to the container, one after the other, back to back.

Specify an axis, along which the Box layout manager will arrange widgets. For this select the `BoxLayout` node in the inspector widget tree and select the `Axis` property value from the list on the properties panel:

- `HORIZONTAL` for widgets are laid out horizontally from left to right.
- `VERTICAL` for widgets are laid out vertically from top to bottom.

Use `BoxPane` constructor to create this container in JavaScript code:

```
var pane = new BoxPane(orientation, hgap, vgap);
```

Where `orientation` is a value of `P.Orientation.HORIZONTAL` or `P.Orientation.VERTICAL` constants (optional). By default `P.Orientation.HORIZONTAL` orientation is specified. If orientation is specified as `P.Orientation.HORIZONTAL` `hgap` is horizontal gap between child widgets and it is ignored otherwise. If orientation is specified as `P.Orientation.VERTICAL` `vgap` is vertical gap between child widgets and it is ignored otherwise.

To add child widgets to the container, use `add` instance method:

```
pane.add(widget);
```

where `widget` is a widget to add.

The following example shows how to create a `BoxPane` instance and add a widget to this container:

```
require(['forms/button', 'forms/box-pane', 'ui'], function(Button, BoxPane, Ui){
  var pane = new BoxPane(Ui.Orientation.VERTICAL, 0, 20); // vertical box with 20 pixels
  var comp = new Button("Sample");
  pane.add(comp);
});
```

Note

Take into account, that changing of orientation in box pane will rearrange child widgets, but their widths and heights will remain unchanged if it will be allowed by the container. E.g. if you've got a horizontal box with different widths of child widgets and then you will change orientation to `Ui.Orientation.VERTICAL`, then all child widgets heights will remain equal to height of the container and widths will be changed to fit container's width. Of course you may reassign heights of child widgets in such case and layout will become pretty again.

7.8.7. TabbedPane

`TabbedPane` container allows the user to switch between a group of widgets by clicking tabs with titles and icons.

Widget's specific properties:

| Property | Description |
|--------------------------------|---------------------|
| <code>selectedComponent</code> | Active tab's widget |
| <code>selectedIndex</code> | Active tab index |

Widget's specific events:

| Event | Event type | Description |
|-----------------------------|------------------------|---------------------|
| <code>onItemSelected</code> | <code>ItemEvent</code> | Tab switching event |

To create a widget of this type by program means, use the `TabbedPane` constructor:

```
var pane = new TabbedPane();
```

To add child widgets to the container, use the `add` method and pass a child widget as well as a tab title and an optional icon as parameters to this method:

```
pane.add(widget, text, icon);
```

where `widget` is a widget to add, `text` is the tab's label text, `icon` is the tab's label icon (optional).

An example of code using the `TabbedPane` container:

```
require(['forms/anchors-pane', 'forms/tabbed-pane'], function(AnchorsPane, TabbedPane) {
  var pane = new TabbedPane();
  var tab1 = new AnchorsPane();
  var tab2 = new AnchorsPane();
  pane.add(tab1, "Tab 1");
  pane.add(tab2, "Tab 2");
});
```

7.8.8. SplitPane

`SplitPane` container is used to display two (and only two) splitted widgets. The user can change their size by moving the separator.

Split pane setup in form editor:

- Drag-and-drop a container of the type from the palette.
- Drag one widget to be displayed as the first widget of `SplitPane`.
- Drag another widget to be displayed as the second widget of `SplitPane`.

The specific properties of the `SplitPane`:

| Property | Description |
|---------------------------------|---|
| <code>orientation</code> | The separator's orientation: <code>Ui.Orientation.VERTICAL</code> OR <code>Ui.Orientation.HORIZONTAL</code> |
| <code>dividerLocation</code> | The split pane divider's location in pixels |
| <code>oneTouchExpandable</code> | <code>true</code> if the pane is one touch expandable and <code>false</code> otherwise. |
| <code>firstComponent</code> | The first widget of the container. |
| <code>secondComponent</code> | The second widget of the container. |

To create a widgets of this type by program means, use the `SplitPane` constructor with an optional parameter for specifying orientation:

```
var pane = new SplitPane(orientation);
```

where `orientation` is an object of the `Orientation` type, which defines orientation of the panel separator (optional). The container uses the horizontal orientation by default.

As an alternative to the `firstComponent` and `secondComponent` properties use `add` method:

```
pane.add(firstWidget);
pane.add(secondWidget);
```


where `firstWidget` and `secondWidget` are the first and then the second widget to add.

```
require(['forms/anchors-pane', 'forms/split-pane', 'ui'], function(AnchorsPane, SplitPane) {
    var pane = new SplitPane(Ui.Orientation.VERTICAL);
    var comp1 = new AnchorsPane();
    var comp2 = new AnchorsPane();
    pane.firstComponent = comp1;
    pane.secondComponent = comp2;
});
```

7.8.9. ScrollPane

`ScrollPane` is a container, which supports scrolling of its content. Usually another container is added to this one, using `ScrollPane` as a wrapper.

The specific properties of the `ScrollPane`:

| Property | Description |
|--|---|
| <code>view</code> | Single child widget - content of the <code>ScrollPane</code> . |
| <code>horizontalScrollBarPolicy</code> | Horizontal scroll bar policy of the container. <code>P.ScrollBarPolicy.AUTO</code> or <code>P.ScrollBarPolicy.NEVER</code> or <code>P.ScrollBarPolicy.ALWAYS</code> can be assigned to this property to specify scroll bars appearance. |
| <code>verticalScrollBarPolicy</code> | Vertical scroll bar policy of the container. <code>P.ScrollBarPolicy.AUTO</code> or <code>P.ScrollBarPolicy.NEVER</code> or <code>P.ScrollBarPolicy.ALWAYS</code> can be assigned to this property to specify scroll bars appearance. |

To create a widget of this type by program means, use the `ScrollPane` constructor, which can be called with a different number of parameters:

```
var pane = ScrollPane(view);
```

where `view` is a widget, which is added inside the scroll panel (optional).

You can add one child widget to the container using the `add` method, for example:

```
require(['forms/anchors-pane', 'forms/scroll-pane'], function(AnchorsPane, ScrollPane) {
    var scroll = new ScrollPane();
    var view = new AnchorsPane();
    scroll.add(view);
});
```

7.8.10. ToolBar

`ToolBar` is a container used to display widgets, which are responsible for the most common user actions.

Toolbars are intended to display a set of buttons (usually without labels, but with tooltips and small, clearly visible icons) which trigger the most frequently used application actions.

Widgets in the toolbar are placed in horizontal box one-by-one.

To create a widget of this type by program means, use the `ToolBar` constructor:

```
var toolbar = new ToolBar();
```

To add child widgets to the container, use the `add` method and pass a child widget:

```
pane.add(widget);
```

where `widget` is the widget to add.

For example:

```
require(['forms/tool-bar', 'forms/button', 'ui'], function(ToolBar, Button, Ui){
  var toolbar = new ToolBar();
  var b1 = new Button();
  pane.add(b1);
  Ui.Icon.load("1.png", function(aLoaded){
    b1.icon = aLoaded;
  });
  var b2 = new Button();
  pane.add(b2);
  Ui.Icon.load("2.png", function(aLoaded){
    b2.icon = aLoaded;
  });
});
```

7.8.11. DesktopPane

`DesktopPane` is used to create a multi-document interface.

Forms can be displayed inside this container. Such forms are named as `frames`. Add forms to the container in your program. After adding, these forms can be moved, closed, minimized or expanded (maximized) to the full container's size.

To create a widget of this type by program means, use the `DesktopPane` constructor:

```
var pane = new DesktopPane();
```

The list of specific methods of the widget:

| Property | Description |
|----------------------------|--|
| <code>minimizeAll()</code> | Minimizes all frames on the pane. |
| <code>restoreAll()</code> | Restores frames original state and location. |
| <code>maximizeAll()</code> | Maximizes all frames on the pane. |
| <code>closeAll()</code> | Closes all frames on the pane. |

The specific property of the widget:

| Property | Description |
|--------------------|---|
| <code>forms</code> | An array of all frames on the pane (read-only). |

To add a form to a `DesktopPane`:

- Create a new form instance.
- Add this new form to the desktop by calling the `showInternalFrame(desktopPane)` method where `desktopPane` is a `DesktopPane` object instance.

Example:

```
define('InnerForm', 'forms', function(Forms, ModuleName){
  return function (){
    var form = Forms.loadForm(ModuleName);
    this.onDesktop = function(aDesktop){
      form.showInternalFrame(aDesktop);
    };
  }
});
```

```
require(['forms/desktop-pane', 'InnerForm'], function(DesktopPane, InnerForm){
  var desktop = new DesktopPane();
  var formModule = new InnerForm();
  formModule.onDesktop(desktop);
});
```

7.9. Menus

Menus widgets provide a convenient way to let the user choose one of several options.

7.9.1. MenuBar

`MenuBar` widget is a form's main menu bar, into which individual menus can be added. This component is a kind of a container and inherits its common properties and methods.

After adding this widget from the palette, the menu bar contains some default menus, this menu can be changed, edited or deleted.

To create a widget of this type by in your code, use the `MenuBar` constructor:

```
var menuBar = new MenuBar();
view.add(menuBar, ...); // add it to the root container
```

The list of specific methods of the widget:

| Method | Description |
|--------------------|--|
| <code>add()</code> | Adds a new menu to the menu bar, where menu is a <code>Menu</code> to add. |

7.9.2. Menu

`Menu` is an individual menu, it can contain `MenuItem` and `MenuSeparator` widgets. This component is a kind of a container and inherits its common properties and methods.

Add new `Menu` widgets on to the `MenuBar` from the widgets palette in the visual editor.

Add the submenu into a `Menu` by selecting Add From Palette in the context menu.

To create a widget of this type by your code, use the `Menu` constructor:

```
var menu = new Menu(text);
menuBar.add(menu);
```

Where `text` is menu's label, displayed in parent menu if this menu is used as a sub menu.

The list of specific properties of the widget:

| Property | Description |
|---------------------|-----------------------------------|
| <code>text</code> | Menu's text label. |
| <code>parent</code> | The parent container (read-only). |

The list of specific methods of the widget:

| Property | Description |
|--------------------------|---|
| <code>add(widget)</code> | Adds an item to the menu, where <code>widget</code> is the <code>MenuItem</code> or <code>MenuSeparator</code> widget to add. |

7.9.3. PopupMenu

`PopupMenu` is an options selection window, which can be assigned to any widget. This component is a kind of a container and inherits its common properties and methods.

Add the `PopupMenu` widget onto the form by dragging it from the palette in visual editor. After adding, this widget will have no visual representation in the form's layout, it will be available under the Other widgets node in the inspector widget tree.

Add items to the popup menu the same way as to the standard menu.

To assign a popup menu for a widget in the visual editor, define a widget's `componentPopupMenu` property and select the required popup menu from the list.

To create a widget of this type by in your code, use the `PopupMenu` constructor:

```
var popup = new PopupMenu();
var label = new Label("Sample");
label.componentPopupMenu = popup;
```

The list of specific methods of the widget:

| Method | Description |
|------------------------|---|
| <code>add(item)</code> | Adds an item to the menu, where <code>comp</code> is the <code>MenuItem</code> or <code>MenuSeparator</code> widget to add. |

7.9.4. MenuItem

The default `MenuItem` object contains a simple labeled menu item.

To create a widget of this type by in your program, use the `MenuItem` constructor:

```
var menuItem = new MenuItem(text, icon, actionPerformed);
```

where `text` is the text of the menu item (optional), `icon` is the icon of the widget (optional), `actionPerformed` the function for the action performed handler (optional).

The list of specific properties of the widget:

| Property | Description |
|---------------------|-----------------------------------|
| <code>text</code> | Menu item's text label. |
| <code>icon</code> | Menu item's Icon. |
| <code>parent</code> | The parent container (read-only). |

An example of code using `MenuItem` widget:

```
var item = new MenuItem("Sample");
item.onActionPerformed = function(evt) {
    alert("Sample selected.")
}
menu.add(item);
```

7.9.5. CheckMenuItem

`CheckMenuItem` is a menu item combined with a checkbox.

To create a widget of this type by in your program, use the `CheckMenuItem` constructor:

```
var checkMenuItem = new CheckMenuItem(text, selected, actionPerformed);
```

where `text` is the text of the widget (optional), `selected` is `true` when the check box is selected and `false` otherwise (optional), `actionPerformed` the function for the action performed handler (optional).

The list of specific properties of the widget:

| Property | Description |
|-----------------------|--|
| <code>text</code> | Menu item text. |
| <code>selected</code> | <code>true</code> if the menu item is selected and <code>false</code> otherwise. |
| <code>parent</code> | The parent container (read-only). |

A menu item of this type can be added to a `ButtonGroup` widget, which is shared by other check boxes and radio buttons, including elements which are not present in the menu.

7.9.6. RadioMenuItem

`RadioMenuItem` is a menu item combined with a radio button.

To create a widget of this type by in your program, use the `RadioMenuItem` constructor:

```
var radioMenuItem = new RadioMenuItem(text, selected, actionPerformed);
```

where `text` is the text of the widget (optional), `selected` is `true` when the check box is selected and `false` otherwise (optional), `actionPerformed` the function for the action performed handler (optional).

The list of specific properties of the widget:

| Property | Description |
|--------------------------|--|
| <code>text</code> | Menu item text. |
| <code>selected</code> | <code>true</code> if the menu item is selected and <code>false</code> otherwise. |
| <code>buttonGroup</code> | The button group this widget belongs |
| <code>parent</code> | The parent container (read-only). |

A menu item of this type can be added to a `ButtonGroup` widget, which is shared by other check boxes and radio buttons, including elements which are not present in the menu.

7.9.7. MenuSeparator

`MenuSeparator` is a separator of menu items. Use this widget to visually split the groups of menu items.

To create a widget of this type by in your program, use the `MenuSeparator` constructor:

```
var separator = new MenuSeparator();
```

The list of specific properties of the widget:

| Property | Description |
|---------------------|-----------------------------------|
| <code>parent</code> | The parent container (read-only). |

7.10. UI utilities API

7.10.1. Icon

`Icon` is a small picture.

To create an icon object, use the factory `load` method of the `Icon` object:

```
var icon = Ui.Icon.load(path);
```

where `path` is the name of the icon file, relative path of an application or http URL.

The icon file name will be used for accessing the application project's collection of icons.

An example of using an icon to create a button:

```
require(['ui', 'forms/button'], function(Ui, Button){
  Ui.Icon.load("car.png", function(aCarIcon){
    var b = new Button("Car", aCarIcon);
    view.add(b, ...);
  });
});
```

```
    });
  });
```

7.10.2. FontStyle

FontStyle object contains constants, which can be used to set font styles.

| Property | Description |
|-------------|---------------|
| NORMAL | Standard font |
| BOLD | Bold |
| ITALIC | Italics |
| BOLD_ITALIC | Bold italics |

Example of usage:

```
var italicFontStyle = Ui.FontStyle.ITALIC;
```

7.10.3. Font

Font object.

Object properties:

| Property | Description |
|----------|-------------------------|
| family | Name of the font family |
| style | Style, See FontStyle |
| size | Size |

To create a font object, use the Font constructor:

```
var font = new Ui.Font(family, style, size)
```

where family is a string of the font family name; style is a font style of the FontStyle type, size is a font size in points.

Example:

```
button.font = new Ui.Font("Verdana", P.FontStyle.BOLD, 14);
```

7.10.4. Color

Color represents color an the object.

The color object contains constants of main colors:

| Property | Description |
|------------|-------------|
| WHITE | White |
| LIGHT_GRAY | Light gray |

| Property | Description |
|-----------|-------------|
| GRAY | Gray |
| DARK_GRAY | Dark gray |
| BLACK | Black |
| RED | Red |
| PINK | Pink |
| ORANGE | Orange |
| YELLOW | Yellow |
| MAGENTA | Magenta |
| CYAN | Cyan |
| GREEN | Green |
| BLUE | Blue |

To create an object of an arbitrary color, use the `Color` constructor by passing it three RGB integers as parameters:

```
var color = new Ui.PColor(red, green, blue, alpha);
```

where R, G, B are red, green, blue and alpha are integer constituents of the color.

Example of usage:

```
button.foreground = Ui.P.Color.BLUE;

var ivory = new Ui.Color(255, 255, 240);
panel.background = ivory;
```

7.10.5. HorizontalPosition

`HorizontalPosition` is the horizontal position constants object.

This object contains constants, which determine the horizontal position:

| Property | Description |
|----------|--------------|
| LEFT | To the left |
| CENTER | Center |
| RIGHT | To the right |

Example of usage:

```
var horizontalPosition = Ui.HorizontalPosition.CENTER;
```

7.10.6. VerticalPosition

`VerticalPosition` is the vertical position constants object.

This object contains constants, which determine the vertical position:

| Property | Description |
|----------|---------------|
| TOP | To the top |
| CENTER | Center |
| BOTTOM | To the bottom |

Example of usage:

```
var verticalPosition = Ui.VerticalPosition.CENTER;
```

7.10.7. Orientation

Orientation is the orientation constants object.

This object contains constants, which determine the orientation:

| Property | Description |
|------------|--------------|
| HORIZONTAL | Horizontally |
| VERTICAL | Vertically |

Example of usage:

```
var orientation = Ui.Orientation.HORIZONTAL;
```

7.10.8. ScrollBarPolicy

ScrollBarPolicy is the scroll bar policy constants object.

This object contains constants, which determine the scroll bar policy:

| Property | Description |
|----------|---|
| AUTO | Scroll bar appears automatically, when content of scroll pane becomes greater than scroll pane. |
| NEVER | Scroll bar is never shown. |
| ALLWAYS | Scroll bar is allways shown. |

Example of usage:

```
scrooll.scrollBarPolicy = Ui.ScrollBarPolicy.NEVER;
```

7.11. Dialogs API

Use this global functions to display custom dialogs:

| Function | Description |
|----------------|--|
| alert(message) | Displays an info message, where <code>message</code> is the message text. Platypus J2SE client accepts extra parameter, - <code>title</code> and uses it as title of the message window. |

| Function | Description |
|---|--|
| <code>prompt(message, default)</code> | Displays a prompt window, returns the response string, where <code>message</code> is the message text, <code>default</code> is the default text. |
| <code>confirm(message)</code> | Displays a dialog with confirmation, where <code>message</code> is the message text. |
| <code>selectFile(callback, curDir, fileFilter)</code> | Displays a dialog, which allows the user to select a file. Calls <code>callback</code> and passes a file object, where <code>curDir</code> is the current directory, <code>fileFilter</code> is a files names filter. It has the following format: <code>.png, .txt, .xls</code> . |
| <code>selectDirectory(callback, curDir)</code> | Displays a dialog, which allows the user to select a directory and <code>callback</code> is called upon user's selection. <code>curDir</code> is the directory the dialog will be opened with. |
| <code>selectColor(callback, oldColor)</code> | Displays a color selection dialog and calls <code>callback</code> upon user's selection. <code>oldColor</code> is the color to be preset in dialog for user's convenience. |

Code examples:

```
alert("Message title", "Message");

var txt = prompt("Enter text here", "Some default text");

if (confirm("Are you sure?")) {
  // Do something here...
}
```

Chapter 8. Report

8.1. Introduction to reports

The reporting tools allow a developer to generate reports as a Microsoft Excel files. You can open a generated report in a spreadsheet application, print or save it to disk.

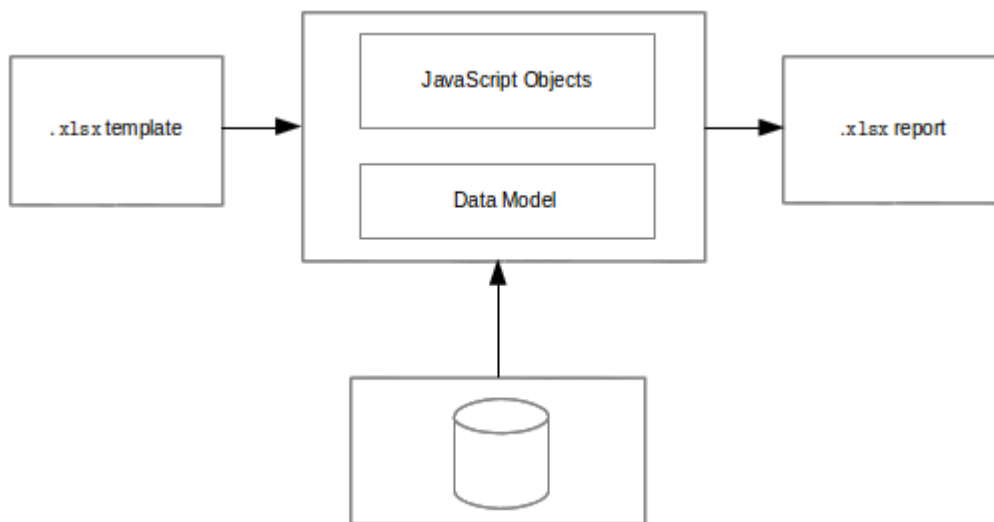
`ReportTemplate` is an `Platypus.js` API class representing a report template. It is used in regular `Platypus.js` modules.

The report application element includes the following:

- a report template (a file in the Microsoft Excel format with the `.xlsx` extension,
- JavaScript code,
- a data model.

Reports generator is based on the `jXLS` library, which in turn uses the Apache POI library. Markup and formatting of the report are defined in the template file. Binding to data is performed using `jXLS` library tags placed in spreadsheet cells.

In the process of report generation, template tags are linked to model entity's data arrays as well as to JavaScript objects.



8.2. New report creation

To create a report, perform the following actions:

- Select a `New` item in the parent directory context menu, or select the parent directory and click `New File` in the main menu, or click `New File` on the toolbar, or use a corresponding shortcut.
- Select a `Report` type in the context menu, or select `Choose file type Platypus application elements Report` on the wizard first step and click `Next`.

- Enter the name of a new application element in the Name field and click Finish to create it, or click Cancel to cancel.

8.3. Reports editor

To open reports editor, double-click the application element in the project tree.

Edit the report template in the spreadsheet application. The following applications are used by default for different operating systems:

- Windows: Microsoft Excel.
- Linux: Open/Libre Office Calc.
- Mac OS: Microsoft Excel.

To edit a report:

- Open the Layout tab of the report editor, run the template editor by clicking Edit report template.
- Specify the report formatting, add tags of linking to data to the template, save the report template in the template editor application.
- On the Datamodel and Source tabs configure the data model and write the JavaScript code.
- Implement report `onBeforeRender` event handler in the JavaScript editor.
- Save the application element by clicking Save All on the Platypus Application Designer toolbar or by clicking the Ctrl S shortcut.

8.4. Template tags

Edit the report template in a spreadsheet application.

Place tags for linking to JavaScript objects and model entities' data arrays in the template cells. To access data, use the following syntax: `${propertyName}`, where `propertyName` is the object's property of object accessible to report generator. Report generator has access to object, that is passed to `P.loadTemplate(modeulName, object)` as second argument.

Example of writing the name of a documents into cells:

```
${documents.name}
```

Such a template will lead to insertion of multiple rows in a resulting spreadsheet. Each row will represent documents collection item.

Similarly, you can use a complex object:

```
${library.documents.name}
```

You can use multiple tags in a single cell, for example:

```
Employee: ${employee.name} - ${employee.age} years
```

In the JavaScript code, define objects, which will be available in the template tags:

```
define(['template'], function (loadTemplate, ModuleName) {
  function ReportConstructor() {
    var self = this;

    var library = {};
    var template = loadTemplate(ModuleName, library);

    library.docs = this.model.documents;
    library.documents = [
      {name: 'foo'},
      {name: 'bar'},
      {name: 'baz'}
    ];
  }
  return ReportConstructor;
});
```

Add entities, which will be linked to the template, to the report module data model.

When outputting collections, a new row is added for each collection element and the style of a cell, which contains tag, is set for the cells of this row.

If you know the size of the collection beforehand, you can use the template rows instead of adding new rows for each element. To do this, add name of the collection to fixed property of a template (variable `rt` in the above example).

There is another way yo display collections using the `jx:forEach` tag:

```
<jx:forEach items="${departments}" var="department">
  ${department.name} | ${department.chief}
</jx:forEach>
```

The `jx` tags may be embedded into each other. If you place opening and closing tags on the same row, columns in this row will be duplicated. Place the `jx:forEach` and `jx:forEach` tags on different rows to enable duplication of rows between these tags. Other cells in rows, which contain opening and closing tags, will be ignored.

The `jx:forEach` tag allows grouping of collection data by one of the properties. To arrange grouping, use the `groupBy` and `groupOrder`, attributes, which determine the property to be used for grouping data and the order of outputting groups, for example:

```
<jx:forEach items="${employees}" groupBy="age">
  Age: ${group.item.age}
  <jx:forEach items="${group.items}" var="employee">
    ${employee.name} |
    ${employee.payment} |
    ${employee.bonus}
  </jx:forEach>
</jx:forEach>
```

In this example, we group employees by age. When grouping, a new group object is created in the context of the cycle. This object contains two properties: `item`, which is the current group, and `items`, which is the collection of all objects in the group.

By default, if the `groupOrder` attribute is not present when grouping, the original order of items in the collection is maintained. Use the `groupOrder` attribute and assign `asc` and `desc` values for forward and reverse sorting to this attribute.

If the `groupBy` attribute is used in the `jx:forEach` tag, the `var` attribute is ignored.

Use the `select` attribute to determine elements of the collection which should be included into the report. In the example below, we include only employees with salary greater than 2000 into the report:

```
<jx:forEach items="{employees}" var="employee" select="{employee.payment > 2000}">
  {employee.name} | {employee.payment} | {employee.bonus}
</jx:forEach>
```

To get access to the index of the current collection element, use the `varStatus` attribute and set the name of the object, to which the status object will be assigned, for this attribute. The status object have only an `index` property, for example:

```
<jx:forEach items="{employees}" var="employee" varStatus="status">
  {status.index}
  {employee.name}
  {employee.payment}
  {employee.bonus}
</jx:forEach>
```

Use the `jx:if` tag to control output depending on the condition:

```
<jx:if test="{department.chief.payment > 2000.0}">
  Chief Name: {department.chief.name}
</jx:if>
```

You can use the `jx:if` tag to show or hide columns; to do this, place opening and closing tags in the same row — when exporting data, columns contained in the body of the tag will be displayed or hidden.

Use the `jx:outline` tag to group rows:

```
<jx:outline>
  //any rows can go here
</jx:outline>
```

The `jx:outline` tag has an optional `detail` attribute, which determines the state of the row group. By default, it is set to `false`, which means that the row group will be hidden.

8.5. Report API

To generate a report, create a report object by passing the required report identifier to `loadTemplate` function.

Use the report object:

- Create an report instance using `generateReport()` method of `ReportTemplate` on the server side.
- Display a report by calling the `show()` method. The report will be downloaded and a command to open it will be executed.

- Send the report to print by calling the `print()` method.
- Save the report file to disk by calling the `save()` method; pass the path of the file, to which the report should be saved, as a parameters.

Note

When executing the report in the HTML5 browser client, calling the `show()`, `print()`, and `save(reportPath)` methods lead to the same results, - the report file will be downloaded by your browser.

In the example below, the report is generated on client side by desktop application:

```
var r = new DocumentReport();
r.execute('execute'); // generate report
```

To execute the report on the server side (from a HTML5 browser or a desktop client):

```
/*
 * @stateless
 * @public
 */
define('DocumentReport', ['orm', 'template'], function (Orm, loadTemplate, ModuleName) {
    function ReportConstructor(){
        var self = this
            , model = Orm.loadModel(ModuleName)
            , template = loadTemplate(ModuleName, model);
        self.execute = function(aValue, onSuccess, onFailure){
            model.documents.params.documentCategory = aValue;
            model.requery(function(){
                var report = template.generateReport();
                onSuccess(report);
            }, onFailure);
        };
        // ...
    }
    return ReportConstructor;
});

require('rpc', function(Rpc){
    var r = new Rpc.Proxy('DocumentReport');
    r.execute('execute', function(aReport){
        aReport.show();
    });
});
}
```

Report's JavaScript code prepares data for displaying, calculates new data, etc.

- Write code in the report's module constructor to perform initialization.
- For server-side reports think about what data should be transferred to the server side and provide arguments of method, performing `generateReport`.

There is a problem with dates in Excel documents. Excel is unable to convert UTC dates to localized strings automatically. So you should give dates already in local time zones. To fix this issue, use "timezoneOffset" property of `ReportTemplate`. This property is suited for use with JavaScript dates. To use this property in a right way, call `(new Date()).getTimezoneOffset()` in browser and transfer it

to the server code and in server code use it as value of "timezoneOffset" property of ReportTemplate. Thus you will get localized dates in generated document.

Chapter 9. HTTP

9.1. HTTP interface

Server modules instance methods can be remotely invoked over network using simple GET or POST HTTP requests.

To make the module instance methods available for external requests, mark the module with the `@public` annotation.

To invoke a server method, send a request by the URL formed using the base URL of the Servlet and the `/application` suffix for accessing HTTP API.

Specify the request type (optional for RPC requests), the module name, the method name and parameters of method calling in the URL parameters or in the body of the POST request in the `application/x-www-form-urlencoded` format. The response body will contain a value, which was returned in the executed method.

If the JavaScript object is returned from an instance method, it will be serialized as JSON and string will be sent to a client as a response. If the object of the String, string will be escaped as if it was JSON string and text response will be sent to a client. It is also possible to specify the response content type explicitly.

Parameters of the server module method invocation request:

| Parameter | Description |
|---------------------------|---|
| <code>__moduleName</code> | Module constructor name. |
| <code>__methodName</code> | Name of the called module method. |
| <code>__param</code> | Method's single parameter. A text value, a string, a number or a JavaScript object in the JSON format. Strings are also escaped as if it was JSON string. |
| <code>__param[]</code> | Method's multiply parameters. Several values, value can be a string, a Number or a JavaScript objects in JSON format. Strings are also escaped as if they were JSON string. |

Example of URL for calling a server module method (URL is not encoded):

```
http://server:port/context/application?  
__moduleName=TestModule&__methodName=say&__param=Hello%20Platypus
```

9.2. HTTP request and response API

To access HTTP request and response in the JavaScript server code, use the `HttpContext` class, which is available, if the method is called by the external HTTP request.

```

/**
 * @public
 */
define('http-context', function(HttpContext){
    function ModuleConstructor() {
        var self = this;

        /**
         * @rolesAllowed tester admin
         */
        this.doSomething = function(paramA, paramB) {
            var context = new HttpContext();
            var request = context.request;
            var response = context.response;
            // application logic...
        }
    }
    return ModuleConstructor;
});

```

The `HttpContext` instance contains the following objects:

| Property | Description |
|-----------------------|-----------------------|
| <code>request</code> | HTTP request object. |
| <code>response</code> | HTTP response object. |

The `request` object contains the following properties:

| Property | Description |
|--------------------------------|--|
| <code>authType</code> | Authentication scheme name. |
| <code>characterEncoding</code> | Character encoding name. |
| <code>contentLength</code> | Request body length in bytes or -1, if the length is unknown. |
| <code>contentType</code> | MIME type of the request body or <code>null</code> if the type is unknown. |
| <code>body</code> | Request body as a string. |
| <code>bodyBuffer</code> | Request body as a bytes array. |
| <code>contextPath</code> | Part of URL, the request context. |
| <code>cookies</code> | Cookies which were sent by the client in the request in key-value form. |
| <code>headers</code> | Request headers in key-value form. |
| <code>localAddr</code> | IP address, on which the request was received. |
| <code>localName</code> | Name of the host, on which the request was received. |
| <code>localPort</code> | Port, on which the request was received. |
| <code>method</code> | Request method HTTP name, for example <code>GET</code> , <code>POST</code> . |

| Property | Description |
|----------------|---|
| params | Request parameters in key-value form. If several parameters have the same name, their values will be presented as an array. |
| pathInfo | Additional information about the path in the request URL. |
| pathTranslated | Additional information about the path in the request URL, worked out to the real path. |
| protocol | Request protocol name and version in the form of protocol/majorVersion.minorVersion, for example, HTTP/1.1. |
| queryString | URL request string. |
| remoteAddr | IP address of the client or last proxy. |
| remoteHost | Fully qualified name of the client or last proxy. |
| remotePort | Port of the client or last proxy. |
| requestURI | A part of the URL request from the protocol name to the request string. |
| requestURL | URL of the request. |
| scheme | Request pattern, for example http, https, or ftp. |
| serverName | Name of the host, to which the request was sent. |
| serverPort | Port, to which the request was sent. |
| secure | true when the request was sent via the secured channel, for example HTTPS and false otherwise. |

In the example below, all request headers are output into the log:

```
for (var c in context.request.headers) {
    Logger.info(c + ' - ' + context.request.headers[c]);
}
```

The response object contains the following properties and methods:

| Property/method | Description |
|-----------------|--|
| status | Current status of the response. |
| contentType | MIME type of the response body. |
| body | The text body sent in this response. The body must be set after content type. Note that content length is set automatically. |
| bodyBuffer | The binary body sent in this response, as a bytes array. The body must be set after content type. Note that content length is set automatically. |
| headers | Response headers in key-value form. |

| Property/method | Description |
|--------------------------------|-----------------------------------|
| <code>addCookie(cookie)</code> | Adds new cookies to the response. |

The `response.headers` object contains the following properties and methods:

| Property/method | Description |
|-------------------------------|--|
| <code>add(name, value)</code> | Adds a new header with the specified name and value to the response. |
| <code>set(name, value)</code> | Defines/Redefines a value for the response header. |

The `cookie` object contains the following properties:

| Property | Description |
|----------------------|---|
| <code>name</code> | The cookie name (required). |
| <code>value</code> | The current cookie value (required). |
| <code>comment</code> | Comment, which describes the purpose of the cookie. |
| <code>domain</code> | Cookie domain name. |
| <code>maxAge</code> | Cookie lifetime in seconds. |
| <code>path</code> | Path on the server for which the browser returns this cookie. |
| <code>secure</code> | <code>true</code> set to notify the browser that this cookie should only be sent over a secure protocol and <code>false</code> otherwise. |
| <code>version</code> | Cookie protocol version. |

In the example below, new cookie will be added to the HTTP response:

```
context.response.addCookie({
  name : 'platypus',
  value : 'test',
  maxAge : 60*60
});
```

To eliminate cookie from a browser, set 0 for its `maxAge` property. mg@altsoft.biz [<mailto:mg@altsoft.biz>] jskonst@altsoft.biz [<mailto:jskonst@altsoft.biz>] vadim.vashkevich@gmail.com [<mailto:vadim.vashkevich@gmail.com>]