OptaPlanner Workbench and Execution Server User Guide

The OptaPlanner team [http://www.optaplanner.org/community/team.html]

OptaPlanner Workbench and Execution Server User Guide

by

Version 6.5.1-SNAPSHOT

Part I. OptaPlanner Engine

See the OptaPlanner docs.

Part II. OptaPlanner Workbench

The OptaPlanner

Chapter 1. Workbench (General)

1.1. Installation

1.1.1. War installation

Use the `war` from the workbench distribution zip that corrsponds to your application server. The differences between these `war` files are mainly superficial. For example, some JARs might be excluded if the application server already supplies them.

- `eap6_4`: tailored for Red Hat JBoss Enterprise Application Platform 6.4
- `tomcat7`: tailored for Apache Tomcat 7

Note

Apache Tomcat requires additional configuration to correctly install the Workbench. Please consult the `README.md` in the `war` for the most up to date procedure.

- `was8`: tailored for IBM WebSphere Application Server 8
- `weblogic12`: tailored for Oracle WebLogic Server 12c

Note

Oracle WebLogic requires additional configuration to correctly install the Workbench. Please consult the `README.md` in the `war` for the most up to date procedure.

- `wildfly8`: tailored for Red Hat JBoss Wildfly 8

1.1.2. Workbench data

The workbench stores its data, by default in the directory `$WORKING_DIRECTORY/.niogit`, for example `wildfly-8.0.0.Final/bin/.niogit`, but it can be overridden with the system property `-Dorg.uberfire.nio.git.dir`.

Note

In production, make sure to back up the workbench data directory.

1.1.3. System properties

Here's a list of all system properties:

- **`org.uberfire.nio.git.dir`**: Location of the directory `.niogit`. Default: working directory
- **`org.uberfire.nio.git.daemon.enabled`**: Enables/disables git daemon. Default: `true`
- **`org.uberfire.nio.git.daemon.host`**: If git daemon enabled, uses this property as local host identifier. Default: `localhost`
- **`org.uberfire.nio.git.daemon.port`**: If git daemon enabled, uses this property as port number. Default: `9418`
- **`org.uberfire.nio.git.ssh.enabled`**: Enables/disables ssh daemon. Default: `true`
- **`org.uberfire.nio.git.ssh.host`**: If ssh daemon enabled, uses this property as local host identifier. Default: `localhost`
- **`org.uberfire.nio.git.ssh.port`**: If ssh daemon enabled, uses this property as port number. Default: `8001`
- **`org.uberfire.nio.git.ssh.cert.dir`**: Location of the directory `.security` where local certificates will be stored. Default: working directory
- **`org.uberfire.nio.git.hooks`**: Location of the directory that contains Git hook scripts that are installed into each repository created (or cloned) in the Workbench. Default: N/A
- **`org.uberfire.nio.git.ssh.passphrase`**: Passphrase to access your Operating Systems public keystore when cloning `git` repositories with `scp` style URLs; e.g. `git@github.com:user/repository.git`.
- **`org.uberfire.nio.git.ssh.ciphers`**: A comma-separated string of ciphers. The available ciphers are `aes128-ctr`, `aes256-ctr`, `aes192-cbc`, `aes256-cbc`. If the property is not used, all available ciphers are loaded.
- **`org.uberfire.nio.git.ssh.macs`**: A comma-separated string of message authentication codes (MACs). The available MACs are `hmac-sha2-256`, `hmac-sha2-256`, `hmac-sha2-512`, `hmac-sha1`, `hmac-md5`, `hmac-sha1-96`, `hmac-md5-96`. If the property is not used, all available MACs are loaded.
- **`org.uberfire.metadata.index.dir`**: Place where Lucene `.index` folder will be stored. Default: working directory
- **`org.uberfire.cluster.id`**: Name of the helix cluster, for example: `kie-cluster`
- **`org.uberfire.cluster.zk`**: Connection string to zookeeper. This is of the form `host1:port1,host2:port2,host3:port3`, for example: `localhost:2188`

- **`org.uberfire.cluster.local.id`**: Unique id of the helix cluster node, note that '`:`' is replaced with '_', for example: `node1_12345`
- **`org.uberfire.cluster.vfs.lock`**: Name of the resource defined on helix cluster, for example: `kie-vfs`
- **`org.uberfire.cluster.autostart`**: Delays VFS clustering until the application is fully initialized to avoid conflicts when all cluster members create local clones. Default: `false`
- **`org.uberfire.sys.repo.monitor.disabled`**: Disable configuration monitor (do not disable unless you know what you're doing). Default: `false`
- **`org.uberfire.secure.key`**: Secret password used by password encryption. Default: `org.uberfire.admin`
- **`org.uberfire.secure.alg`**: Crypto algorithm used by password encryption. Default: `PBEWithMD5AndDES`
- **`org.uberfire.domain`**: security-domain name used by uberfire. Default: `ApplicationRealm`
- **`org.guvnor.m2repo.dir`**: Place where Maven repository folder will be stored. Default: working-directory/repositories/kie
- **`org.guvnor.project.gav.check.disabled`**: Disable GAV checks. Default: `false`
- **`org.kie.example.repositories`**: Folder from where demo repositories will be cloned. The demo repositories need to have been obtained and placed in this folder. Demo repositories can be obtained from the kie-wb-6.2.0-SNAPSHOT-example-repositories.zip artifact. This System Property takes precedence over org.kie.demo and org.kie.example. Default: Not used.
- **`org.kie.demo`**: Enables external clone of a demo application from GitHub. This System Property takes precedence over org.kie.example. Default: `true`
- **`org.kie.example`**: Enables example structure composed by Repository, Organization Unit and Project. Default: `false`
- **`org.kie.build.disable-project-explorer`**: Disable automatic build of selected Project in Project Explorer. Default: `false`

To change one of these system properties in a WildFly or JBoss EAP cluster:

1. Edit the file `$JBOSS_HOME/domain/configuration/host.xml`.
2. Locate the XML elements `server` that belong to the `main-server-group` and add a system property, for example:

```
<system-properties>
```

```
    <property name="org.uberfire.nio.git.dir" value="..." boot-time="false"/>
    ...
  </system-properties>
```

1.1.4. Trouble shooting

1.1.4.1. Loading.. does not disappear and Workbench fails to show

There have been reports that Firewalls in between the server and the browser can interfere with Server Sent Events (SSE) used by the Workbench.

The issue results in the "Loading..." spinner remaining visible and the Workbench failing to materialize.

The workaround is to disable the Workbench's use of Server Sent Events by adding file `/WEB-INF/classes/ErraiService.properties` to the exploded WAR containing the value `errai.bus.enable_sse_support=false`. Re-package the WAR and re-deploy.

1.2. Quick Start

These steps help you get started with minimum of effort.

They should not be a substitute for reading the documentation in full.

1.2.1. Add repository

Create a new repository to hold your project by selecting the Administration Perspective.

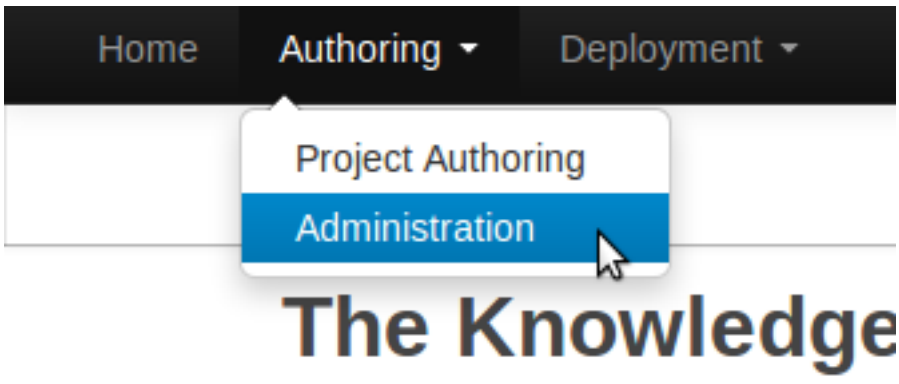


Figure 1.1. Selecting Administration perspective

Select the "New repository" option from the menu.

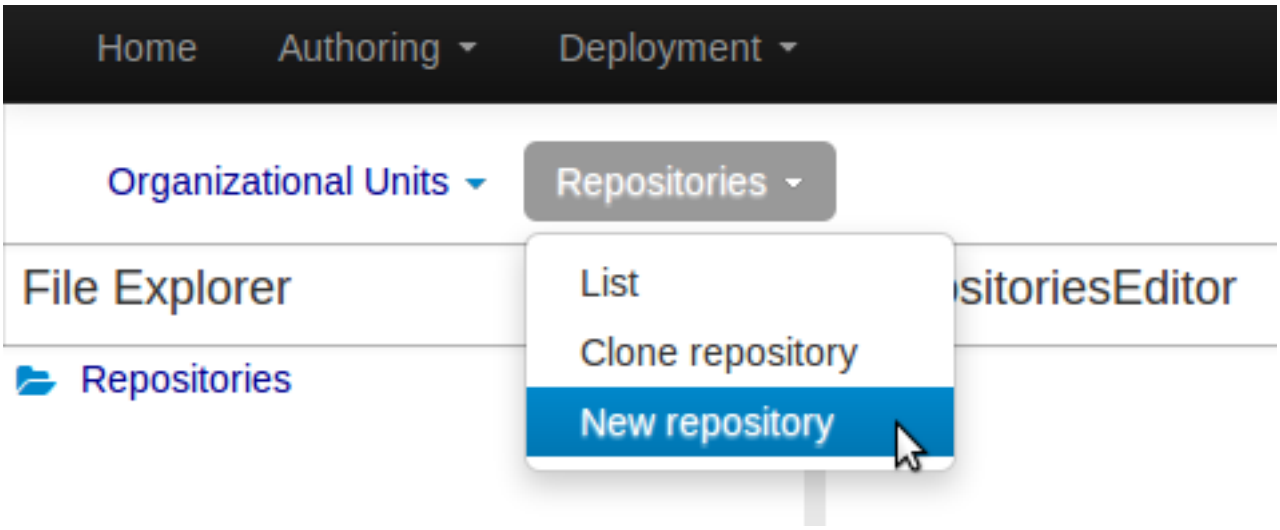


Figure 1.2. Creating new repository

Enter the required information.

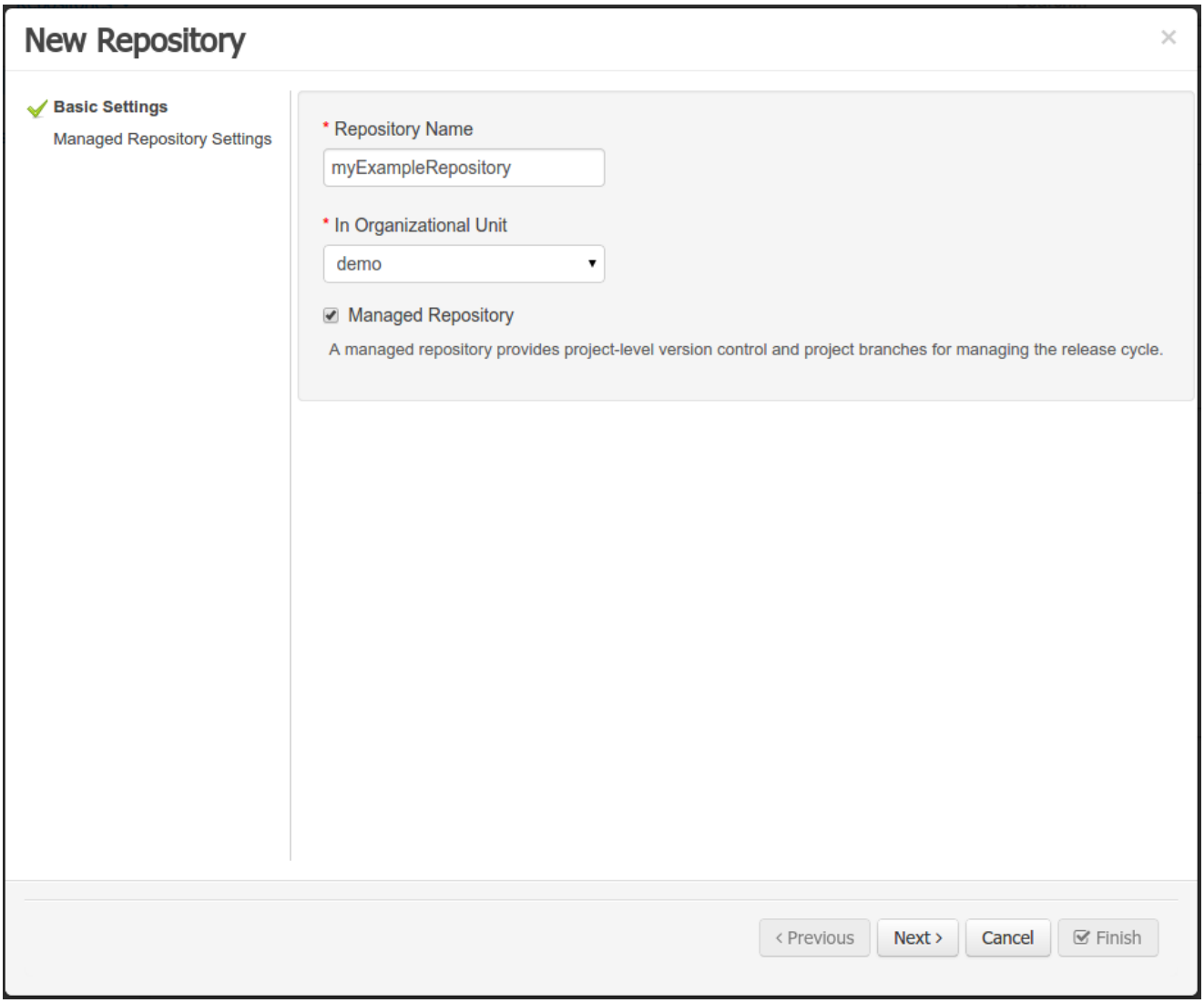


Figure 1.3. Entering repository information step 1/2

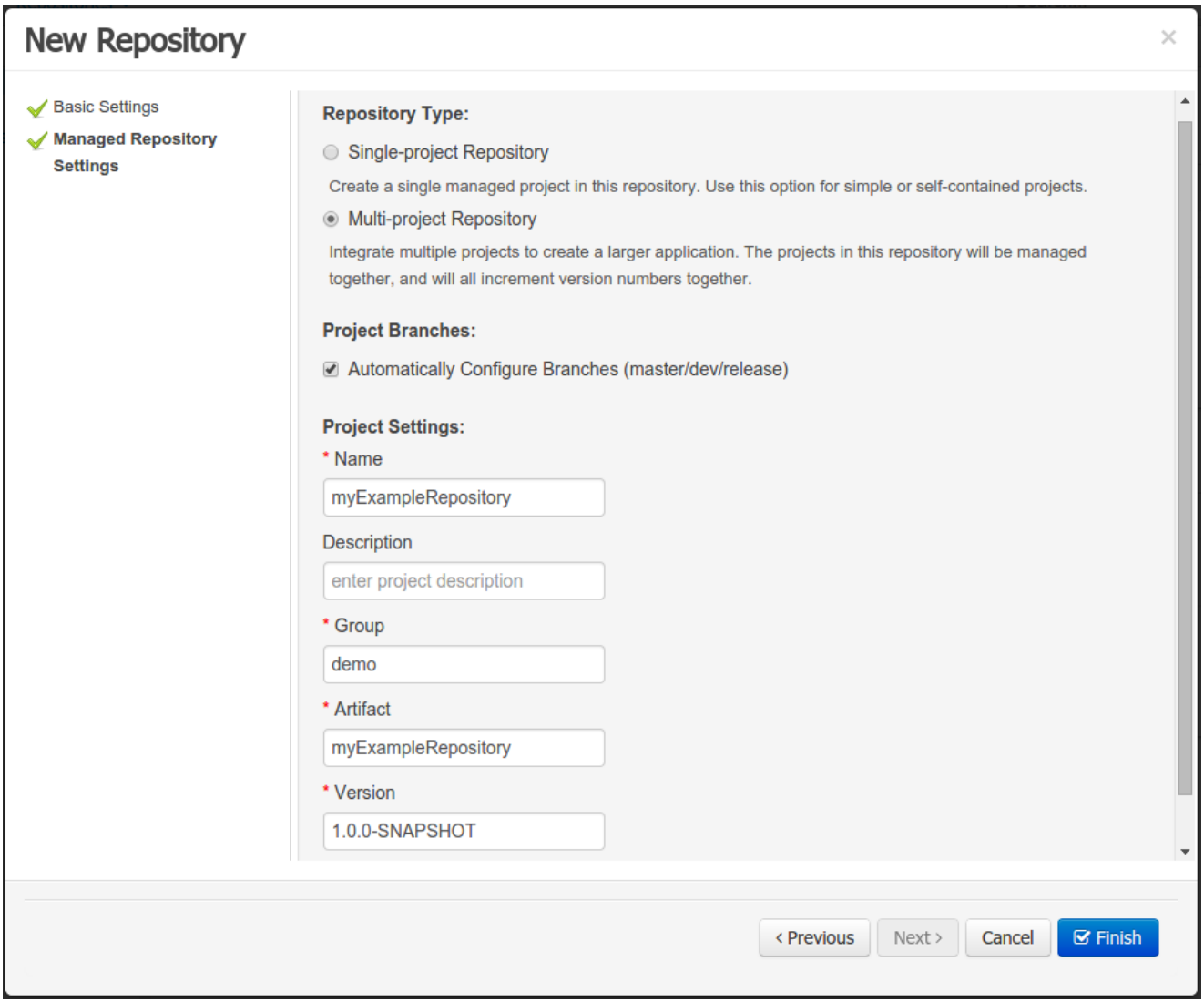


Figure 1.4. Entering repository information step 2/2 (only for managed repositories)

1.2.2. Add project

Select the Authoring Perspective to create a new project.

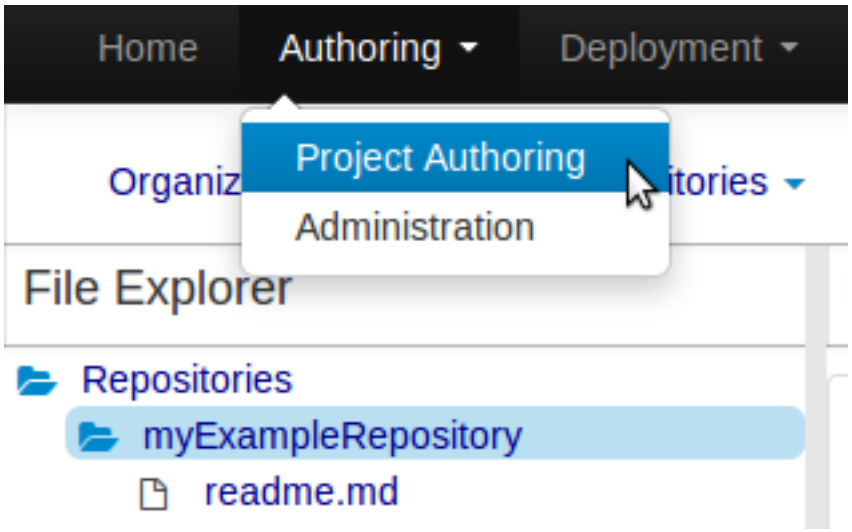


Figure 1.5. Selecting Authoring perspective

Select "Project" from the "New Item" menu.

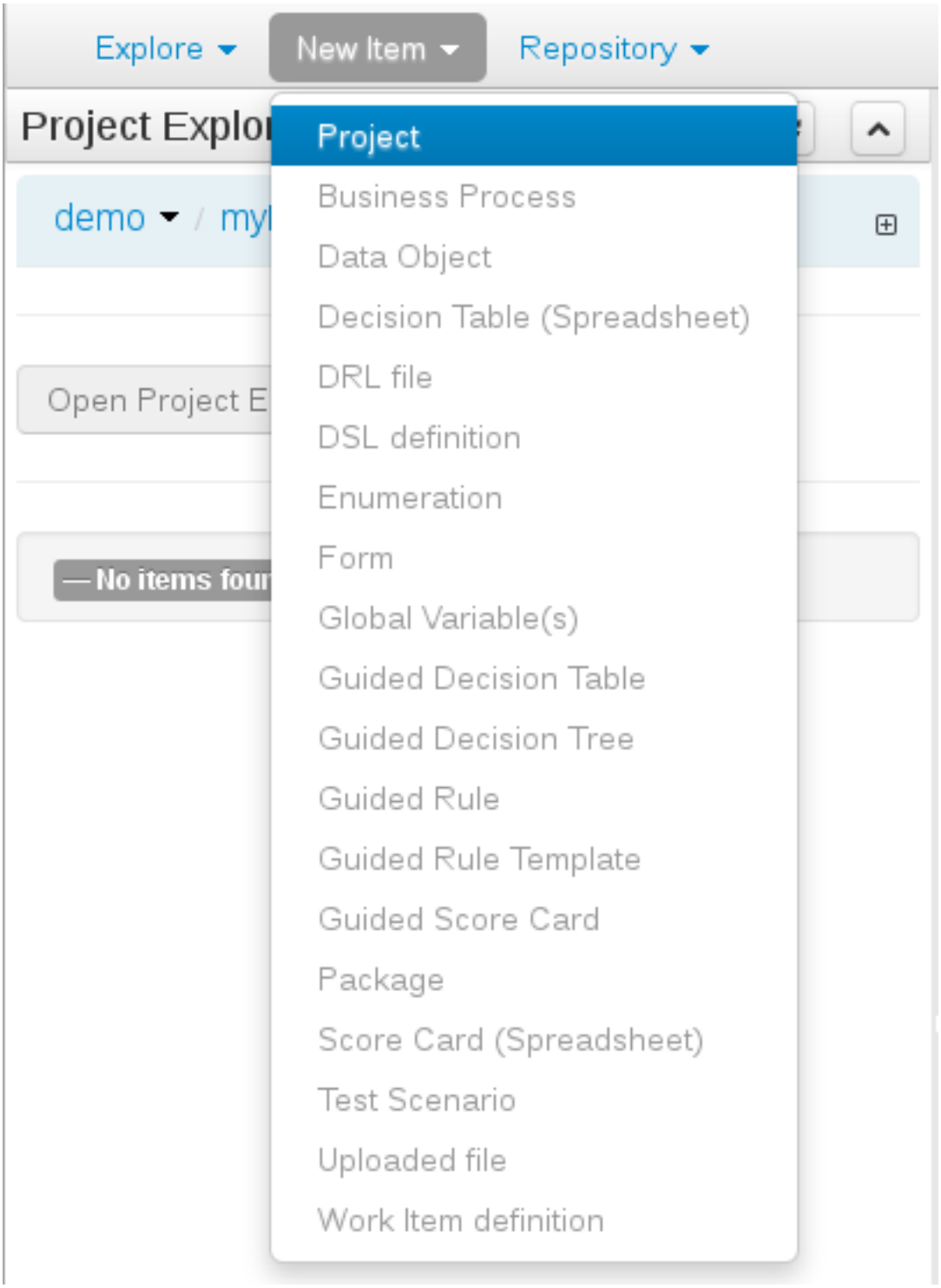


Figure 1.6. Creating new project

Enter a project name first.

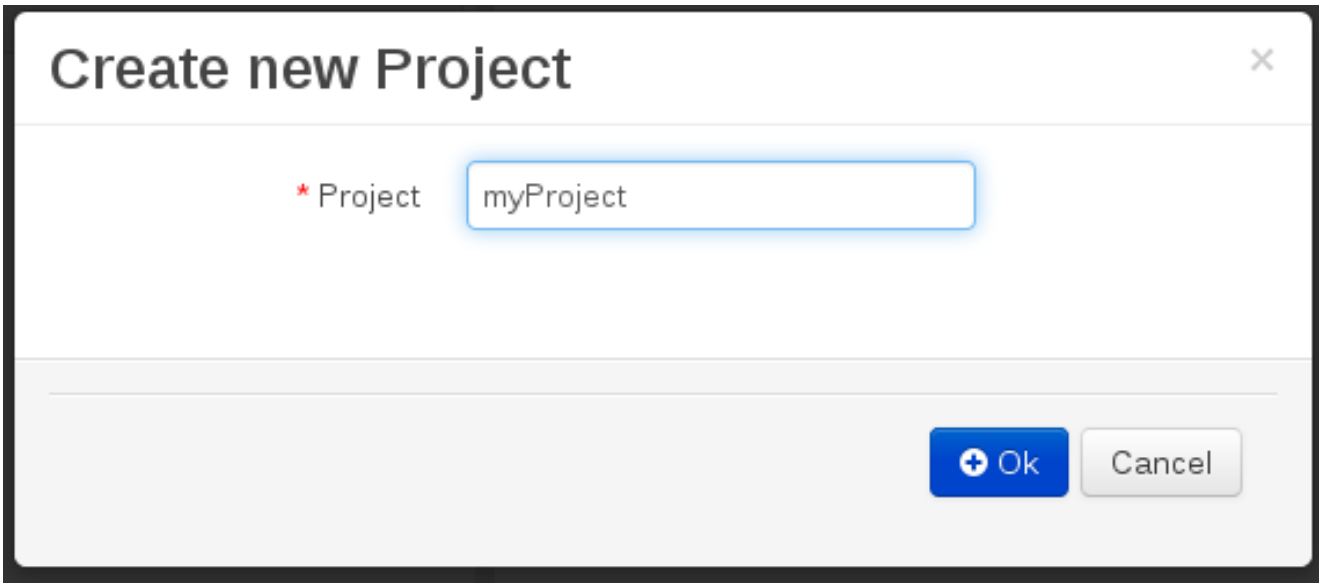


Figure 1.7. Entering project name

Enter the project details next.

- Group ID follows Maven conventions.
- Artifact ID is pre-populated from the project name.
- Version is set as 1.0 by default.

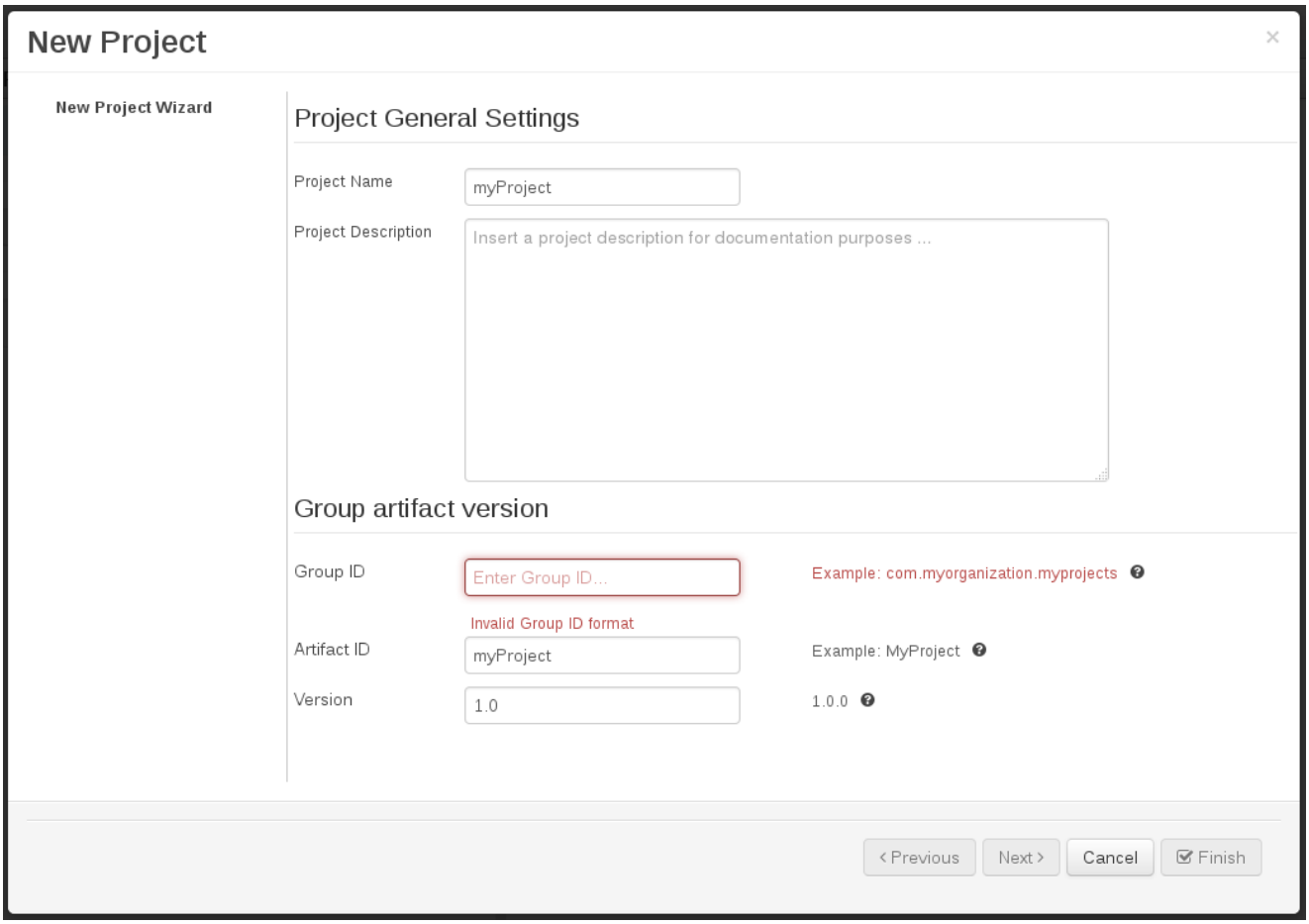


Figure 1.8. Entering project details

1.2.3. Define Data Model

After a project has been created you need to define Types to be used by your rules.

Select "Data Object" from the "New Item" menu.

Note

You can also use types contained in existing JARs.

Please consult the full documentation for details.

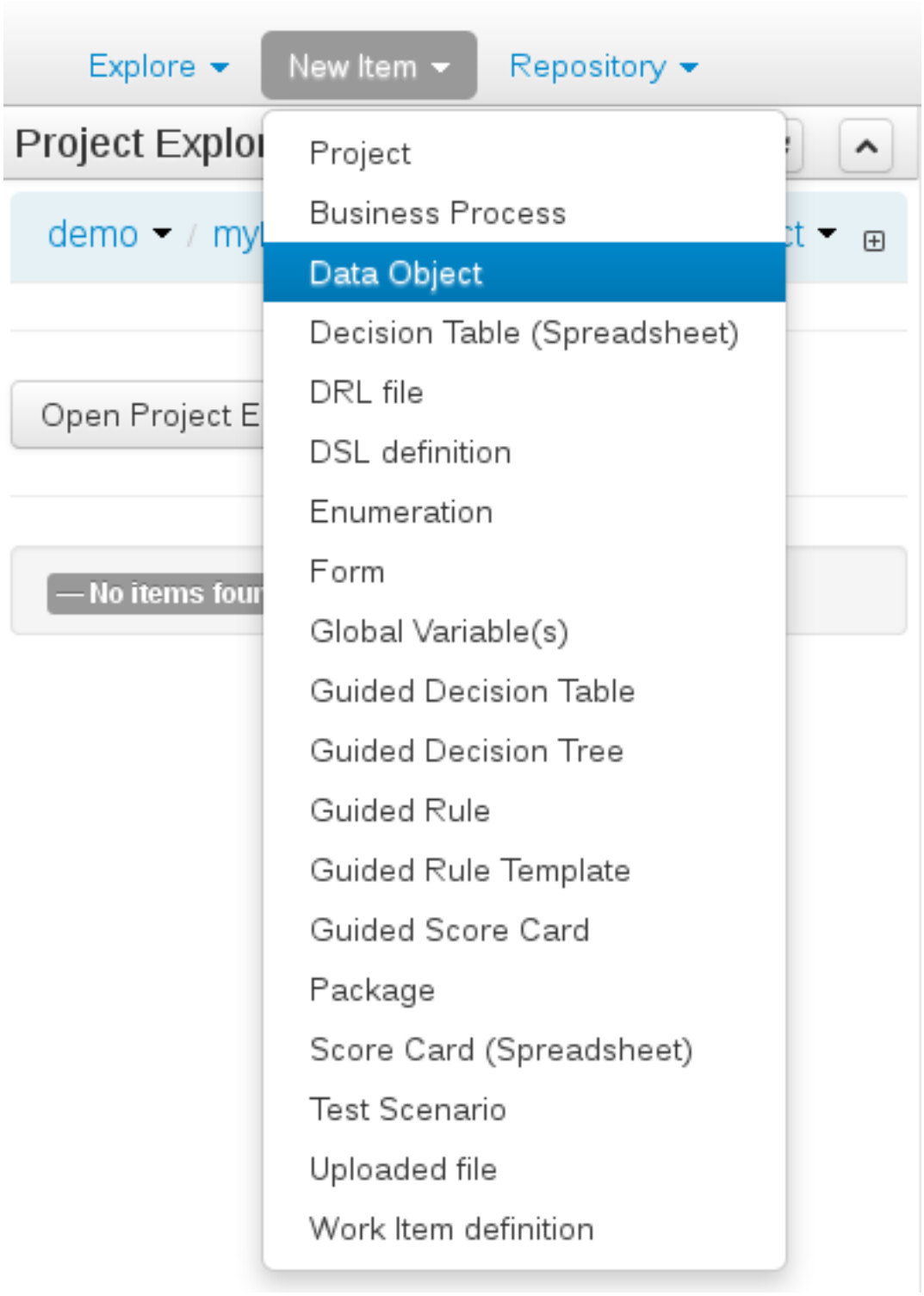


Figure 1.9. Creating "Data Object"

Set the name and select a package for the new type.

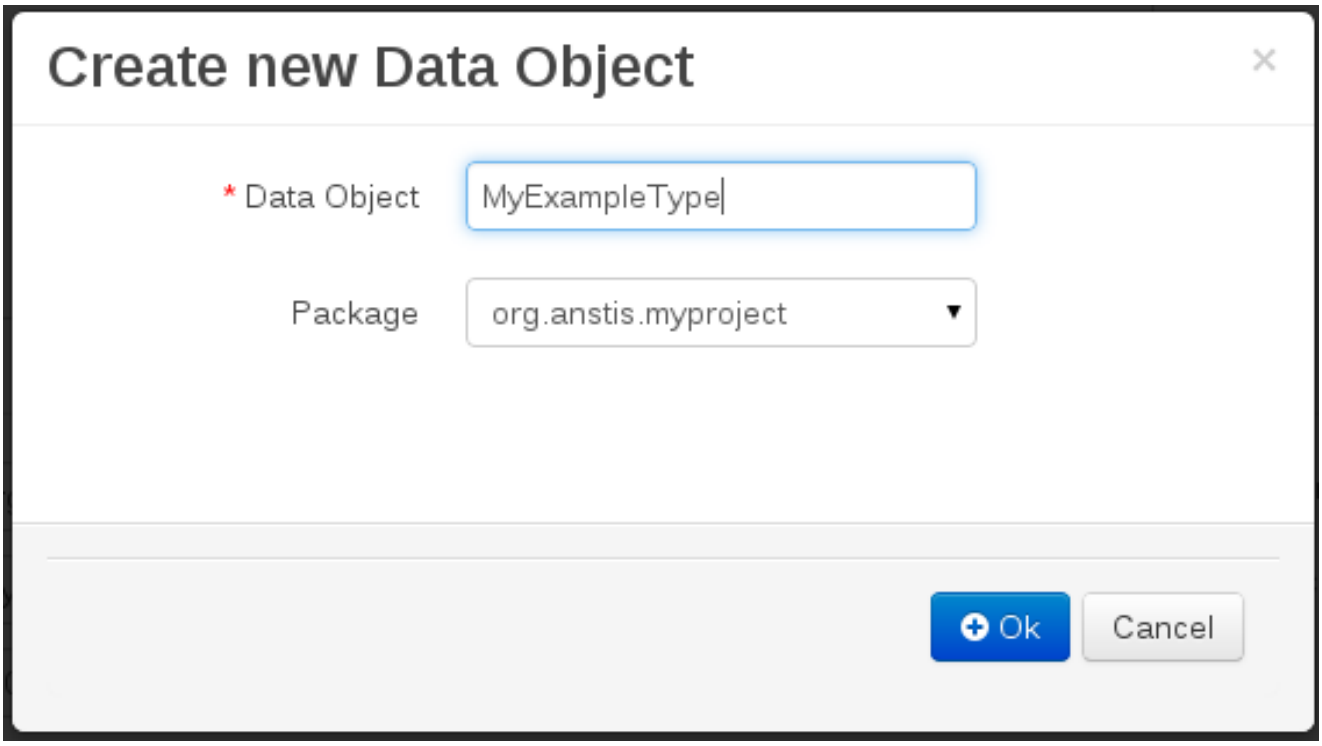


Figure 1.10. Creating a new type

Set field name and type and click on "Create" to create a field for the type.

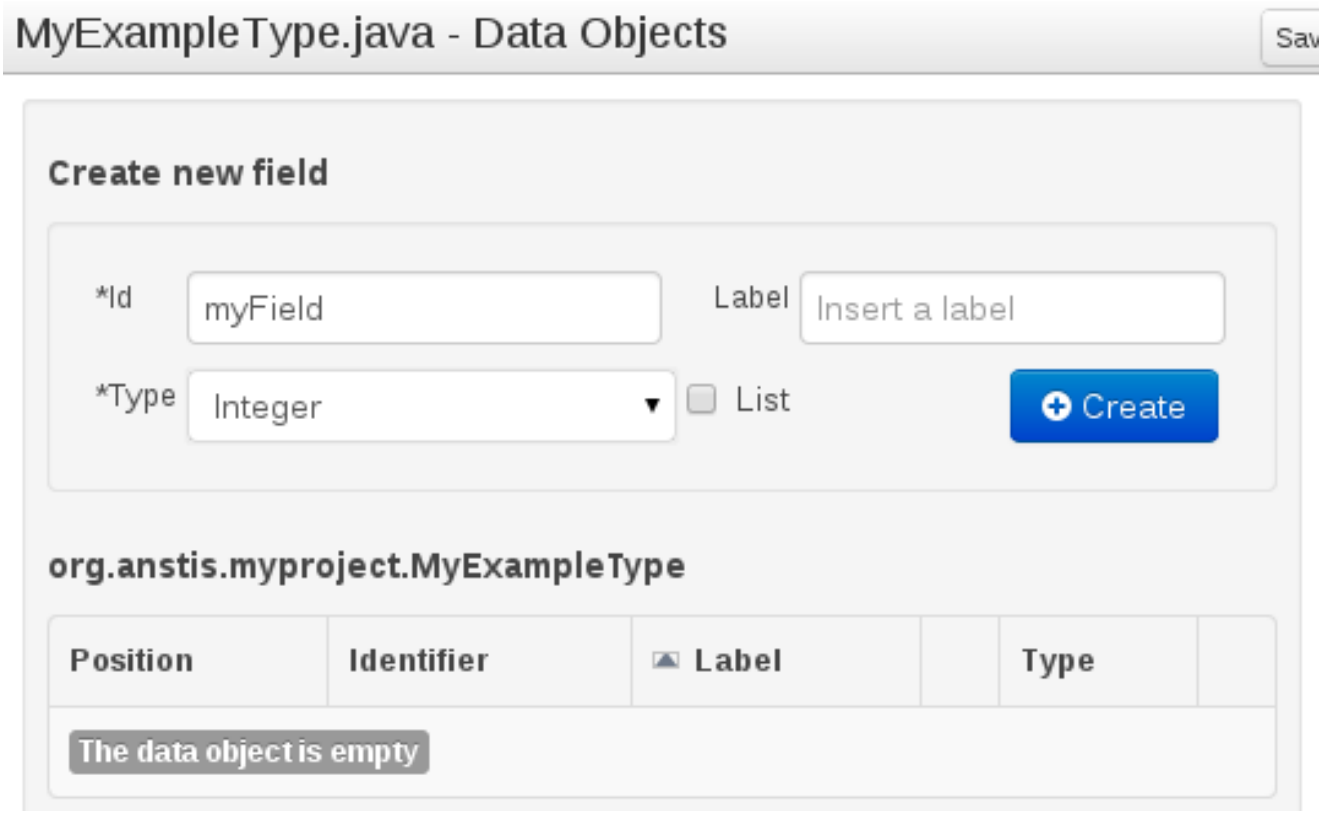


Figure 1.11. Click "Create" and add the field

Click "Save" to update the model.

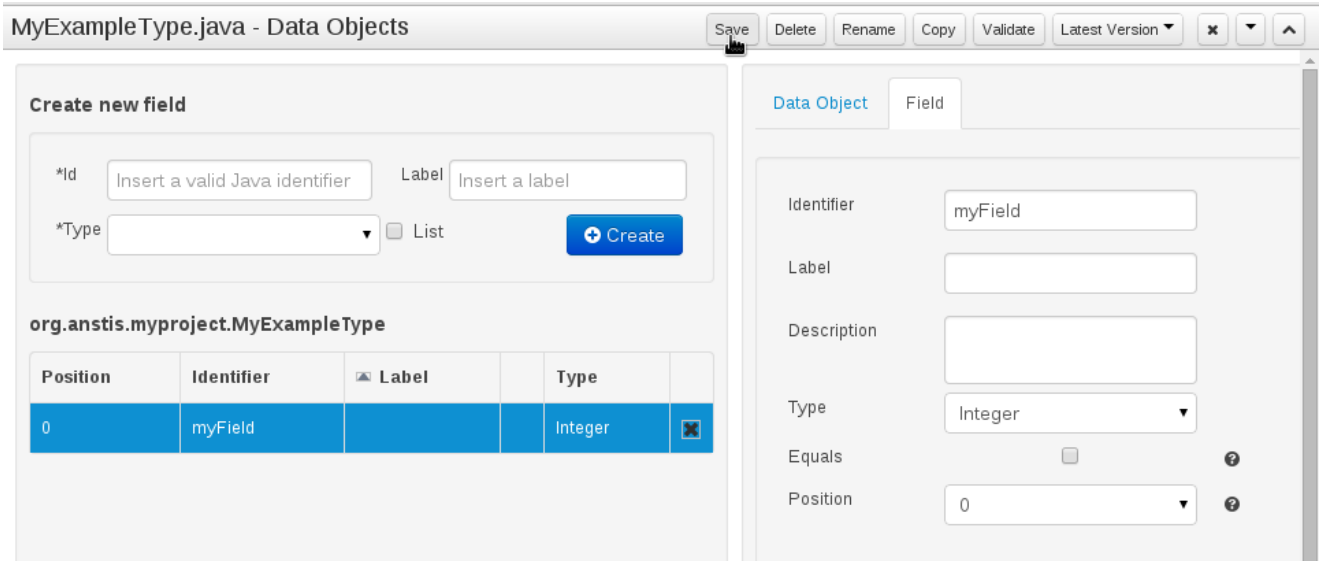


Figure 1.12. Clicking "Save"

1.2.4. Define Rule

Select "DRL file" (for example) from the "New Item" menu.

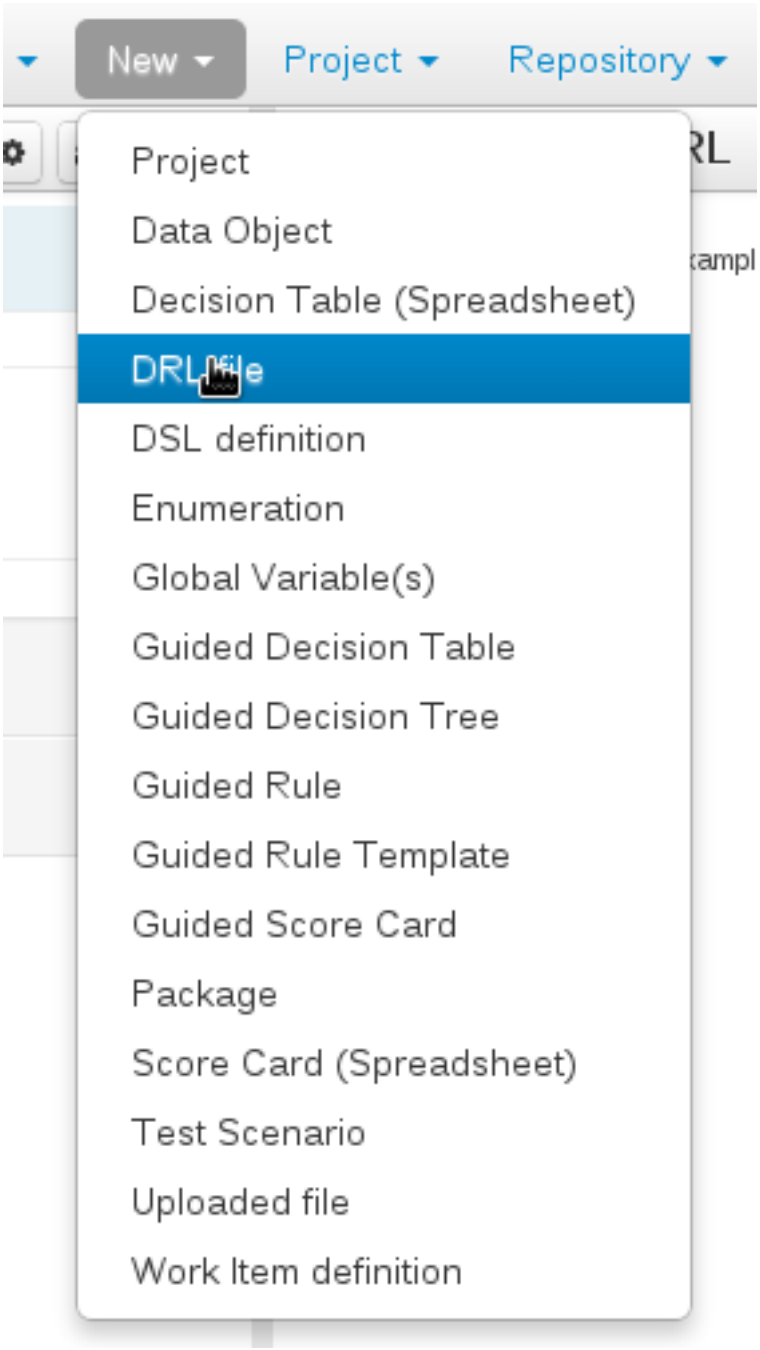


Figure 1.13. Selecting "DRL file" from the "New Item" menu

Enter a file name for the new rule.

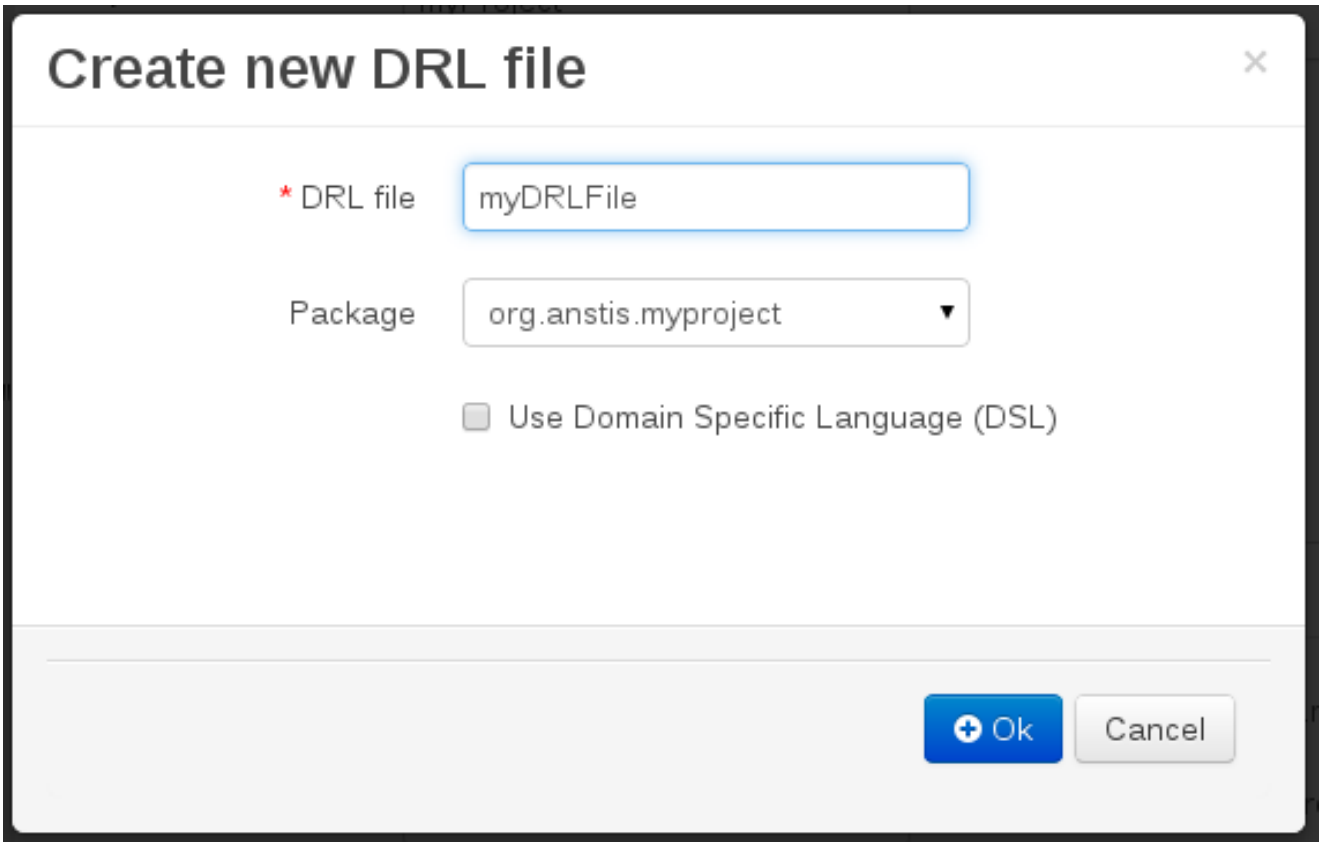


Figure 1.14. Entering file name for rule

Enter a definition for the rule.

The definition process differs from asset type to asset type.

The full documentation has details about the different editors.

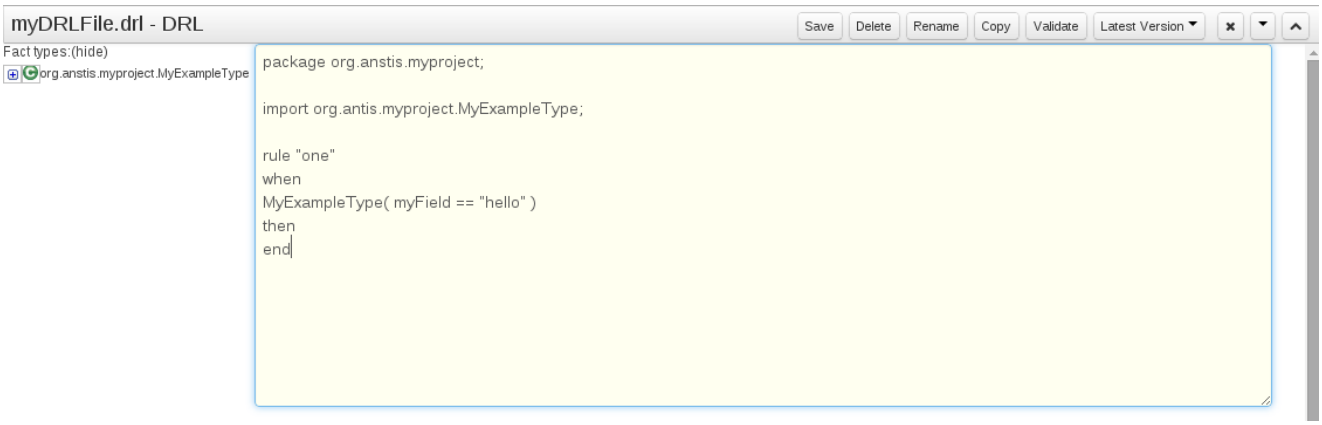


Figure 1.15. Defining a rule

Once the rule has been defined it will need to be saved.

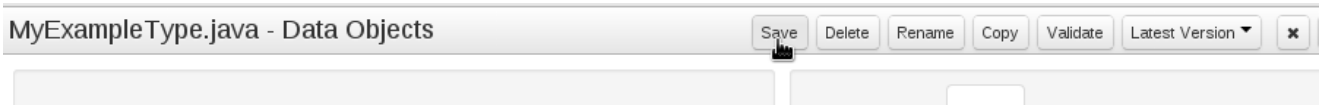


Figure 1.16. Saving the rule

1.2.5. Build and Deploy

Once rules have been defined within a project; the project can be built and deployed to the Workbench's Maven Artifact Repository.

To build a project select the "Project Editor" from the "Project" menu.

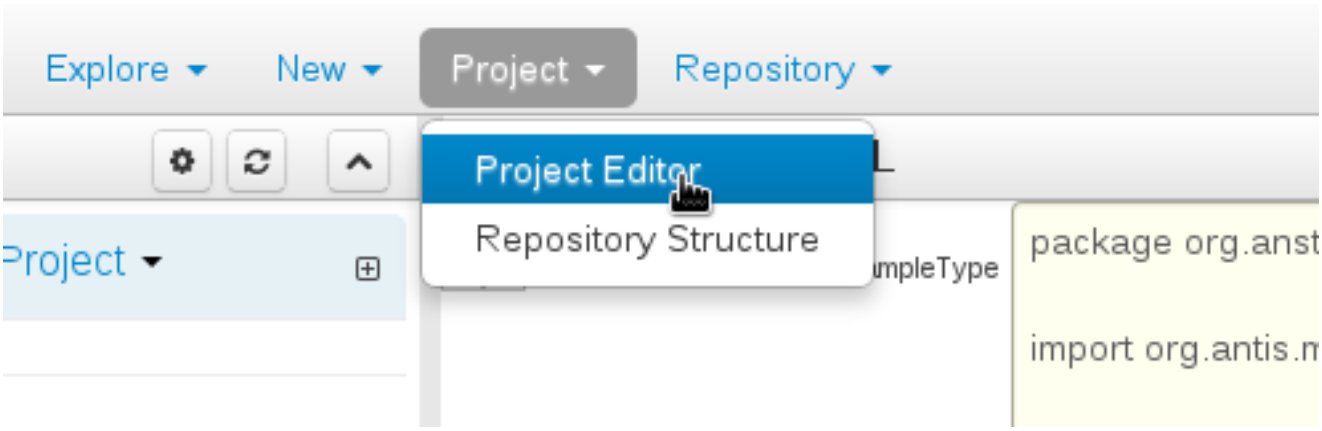


Figure 1.17. Selecting "Project Editor"

Click "Build and Deploy" to build the project and deploy it to the Workbench's Maven Artifact Repository.

When you select Build & Deploy the workbench will deploy to any repositories defined in the Dependency Management section of the pom in your workbench project. You can edit the pom.xml file associated with your workbench project under the Repository View of the project explorer. Details on dependency management in maven can be found here : http://maven.apache.org/guides/introduction/introduction-to-dependency-mechanism.html

If there are errors during the build process they will be reported in the "Problems Panel".

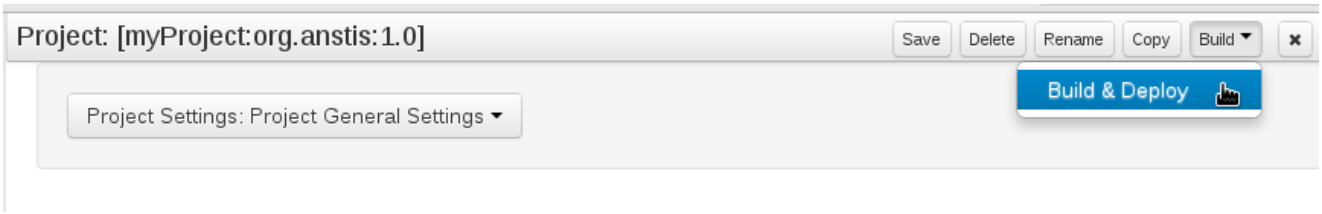


Figure 1.18. Building and deploying a project

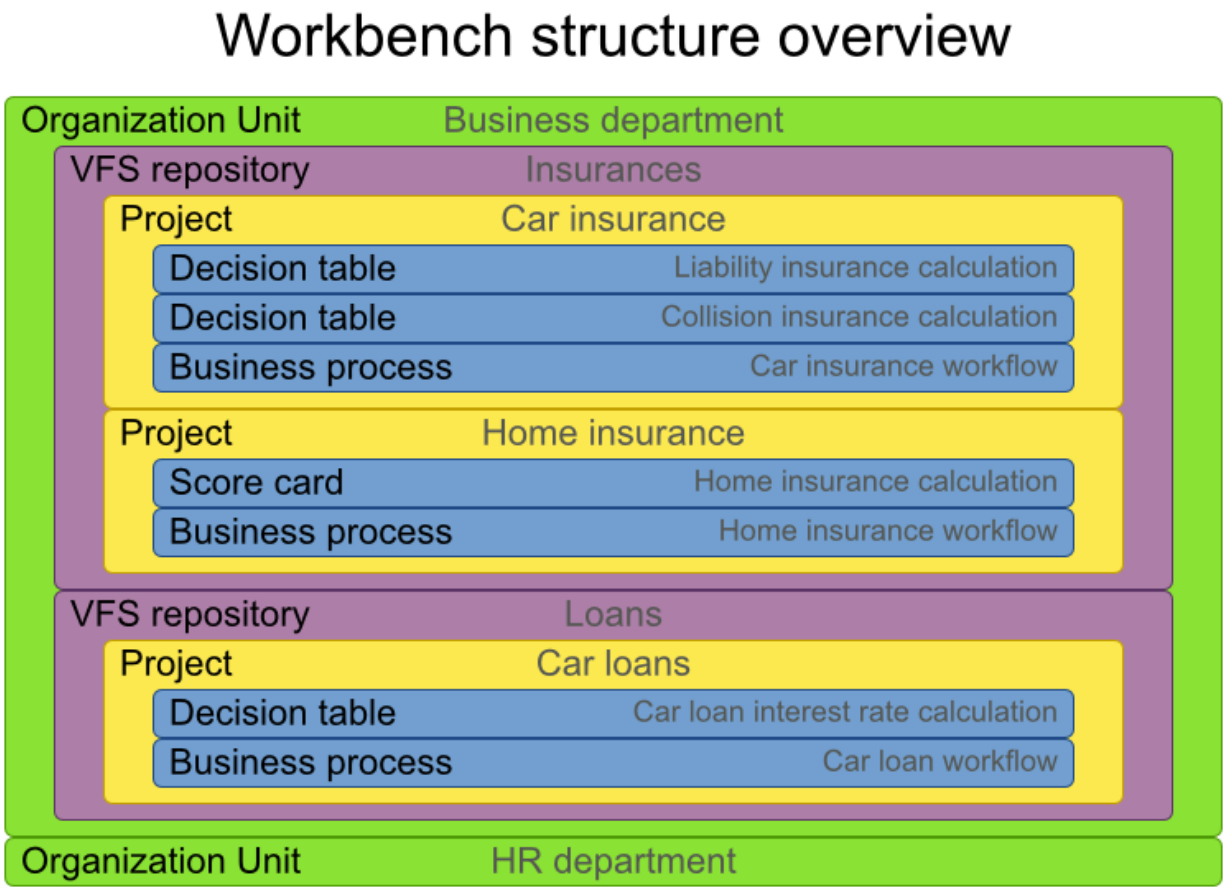
Now the project has been built and deployed; it can be referenced from your own projects as any other Maven Artifact.

The full documentation contains details about integrating projects with your own applications.

1.3. Administration

1.3.1. Administration overview

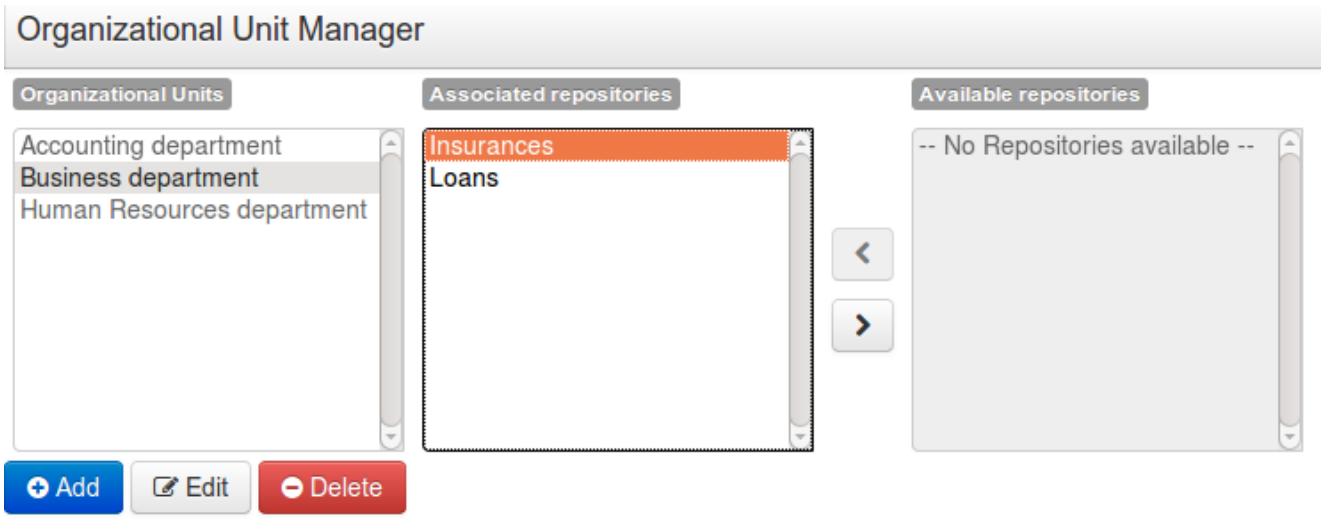
A workbench is structured with Organization Units, VFS repositories and projects:



1.3.2. Organizational unit

Organization units are useful to model departments and divisions.

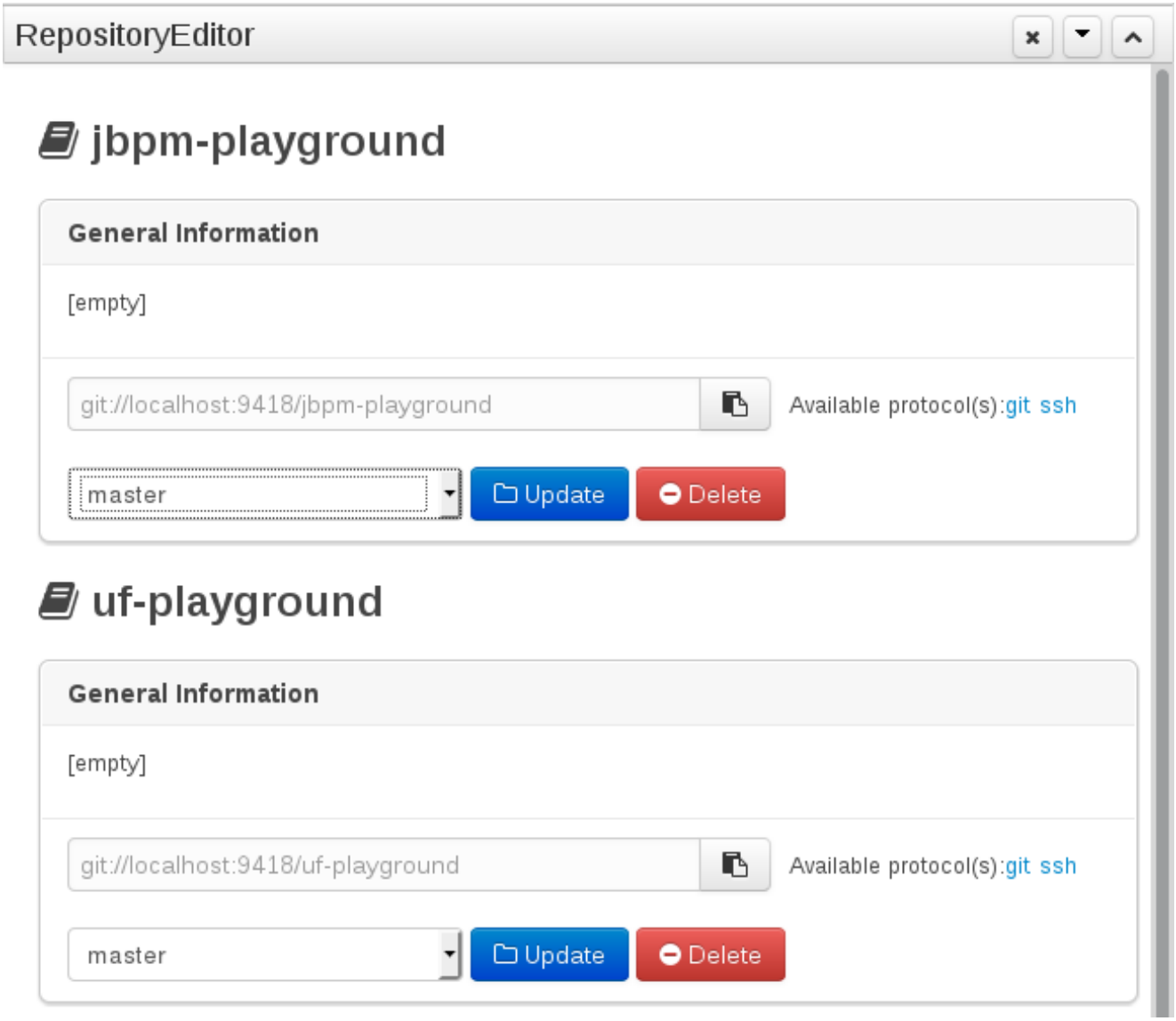
An organization unit can hold multiple repositories.



1.3.3. Repositories

Repositories are the place where assets are stored and each repository is organized by projects and belongs to a single organization unit.

Repositories are in fact a Virtual File System based storage, that by default uses GIT as backend. Such setup allows workbench to work with multiple backends and, in the same time, take full advantage of backend specifics features like in GIT case versioning, branching and even external access.



A new repository can be created from scratch or cloned from an existing repository.

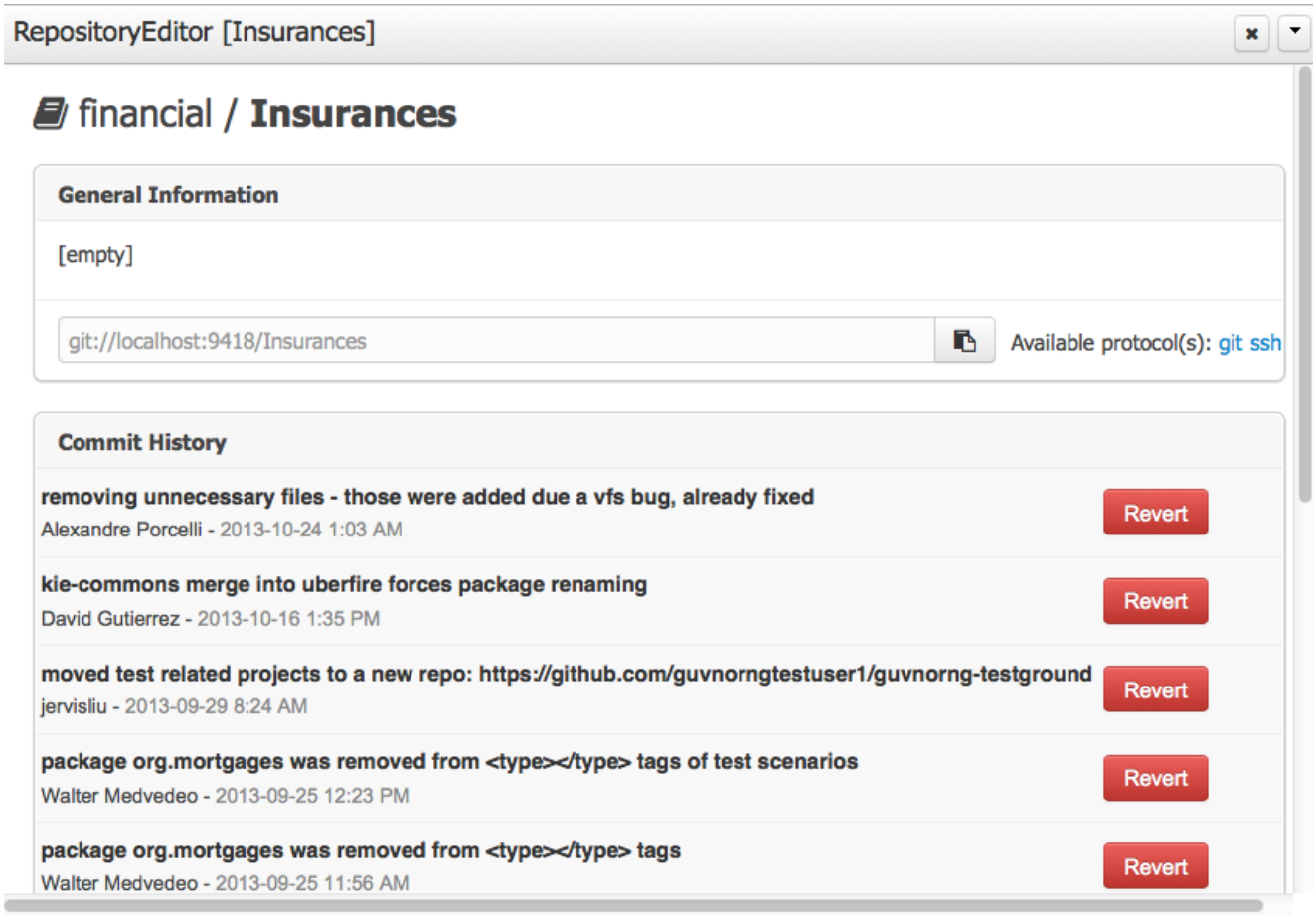
One of the biggest advantages of using GIT as backend is the ability to clone a repository from external and use your preferred tools to edit and build your assets.

Warning

Never clone your repositories directly from .niogit directory. Use always the available protocol(s) displayed in repositories editor.

1.3.3.1. Repository Editor

One additional advantage to use GIT as backend is the possibility to revert your repository to a previous state. You can do it directly from the repository editor by browsing its commit history and clicking the **Revert** button.



1.4. Configuration

1.4.1. Basic user management

The workbench authenticates its users against the application server's authentication and authorization (JAAS).

On JBoss EAP and WildFly, add a user with the script `$JBOSS_HOME/bin/add-user.sh` (or `.bat`):

```
$ ./add-user.sh
// Type: Application User
// Realm: empty (defaults to ApplicationRealm)
// Role: admin
```

There is no need to restart the application server.

1.4.2. Roles

The Workbench uses the following roles:

- admin

- analyst
- developer
- manager
- user

1.4.2.1. Admin

Administrates the BPMS system.

- Manages users
- Manages VFS Repositories
- Has full access to make any changes necessary

1.4.2.2. Developer

Developer can do almost everything admin can do, except clone repositories.

- Manages rules, models, process flows, forms and dashboards
- Manages the asset repository
- Can create, build and deploy projects
- Can use the JBDS connection to view processes

1.4.2.3. Analyst

Analyst is a weaker version of developer and does not have access to the asset repository or the ability to deploy projects.

1.4.2.4. Business user

Daily user of the system to take actions on business tasks that are required for the processes to continue forward. Works primarily with the task lists.

- Does process management
- Handles tasks and dashboards

1.4.2.5. Manager/Viewer-only User

Viewer of the system that is interested in statistics around the business processes and their performance, business indicators, and other reporting of the system and people who interact with the system.

- Only has access to dashboards

1.4.3. Restricting access to repositories

It is possible to restrict access to repositories using roles and organizational groups. To let an user access a repository.

The user either has to belong into a role that has access to the repository or to a role that belongs into an organizational group that has access to the repository. These restrictions can be managed with the command line config tool.

1.4.4. Command line config tool

Provides capabilities to manage the system repository from command line. System repository contains the data about general workbench settings: how editors behave, organizational groups, security and other settings that are not editable by the user. System repository exists in the .niogit folder, next to all the repositories that have been created or cloned into the workbench.

1.4.4.1. Config Tool Modes

- Online (default and recommended) - Connects to the Git repository on startup, using Git server provided by the KIE Workbench. All changes are made locally and published to upstream when:
  - "push-changes" command is explicitly executed
  - "exit" is used to close the tool
- Offline - Creates and manipulates system repository directly on the server (no discard option)

1.4.4.2. Available Commands

Table 1.1. Available Commands

exit	Publishes local changes, cleans up temporary directories and quits the command line tool
discard	Discards local changes without publishing them, cleans up temporary directories and quits the command line tool
help	Prints a list of available commands
list-repo	List available repositories
list-org-units	List available organizational units
list-deployment	List available deployments
create-org-unit	Creates new organizational unit
remove-org-unit	Removes existing organizational unit

add-deployment	Adds new deployment unit
remove-deployment	Removes existing deployment
create-repo	Creates new git repository
remove-repo	Removes existing repository (only from config)
add-repo-org-unit	Adds repository to the organizational unit
remove-repo-org-unit	Removes repository from the organizational unit
add-role-repo	Adds role(s) to repository
remove-role-repo	Removes role(s) from repository
add-role-org-unit	Adds role(s) to organizational unit
remove-role-org-unit	Removes role(s) from organizational unit
add-role-project	Adds role(s) to project
remove-role-project	Removes role(s) from project
push-changes	Pushes changes to upstream repository (only in online mode)

1.4.4.3. How to use

The tool can be found from kie-config-cli-${version}-dist.zip. Execute the kie-config-cli.sh script and by default it will start in online mode asking for a Git url to connect to (the default value is ssh://localhost/system). To connect to a remote server, replace the host and port with appropriate values, e.g. ssh://kie-wb-host/system.

```
./kie-config-cli.sh
```

To operate in offline mode, append the offline parameter to the kie-config-cli.sh command. This will change the behaviour and ask for a folder where the .niogit (system repository) is. If .niogit does not yet exist, the folder value can be left empty and a brand new setup is created.

```
./kie-config-cli.sh offline
```

1.5. Introduction

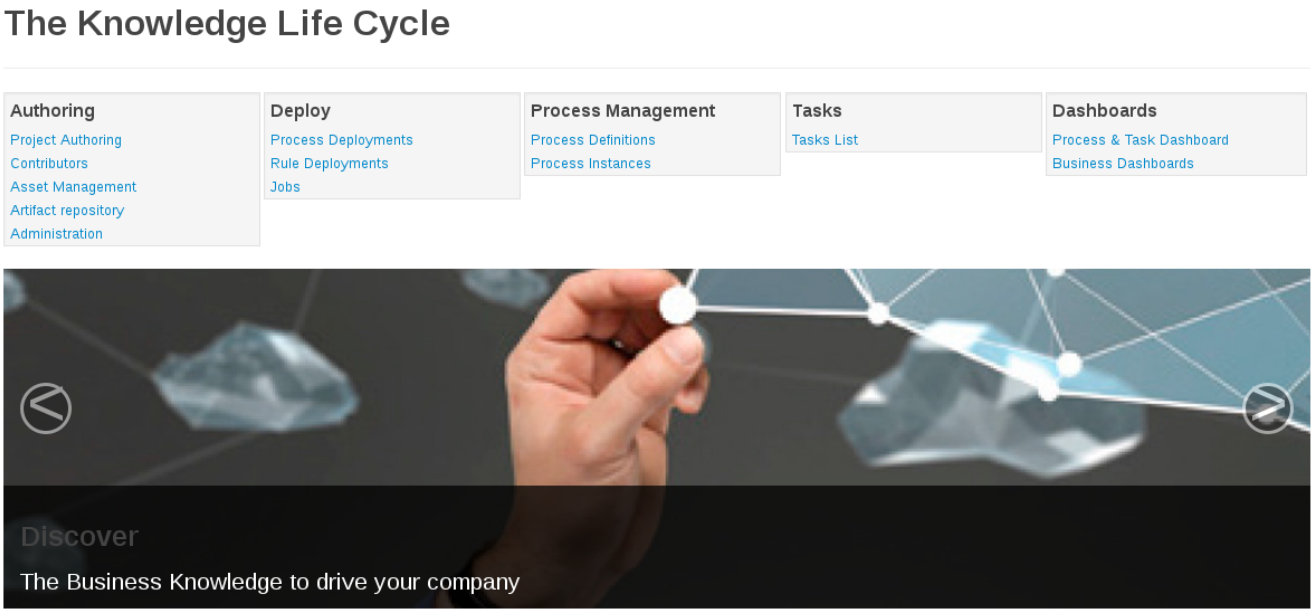
1.5.1. Log in and log out

Create a user with the role `admin` and log in with those credentials.

After successfully logging in, the account username is displayed at the top right. Click on it to review the roles of the current account.

1.5.2. Home screen

After logging in, the home screen shows. The actual content of the home screen depends on the workbench variant (Drools, jBPM, ...).



1.5.3. Workbench concepts

The Workbench is comprised of different logical entities:

- Part

  A Part is a screen or editor with which the user can interact to perform operations.

  Example Parts are "Project Explorer", "Project Editor", "Guided Rule Editor" etc. Parts can be repositioned.

- Panel

  A Panel is a container for one or more Parts.

  Panels can be resized.

- Perspective

  A perspective is a logical grouping of related Panels and Parts.

  The user can switch between perspectives by clicking on one of the top-level menu items; such as "Home", "Authoring", "Deploy" etc.

1.5.4. Initial layout

The Workbench consists of three main sections to begin; however its layout and content can be changed.

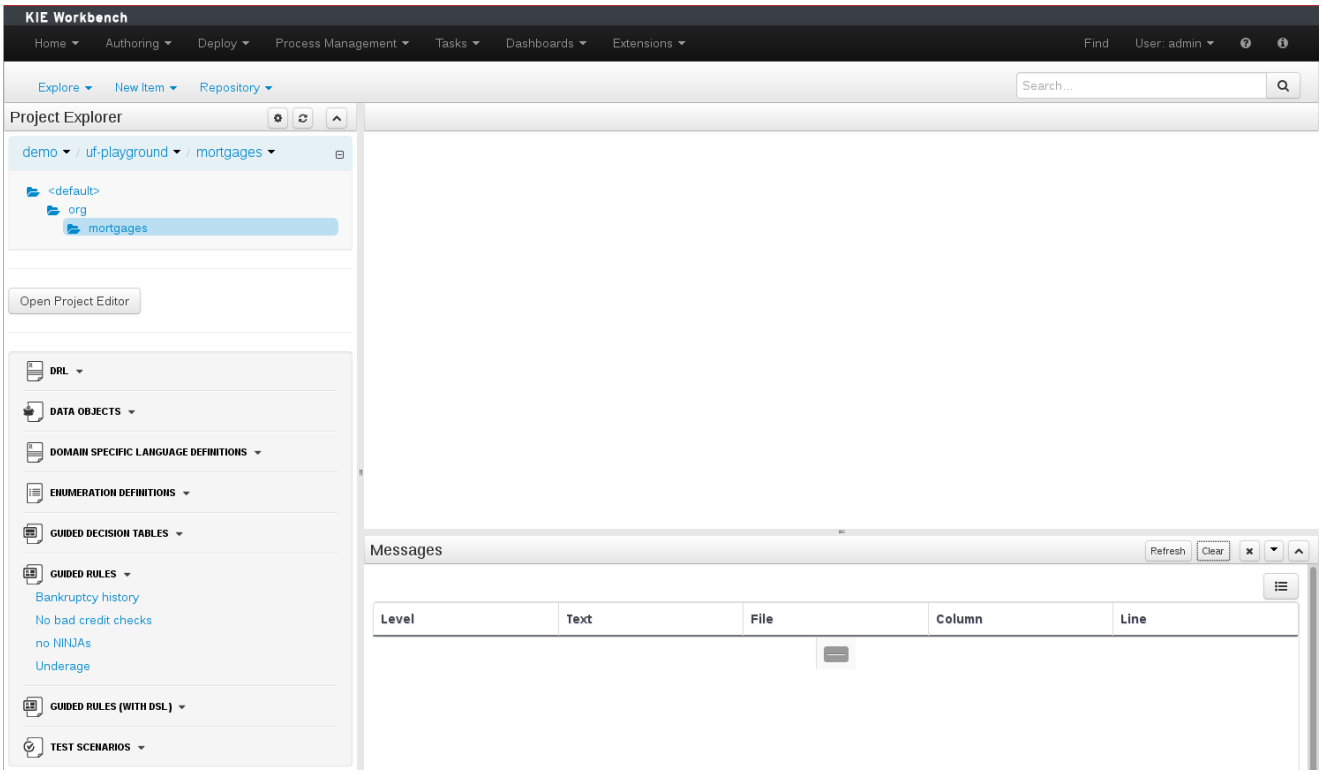


Figure 1.19. The Workbench

The initial Workbench shows the following components:-

- Project Explorer

  This provides the ability for the user to browse their configuration; of Organizational Units (in the above "example" is the Organizational Unit), Repositories (in the above "uf-playground" is the Repository) and Project (in the above "mortgages" is the Project).

- Problems

  This provides the user with real-time feedback about errors in the active Project.

- Empty space

  This empty space will contain an editor for assets selected from the Project Explorer.

  Other screens will also occupy this space by default; such as the Project Editor.

1.6. Changing the layout

The default layout may not be suitable for a user. Panels can therefore be either resized or repositioned.

This, for example, could be useful when running tests; as the test defintion and rule can be repositioned side-by-side.

1.6.1. Resizing

The following screenshot shows a Panel being resized.

Move the mouse pointer over the panel splitter (a grey horizontal or vertical line in between panels).

The cursor will changing indicating it is positioned correctly over the splitter. Press and hold the left mouse button and drag the splitter to the required position; then release the left mouse button.

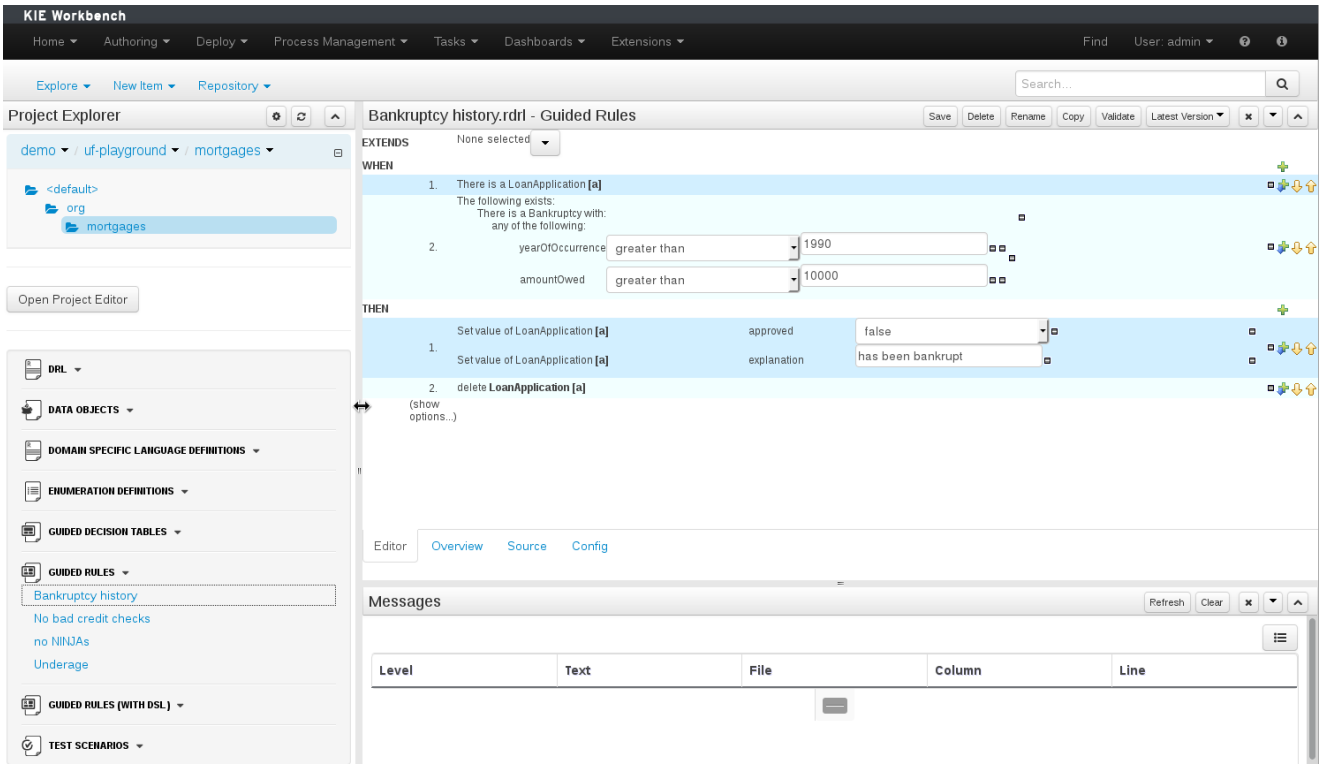


Figure 1.20. Resizing

1.6.2. Repositioning

The following screenshot shows a Panel being repositioned.

Move the mouse pointer over the Panel title ("Guided Editor [No bad credit checks]" in this example).

The cursor will change indicating it is positioned correctly over the Panel title. Press and hold the left mouse button. Drag the mouse to the required location. The target position is indicated with a pale blue rectangle. Different positions can be chosen by hovering the mouse pointer over the different blue arrows.

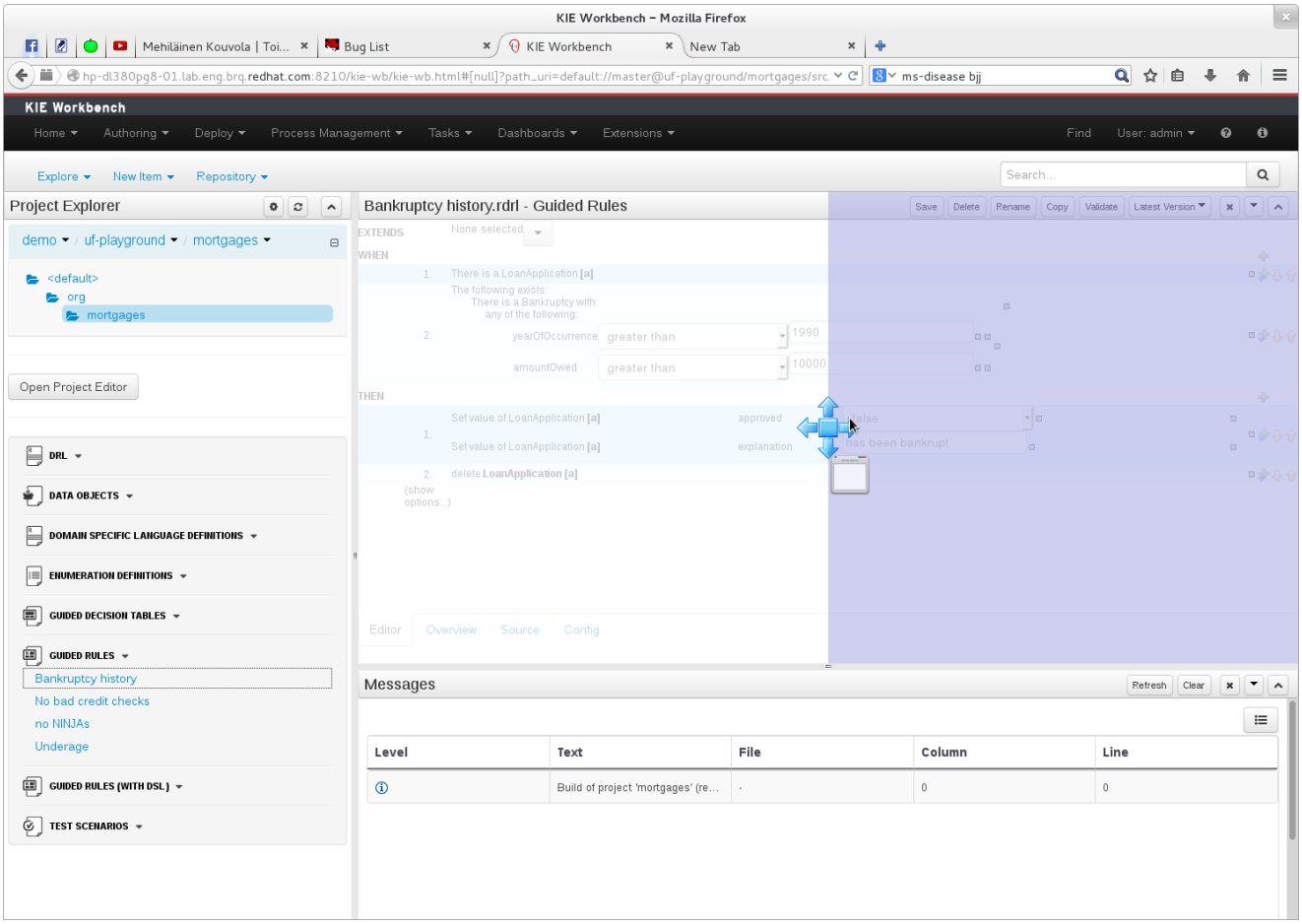


Figure 1.21. Repositioning - dragging

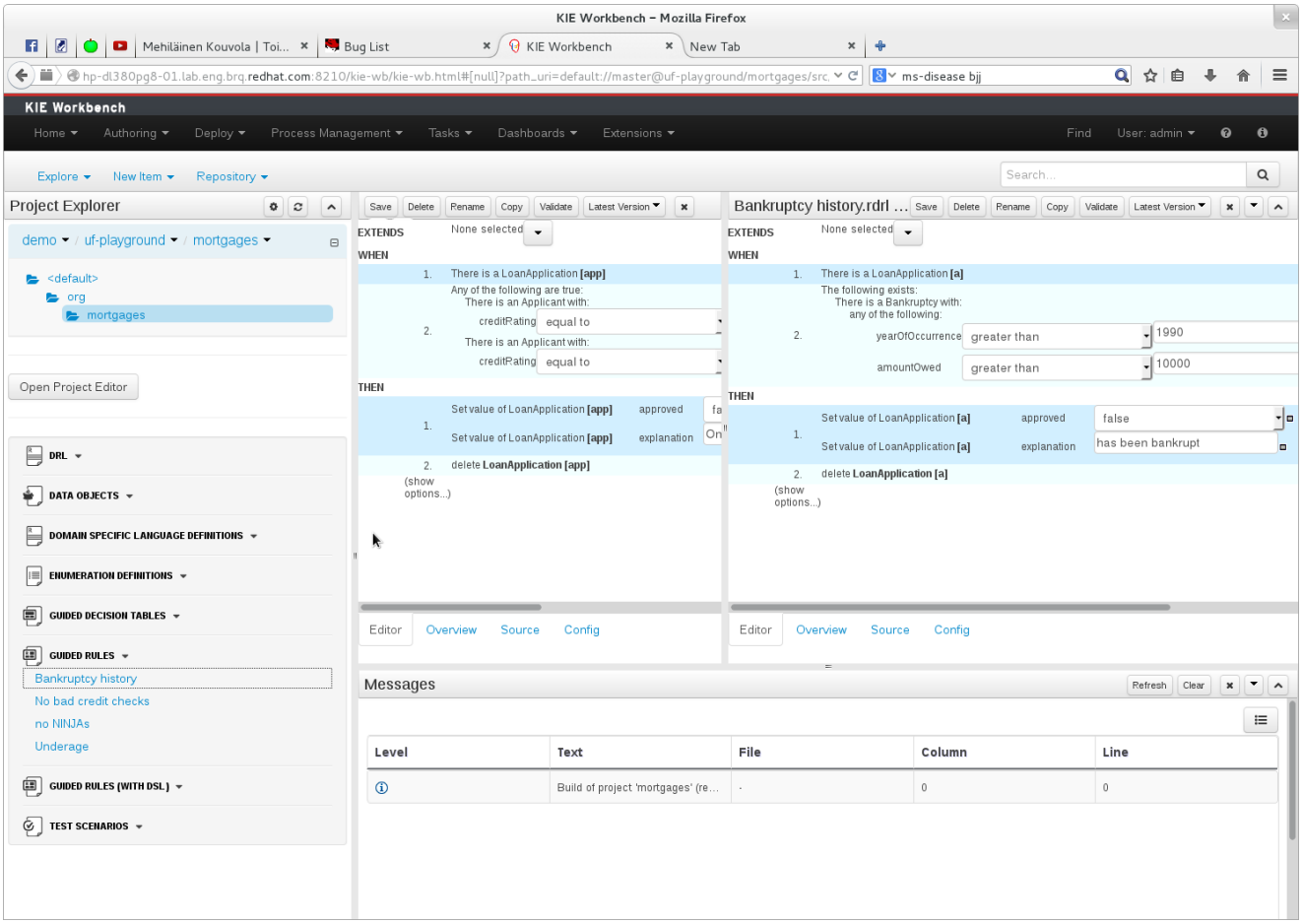


Figure 1.22. Repositioning - complete

1.7. Authoring (General)

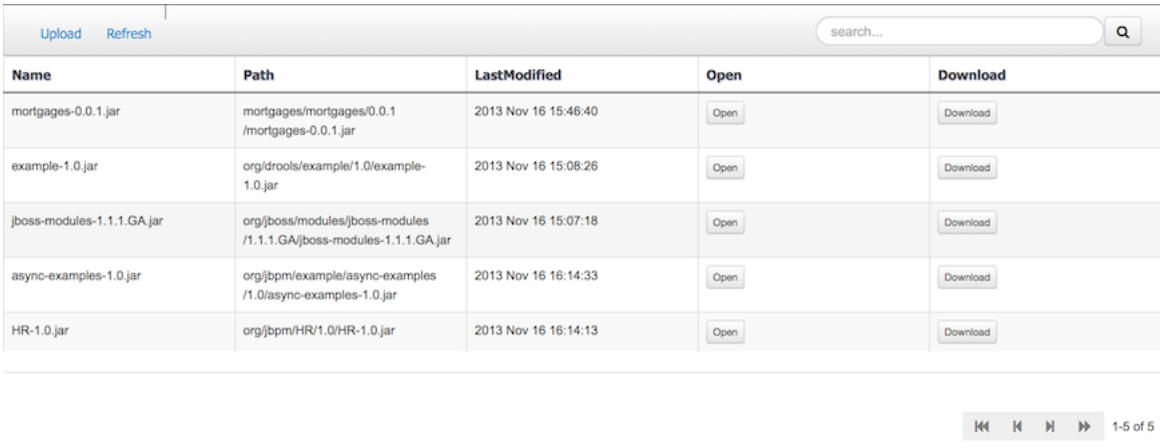
1.7.1. Artifact Repository

Projects often need external artifacts in their classpath in order to build, for example a domain model JARs. The artifact repository holds those artifacts.

The Artifact Repository is a full blown Maven repository. It follows the semantics of a Maven remote repository: all snapshots are timestamped. But it is often stored on the local hard drive.

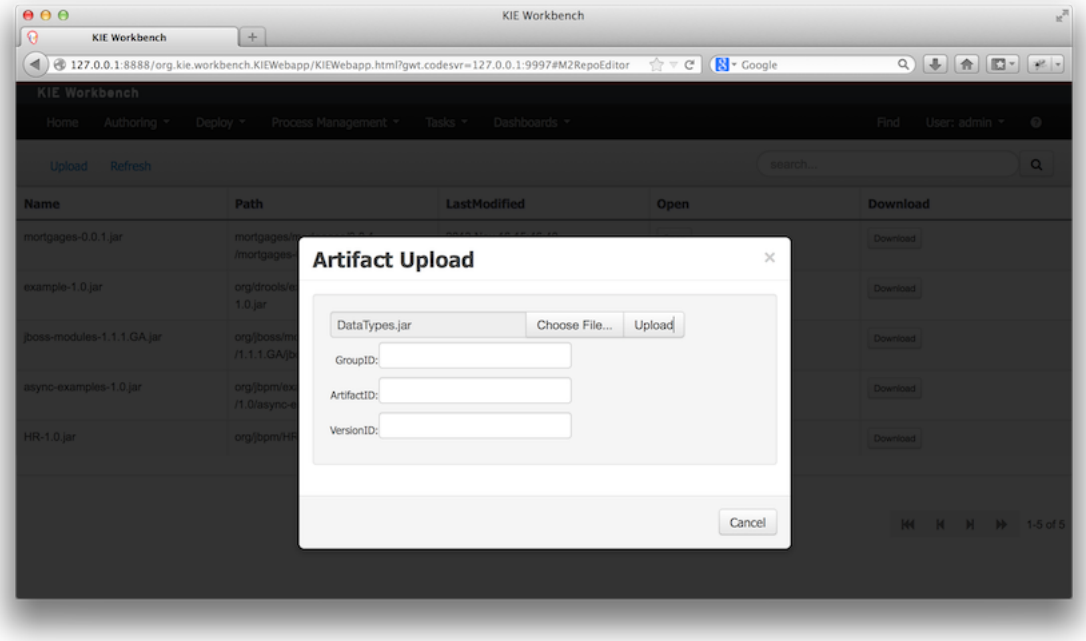
By default the artifact repository is stored under `$WORKING_DIRECTORY/repositories/kie`, but it can be overridden with the system property `-Dorg.guvnor.m2repo.dir`. There is only 1 Maven repository per installation.

The Artifact Repository screen shows a list of the artifacts in the Maven repository:



To add a new artifact to that Maven repository, either:

- Use the upload button and select a JAR. If the JAR contains a POM file under `META-INF/maven` (which every JAR build by Maven has), no further information is needed. Otherwise, a groupId, artifactId and version need be given too.



- Using Maven, `mvn deploy` to that Maven repository. Refresh the list to make it show up.

Note

This remote Maven repository is relatively simple. It does not support proxying, mirroring, ... like Nexus or Archiva.

1.7.2. Asset Editor

The Asset Editor is the principle component of the workbench User-Interface. It consists of two main views Editor and Overview.

- The views

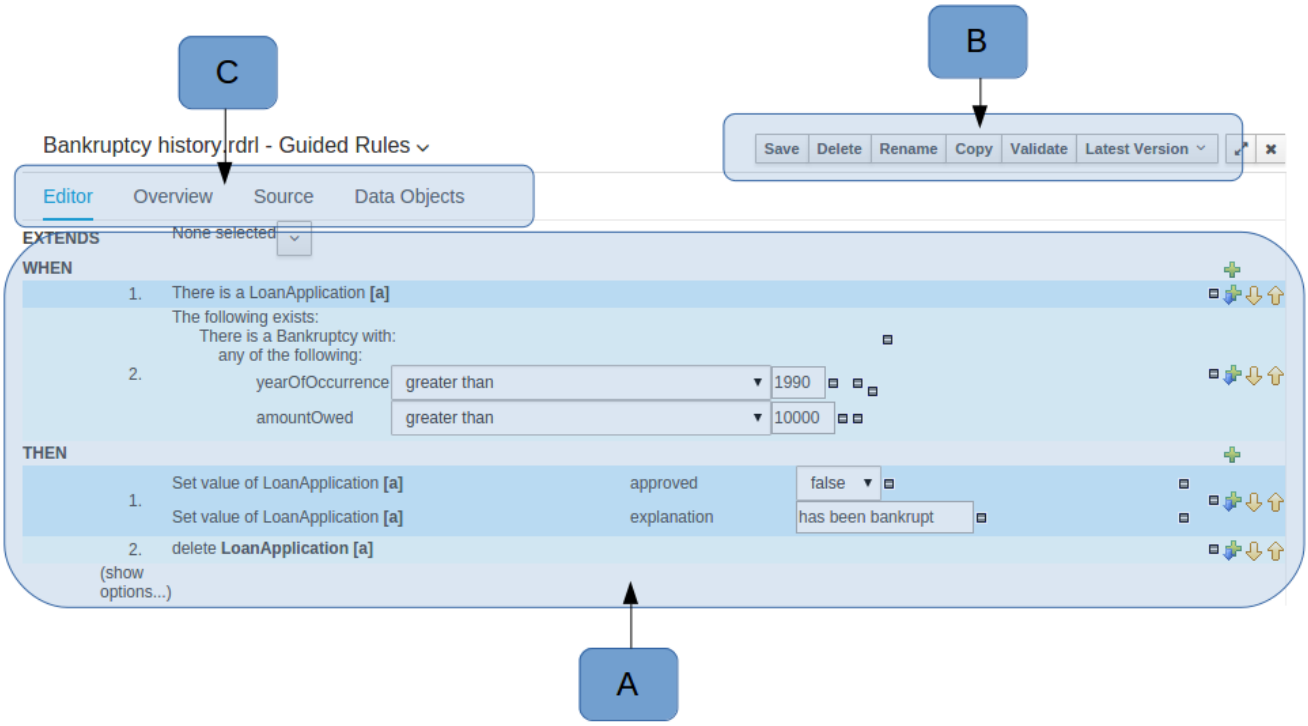


Figure 1.23. The Asset Editor - Editor tab

- A : The editing area - exactly what form the editor takes depends on the Asset type. An asset can only be edited by one user at a time to avoid conflicts. When a user begins to edit an asset, a lock will automatically be acquired. This is indicated by a lock symbol appearing on the asset title bar as well as in the project explorer view (see Section 1.7.4, “Project Explorer” for details). If a user starts editing an already locked asset a pop-up notification will appear to inform the user that the asset can't currently be edited, as it is being worked on by another user. Changes will be prevented until the editing user saves or closes the asset, or logs out of the workbench. Session timeouts will also cause locks to be released. Every user further has the option to force a lock release, if required (see the Metadata section below).

- B : This menu bar contains various actions for the Asset; such as Save, Rename, Copy etc. Note that saving, renaming and deleting are deactivated if the asset is locked by a different user.

- C : Different views for asset content or asset information.

  - Editor shows the main editor for the asset

- Overview contains the metadata and conversation views for this editor. Explained in more detail below.
- Source shows the asset in plain DRL. Note: This tab is only visible if the asset content can be generated into DRL.
- Data Objects contains the model available for authoring. By default only Data Objects that reside within the same package as the asset are available for authoring. Data Objects outside of this package can be imported to become available for authoring the asset.

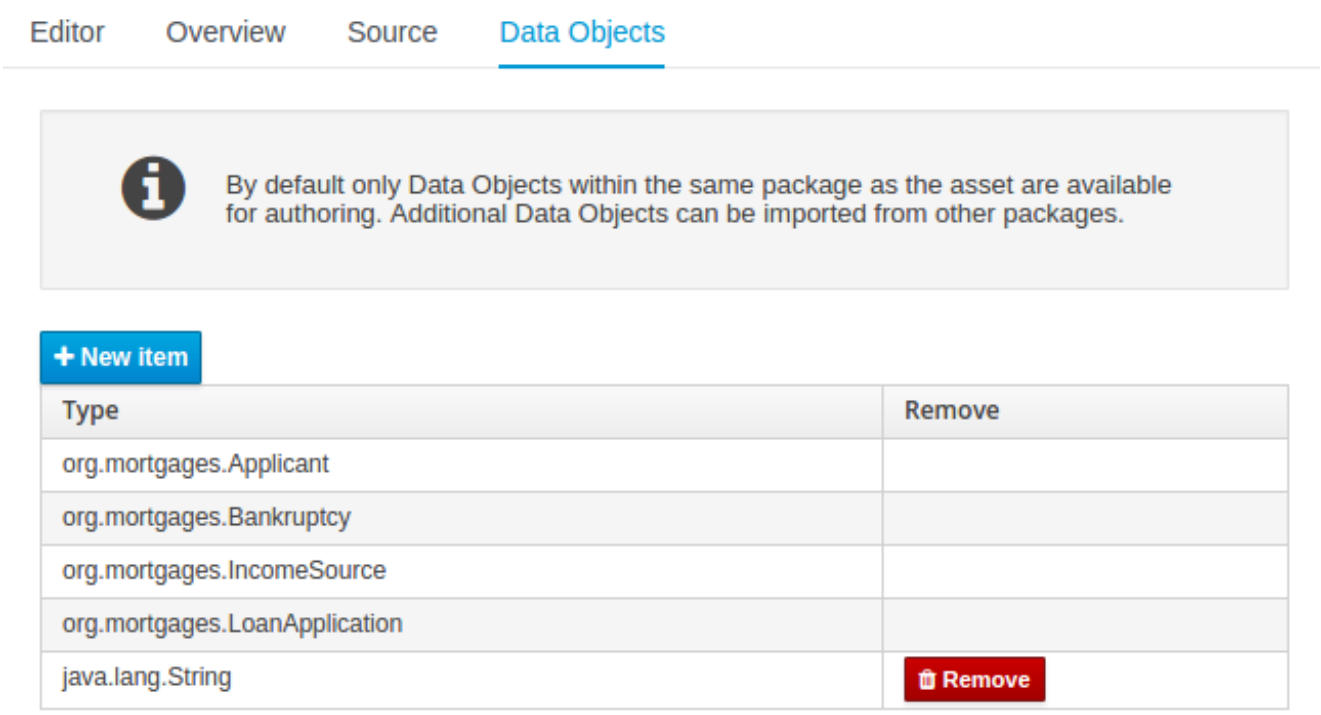


Figure 1.24. The Asset Editor - Data Objects tab

- Overview
  - A : General information about the asset and the asset's description.

    "Type:" The format name of the type of Asset.

    "Description:" Description for the asset.

    "Used in projects:" Names the projects where this rule is used.

    "Last Modified:" Who made the last change and when.

    "Created on:" Who created the asset and when.
  - B : Version history for the asset. Selecting a version loads the selected version into this editor.

- C : Meta data (from the "Dublin Core" standard)
- D : Comments regarding the development of the Asset can be recorded here.

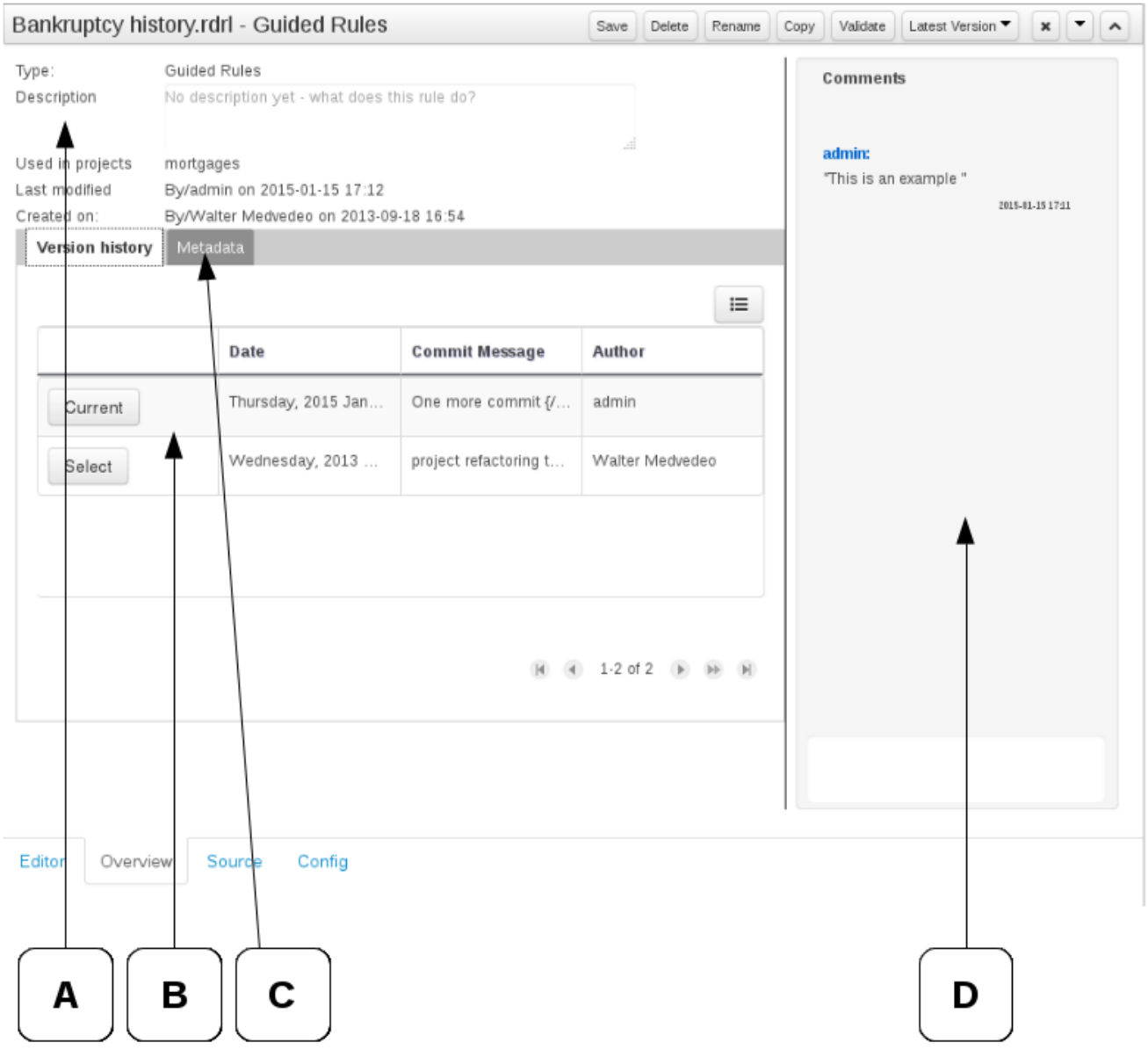


Figure 1.25. The Asset Editor - Overview tab

- Metadata
  - A : Meta data:-

    "Tags:" A tagging system for grouping the assets.

    "Note:" A comment made when the Asset was last updated (i.e. why a change was made)

    "URI:" URI to the asset inside the Git repository.

"Subject/Type/External link/Source" : Other miscellaneous meta data for the Asset.

"Lock status" : Shows the lock status of the asset and, if locked, allows to force unlocking the asset.

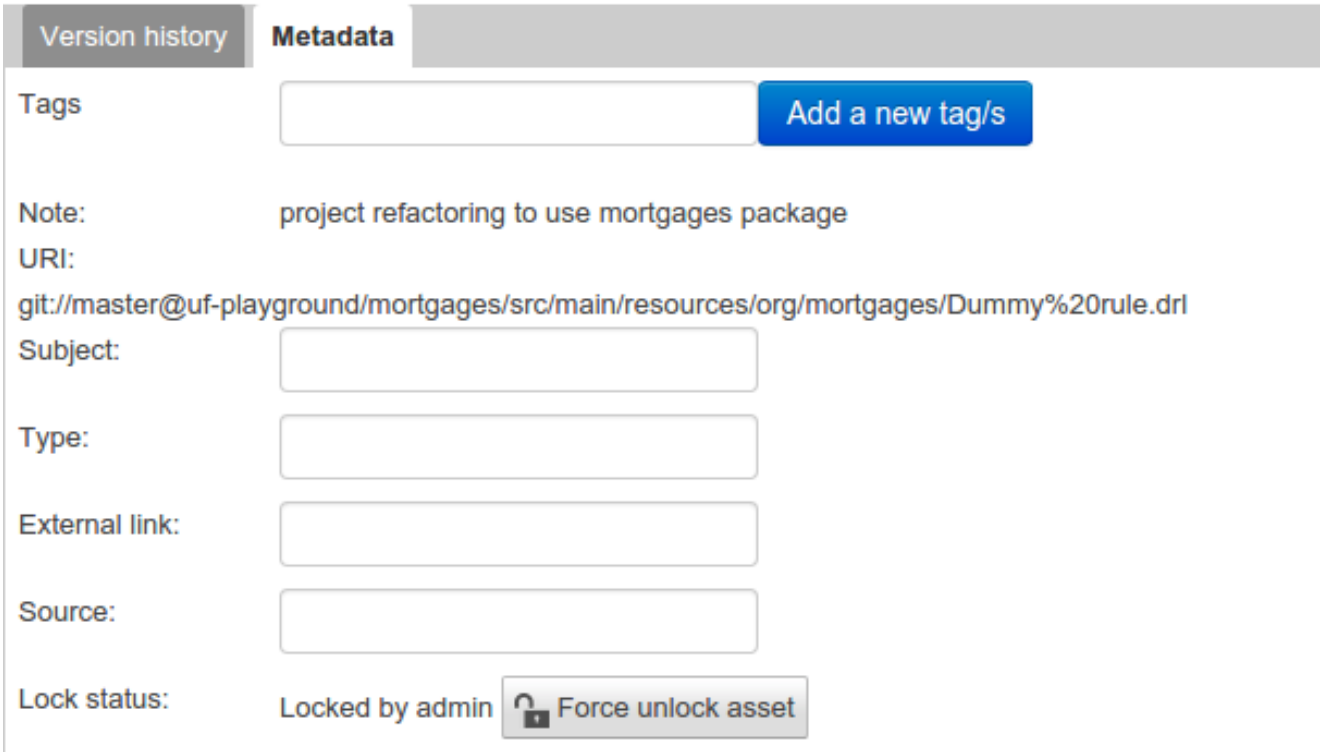


Figure 1.26. The Metadata tab

- Locking

  The Workbench supports pessimistic locking of assets. When one User starts editing an asset it is locked to change by other Users. The lock is held until a period of inactivity lapses, the Editor is closed or the application stopped and restarted. Locks can also be forcibly removed on the MetaData section of the Overview tab.

  A "padlock" icon is shown in the Editor's title bar and beside the asset in the Project Explorer when an asset is locked.

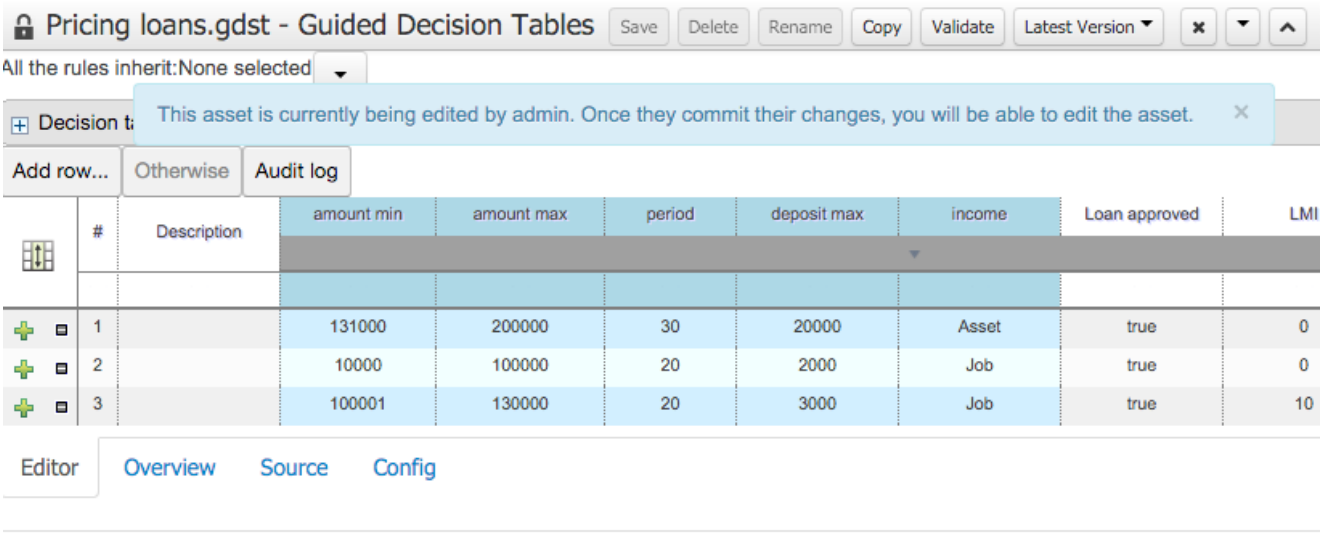


Figure 1.27. The Asset Editor - Locked assets cannot be edited by other users

1.7.3. Tags Editor

Tags allow assets to be labelled with any number of tags that you define. These tags can be used to filter assets on the Project Explorer enabling "Tag filtering".

1.7.3.1. Creating Tags

To create tags you simply have to write them on the Tags input and press the "Add new Tag/s" button. The Tag Editor allows creating tags one by one or writing more than one separated with a white space.

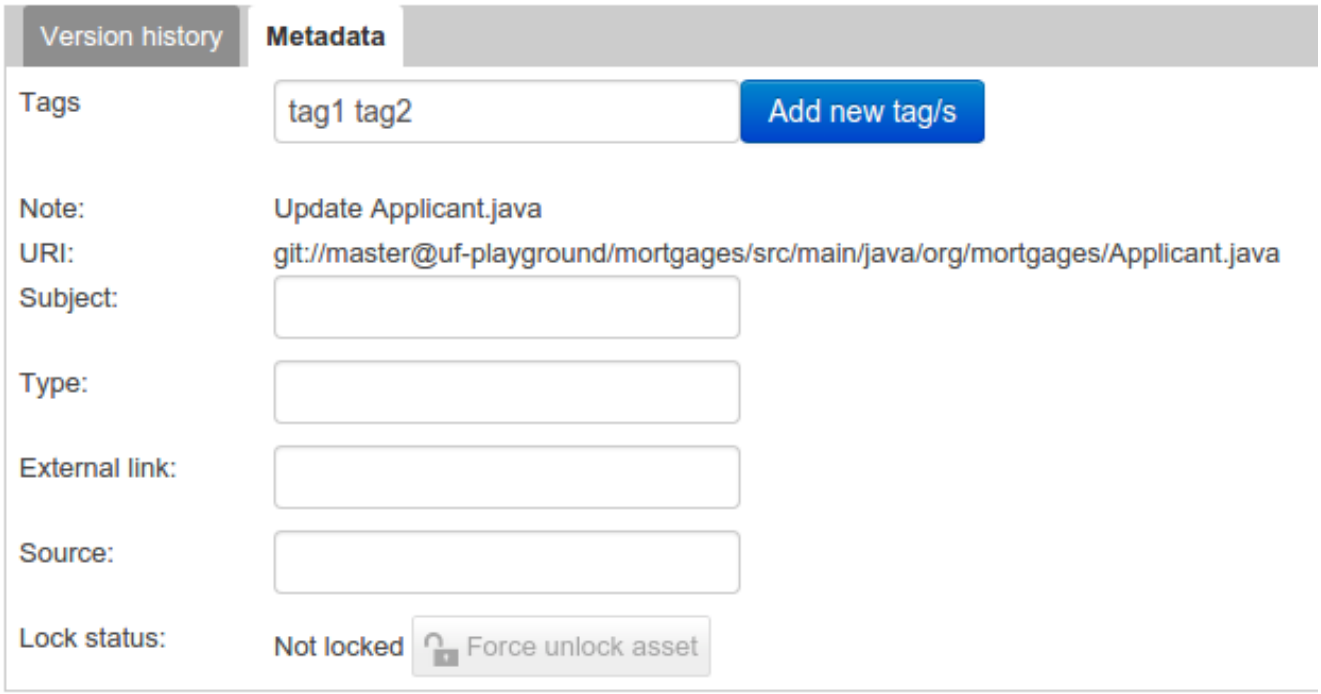


Figure 1.28. Creating Tags

Once you created new Tags they will appear over the Editor allowing you to remove them by pressing on them if you want.

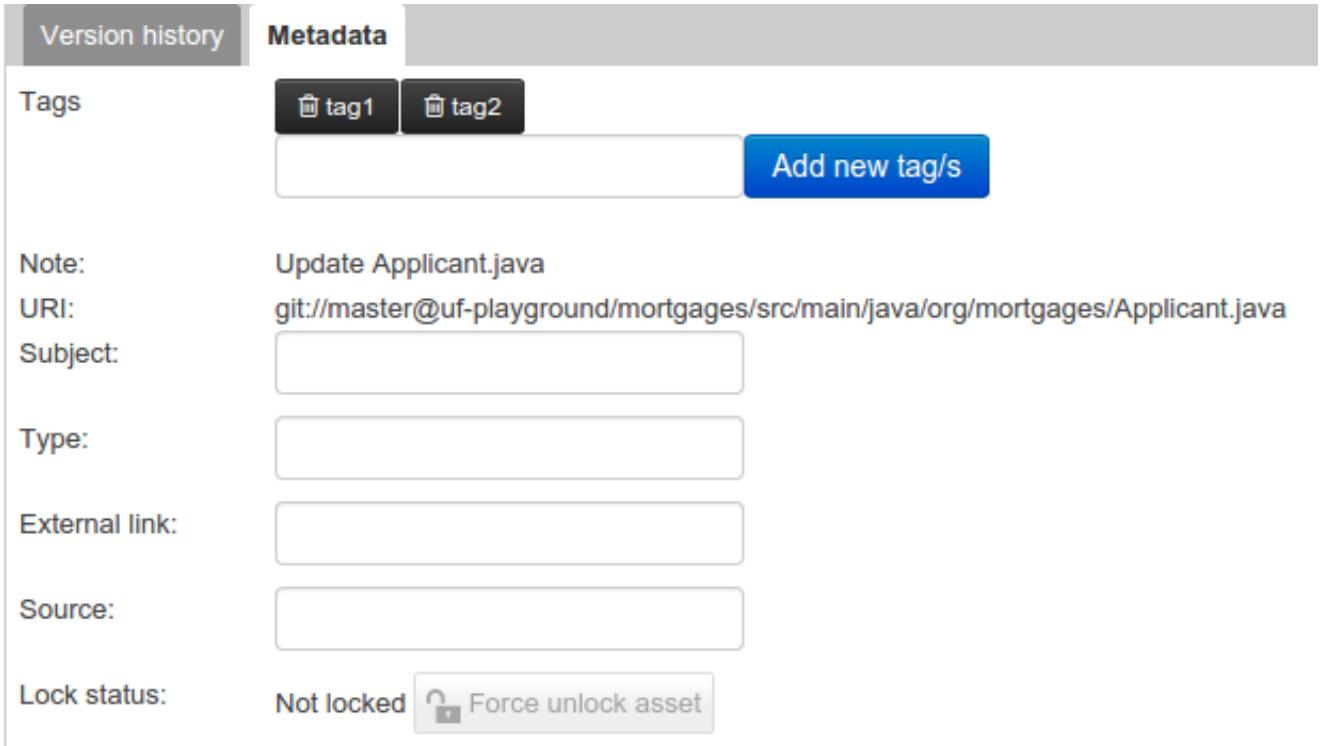


Figure 1.29. Existing Tags

1.7.4. Project Explorer

The Project Explorer provides the ability to browse different Organizational Units, Repositories, Projects and their files.

1.7.4.1. Initial view

The initial view could be empty when first opened.

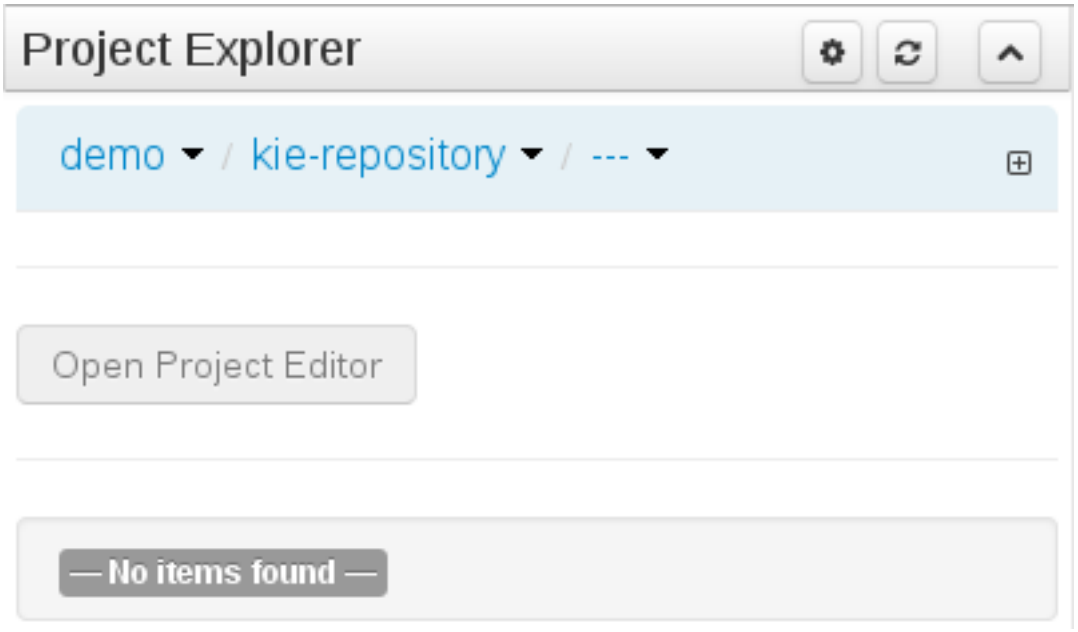


Figure 1.30. An empty initial view

The user may have to select an Organizational Unit, Repository and Project from the drop-down boxes.

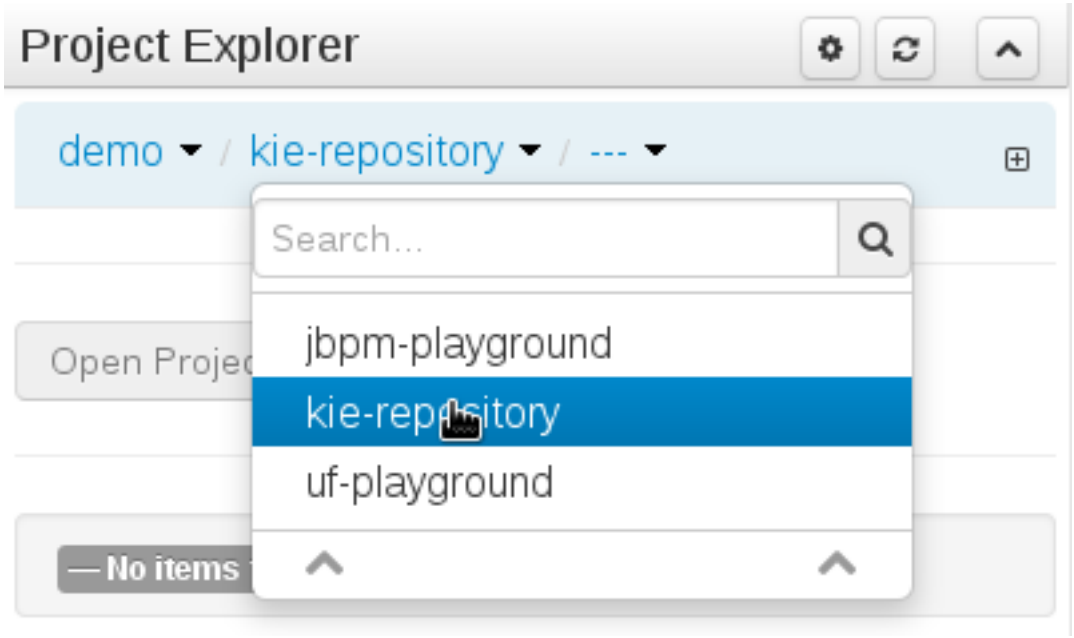


Figure 1.31. Selecting a repository

The default configuration hides Package details from view.

In order to reveal packages click on the icon as indicated in the following screen-shot.

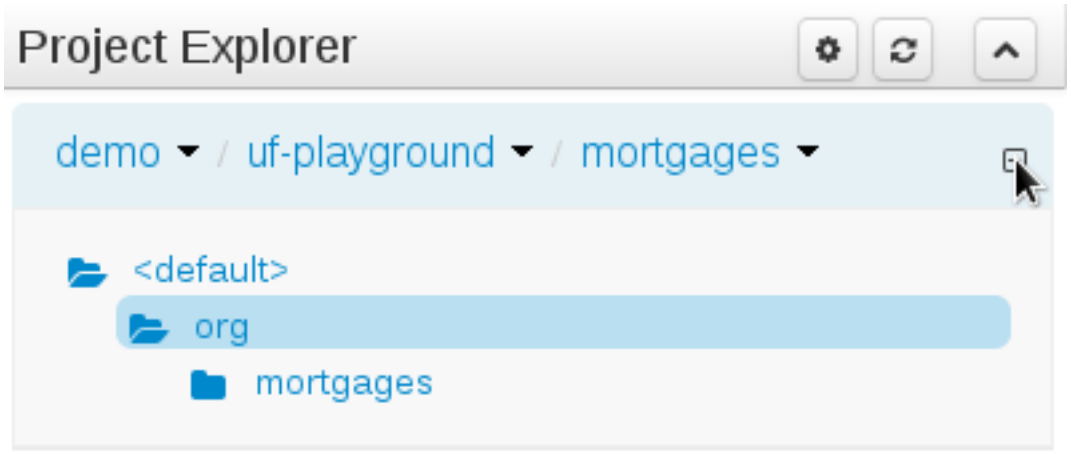


Figure 1.32. Showing packages

After a suitable combination of Organizational Unit, Repository, Project and Package have been selected the Project Explorer will show the contents. The exact combination of selections depends wholly on the structures defined within the Workbench installation and projects. Each section contains groups of related files. If a file is currently being edited by another user, a lock symbol will be displayed in front of the file name. The symbol is blue in case the lock is owned by the currently authenticated user, otherwise black. Moving the mouse pointer over the lock symbol will display a tooltip providing the name of the user who is currently editing the file (and therefore owning the lock). To learn more about locking see Section 1.7.2, “Asset Editor” for details.

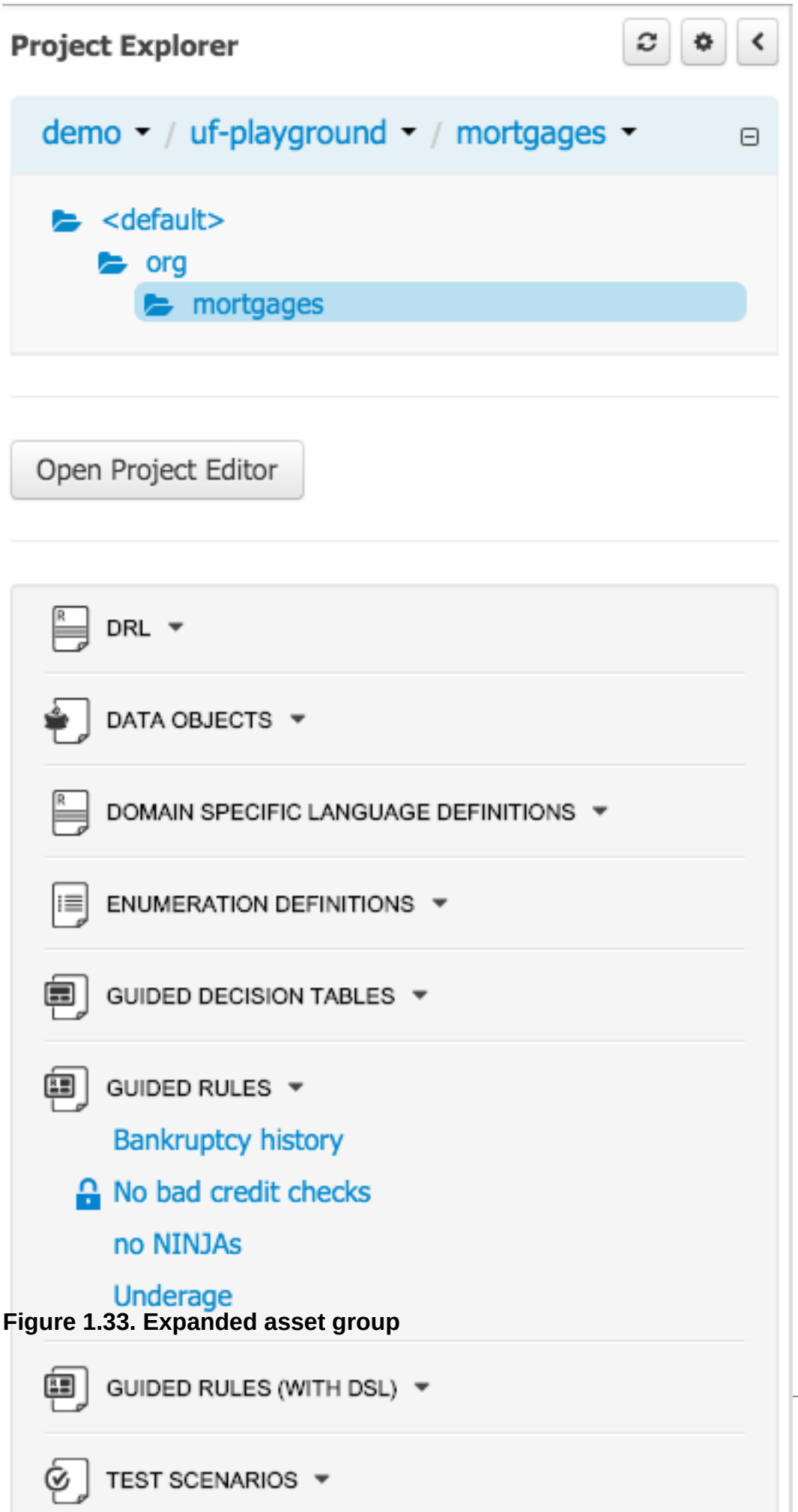


Figure 1.33. Expanded asset group

1.7.4.2. Different views

Project Explorer supports multiple views.

- Project View

  A simplified view of the underlying project structure. Certain system files are hidden from view.

- Repository View

  A complete view of the underlying project structure including all files; either user-defined or system generated.

Views can be selected by clicking on the icon within the Project Explorer, as shown below.

Both Project and Repository Views can be further refined by selecting either "Show as Folders" or "Show as Links".

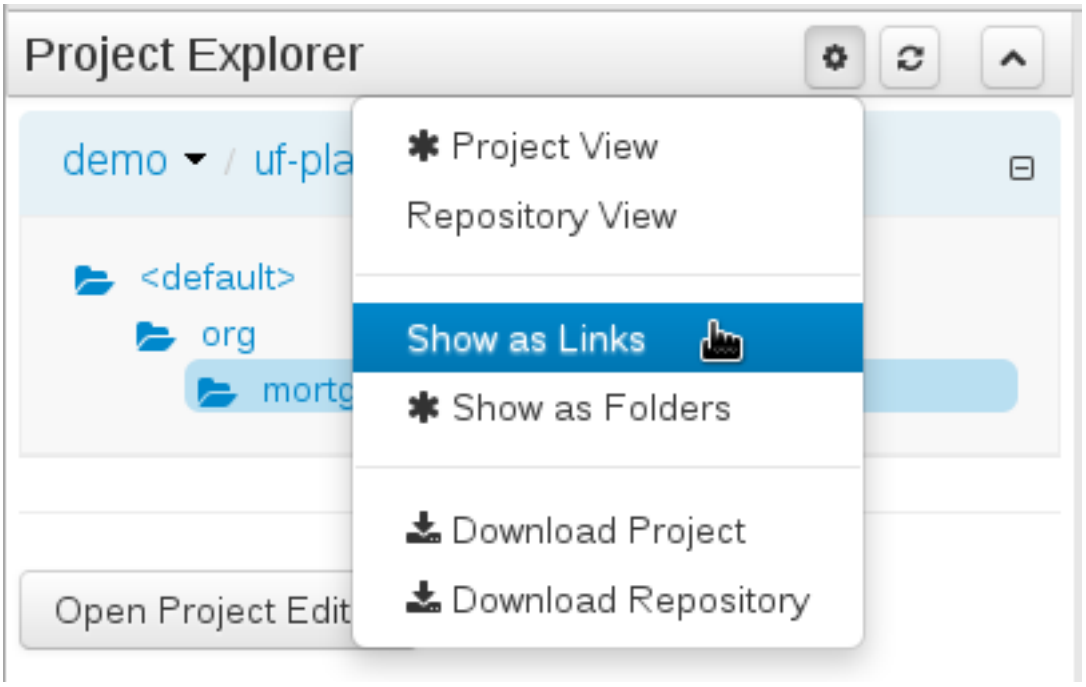


Figure 1.34. Switching view

1.7.4.2.1. Project View examples

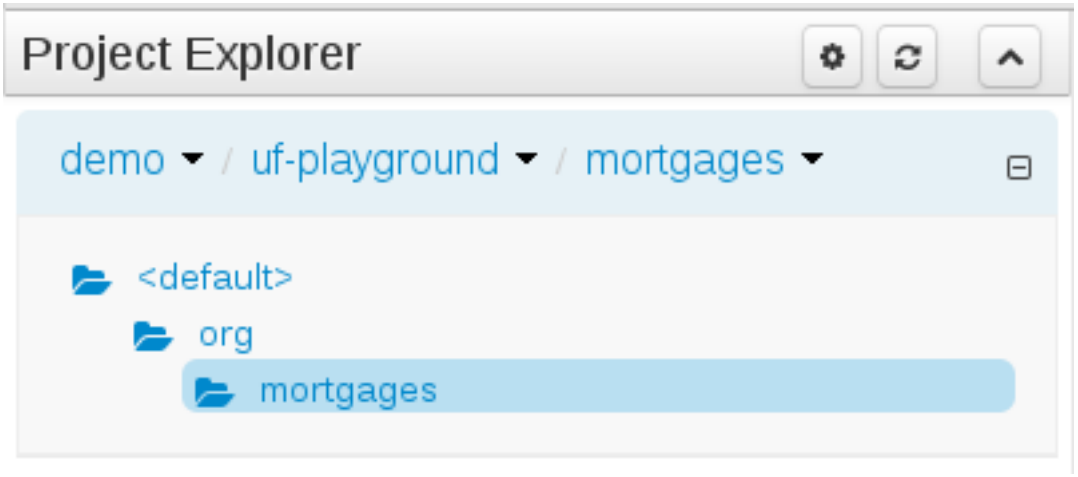


Figure 1.35. Project View - Folders

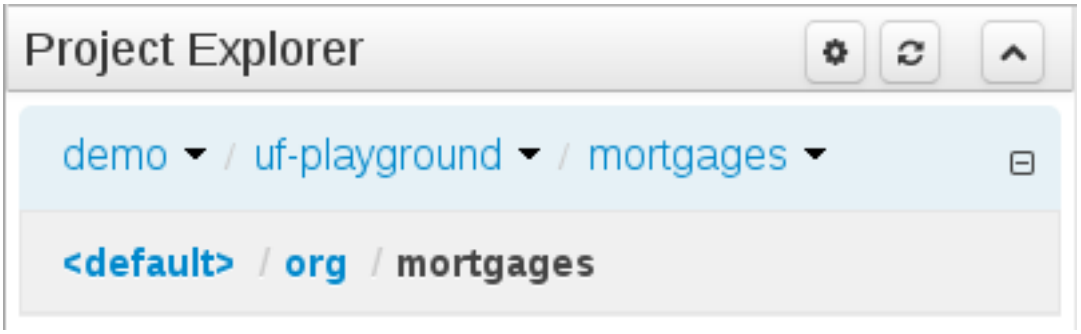


Figure 1.36. Project View - Links

1.7.4.2.2. Repository View examples

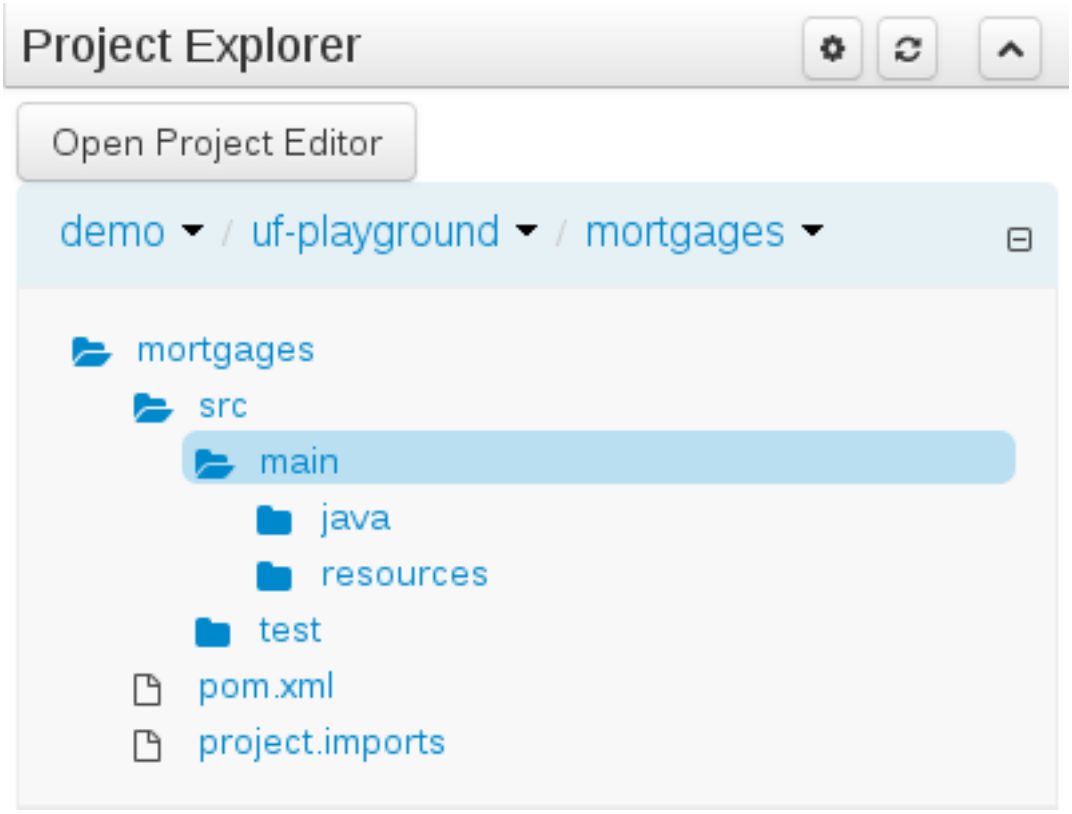


Figure 1.37. Repository View - Folders

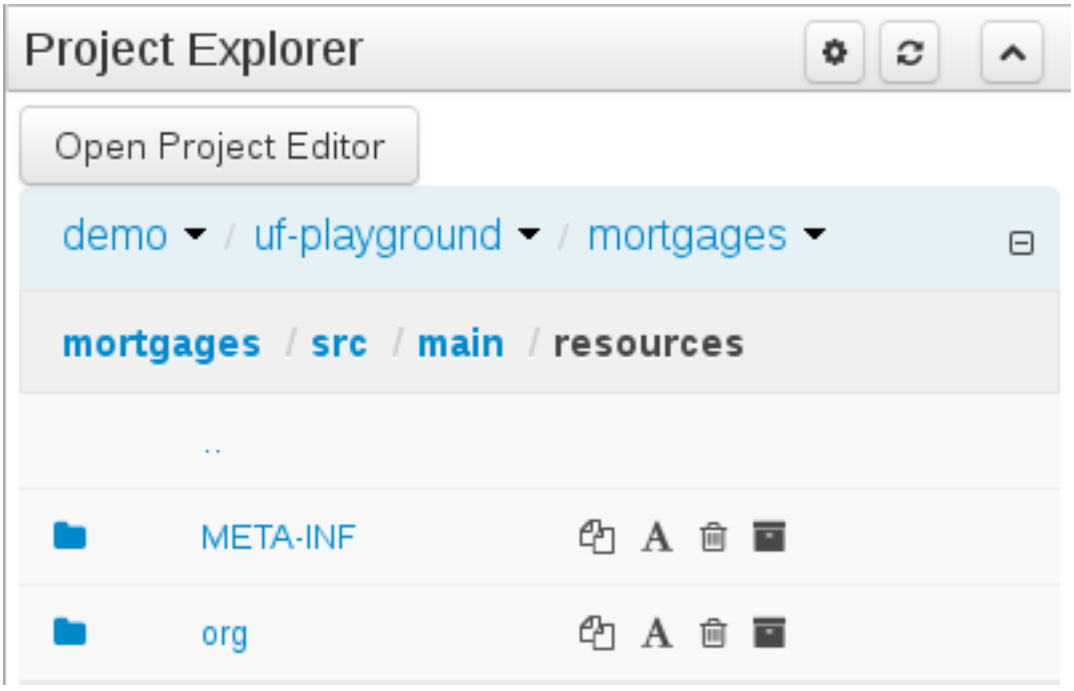


Figure 1.38. Repository View - Links

1.7.4.3. Download Project or Repository

Download Project and Download Repository make it possible to download the project or repository as a zip file.

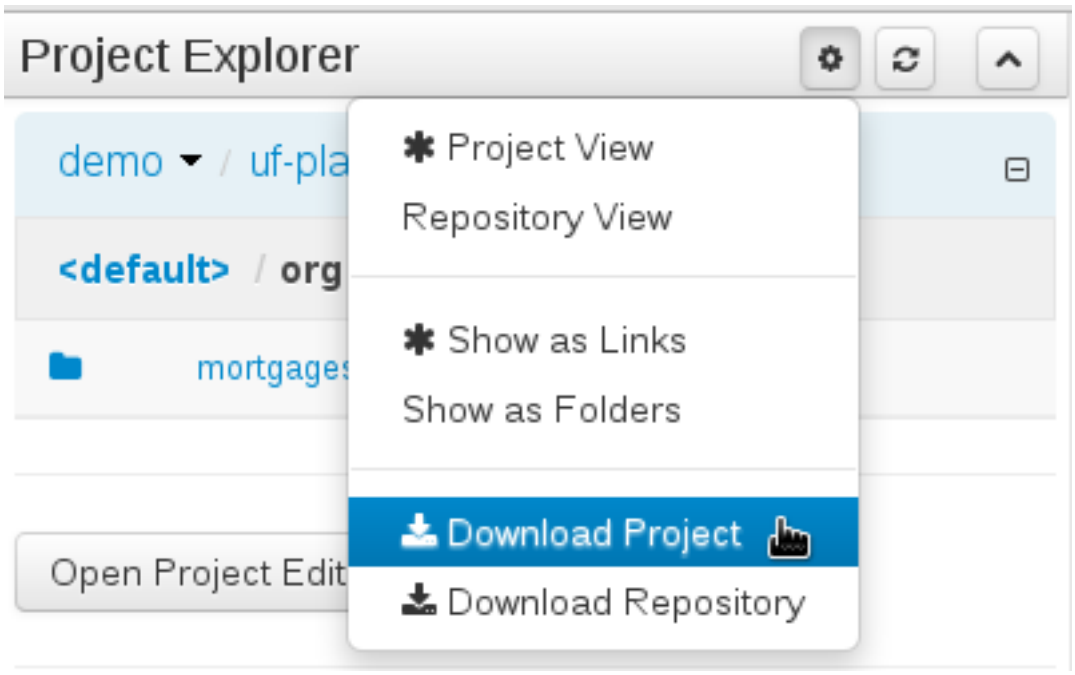


Figure 1.39. Repository and Project Downloads

1.7.4.4. Branch selector

A branch selector will be visible if the repository has more than a single branch.

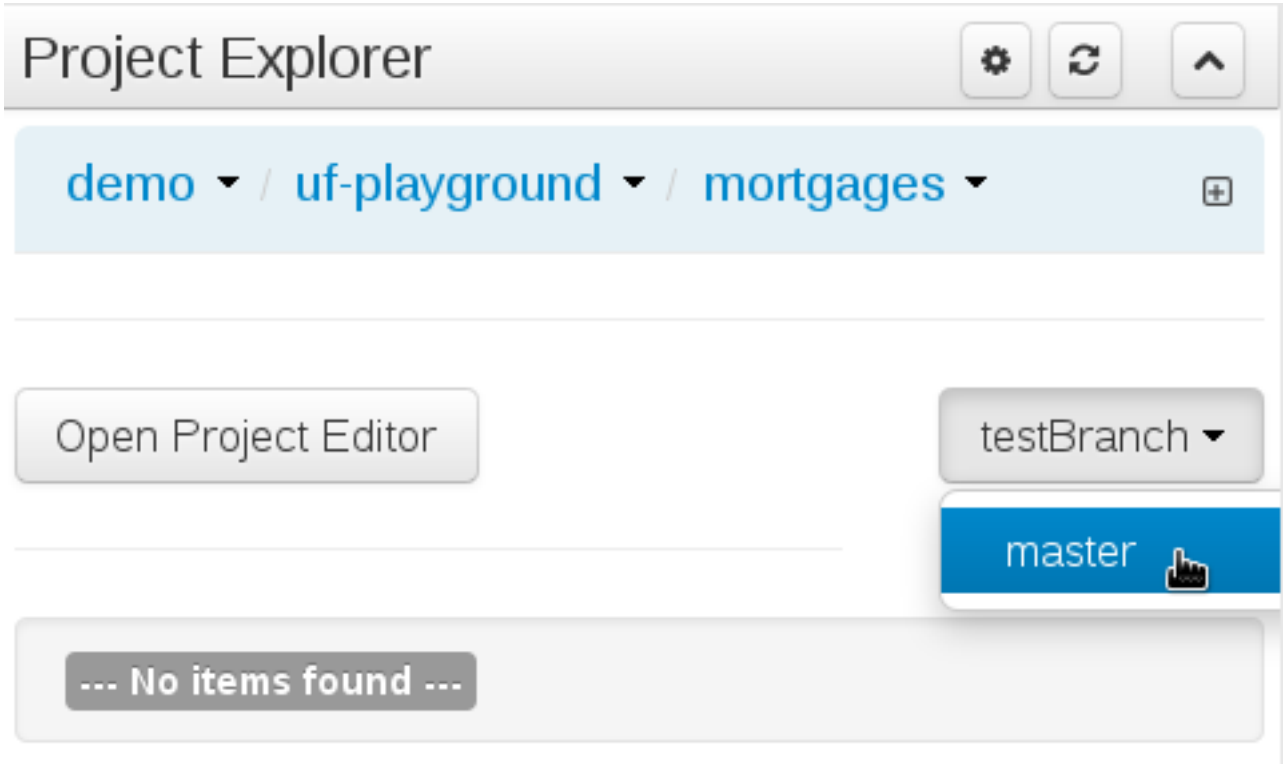


Figure 1.40. Branch selector

1.7.4.5. Filtering by Tag

To make easy view the elements on packages that contain a lot of assets, is possible to enabling the Tag filter, which allows you to filter the assets by their tags.

To see how to add tags to an asset look at: Section 1.7.3, “Tags Editor”

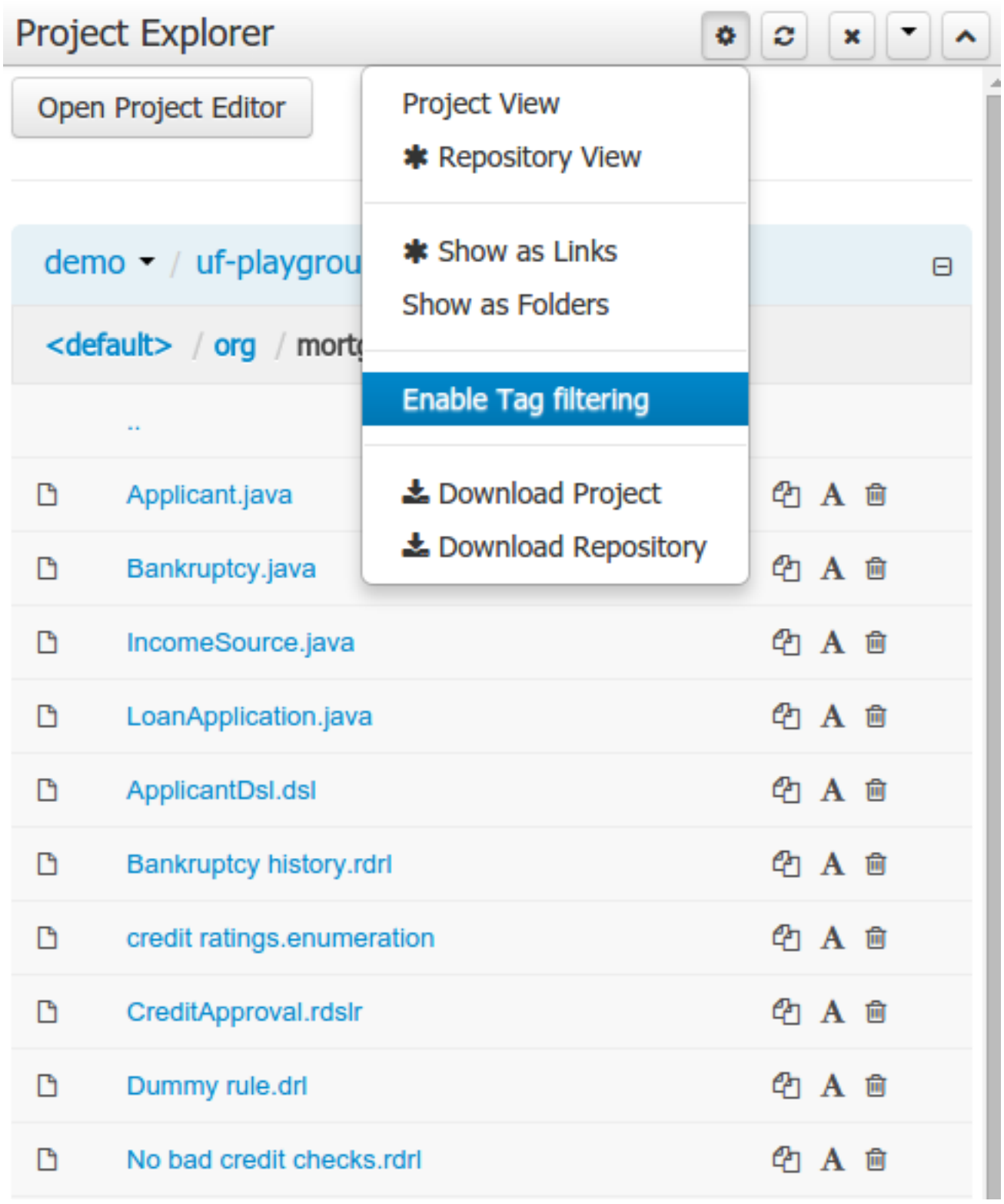


Figure 1.41. Enabling Filter by Tag

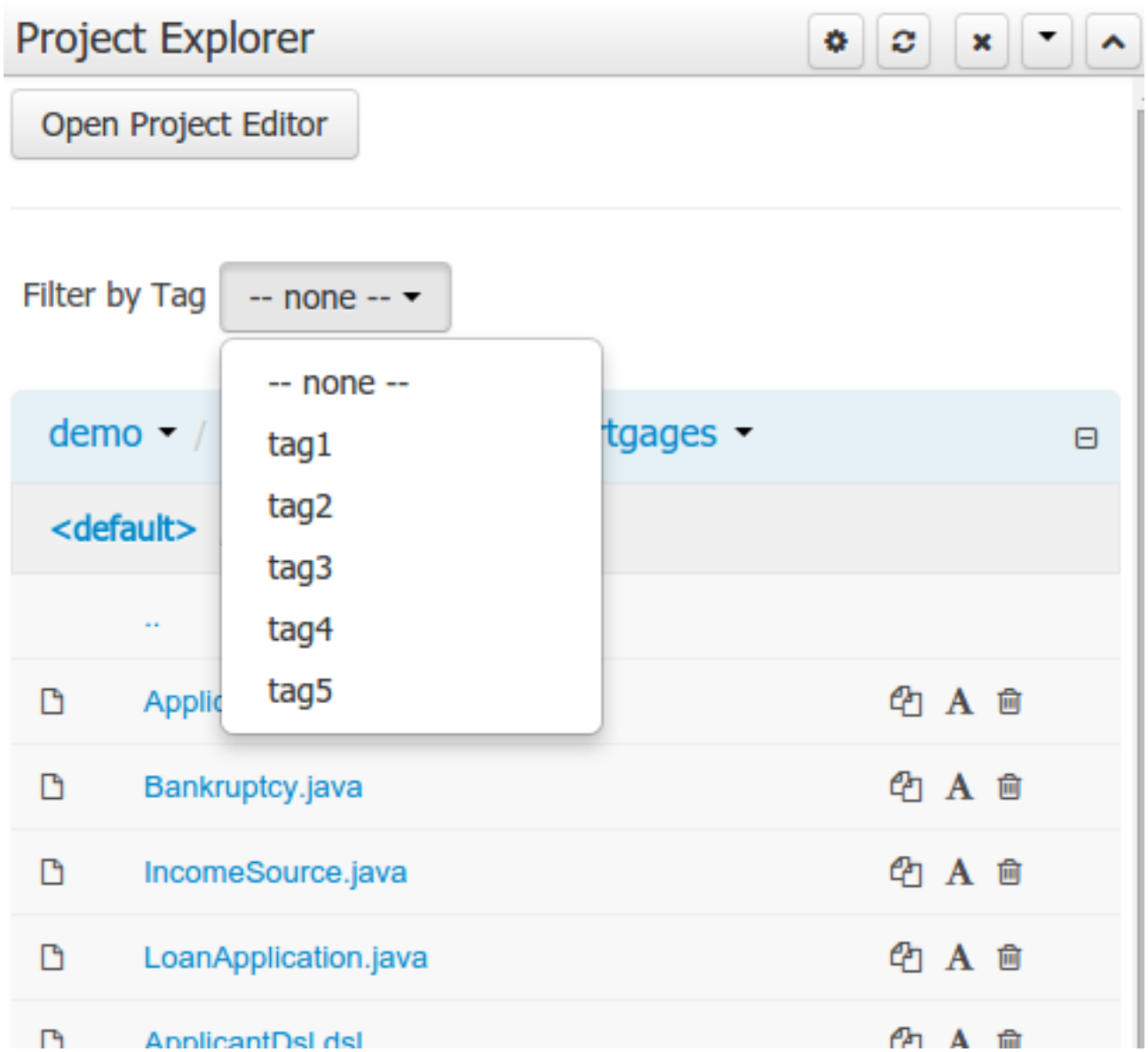


Figure 1.42. Filter by Tag

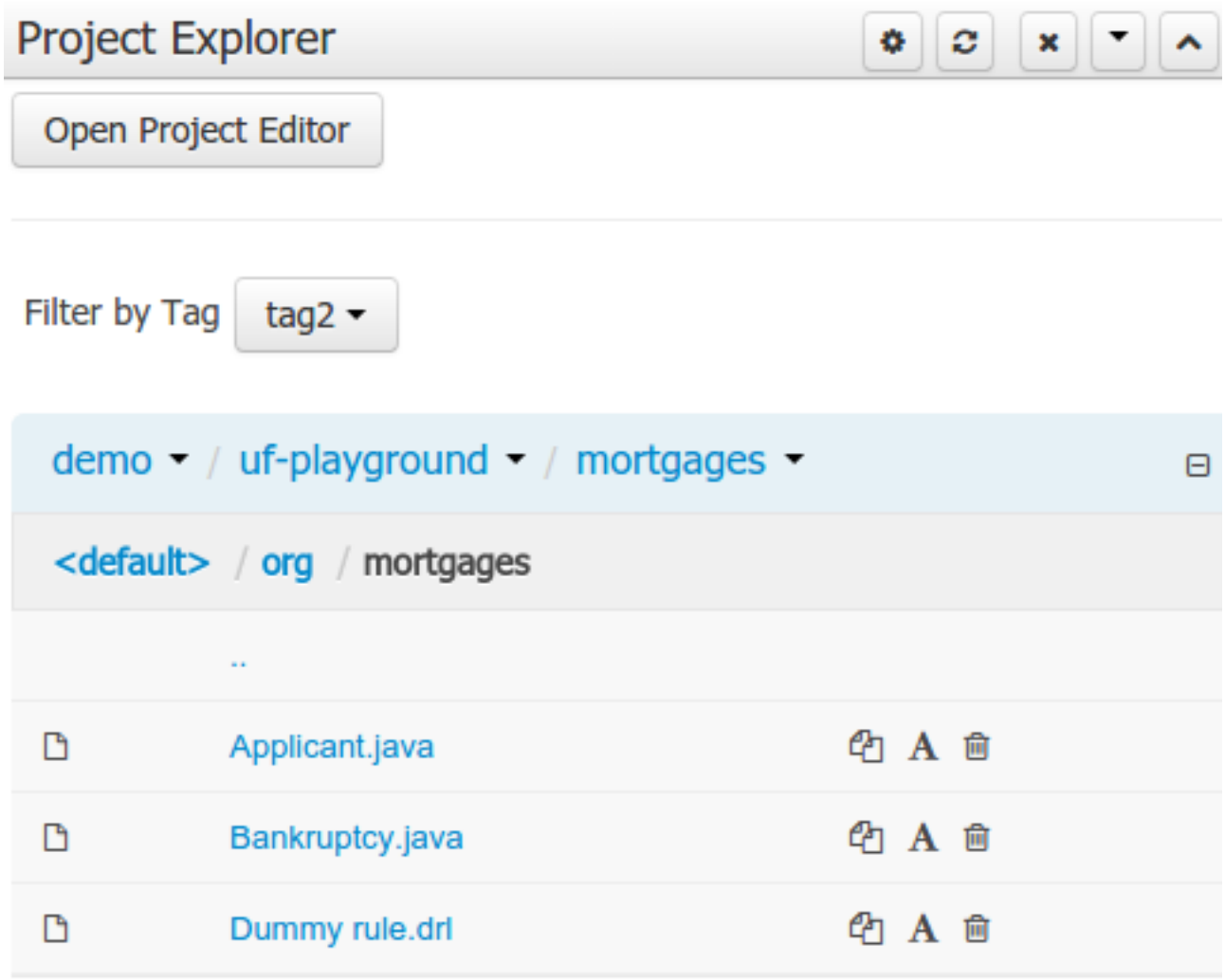


Figure 1.43. Filtering by Tag

1.7.4.6. Copy, Rename, Delete and Download Actions

Copy, rename and delete actions are available on *Links* mode, for packages (in of Project View) and for files and directories as well (in Repository View). Download action is available for directories. Download downloads the selected directory as a zip file.

- A : Copy
- B : Rename
- C : Delete
- D : Download

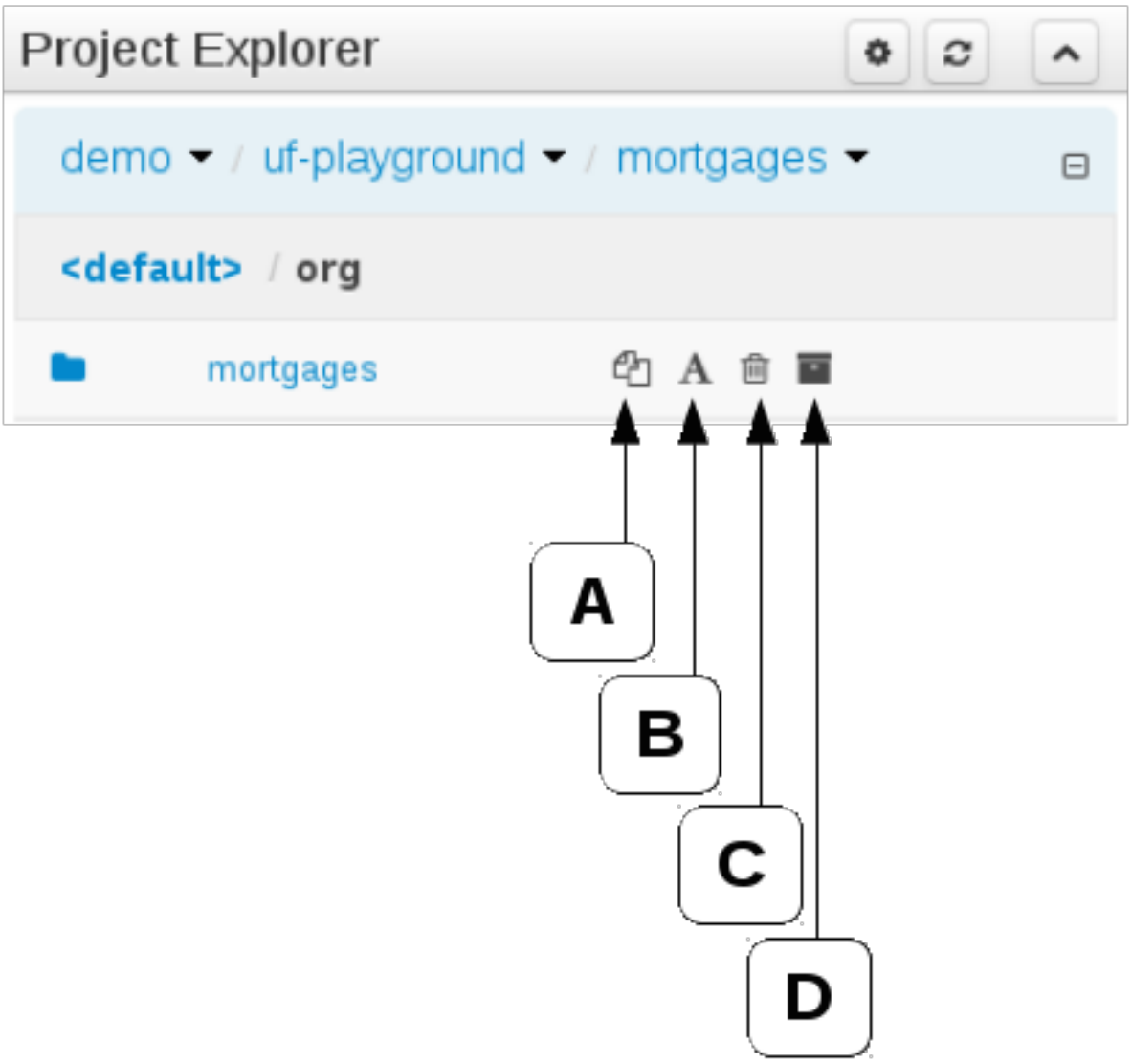


Figure 1.44. Project View - Package actions

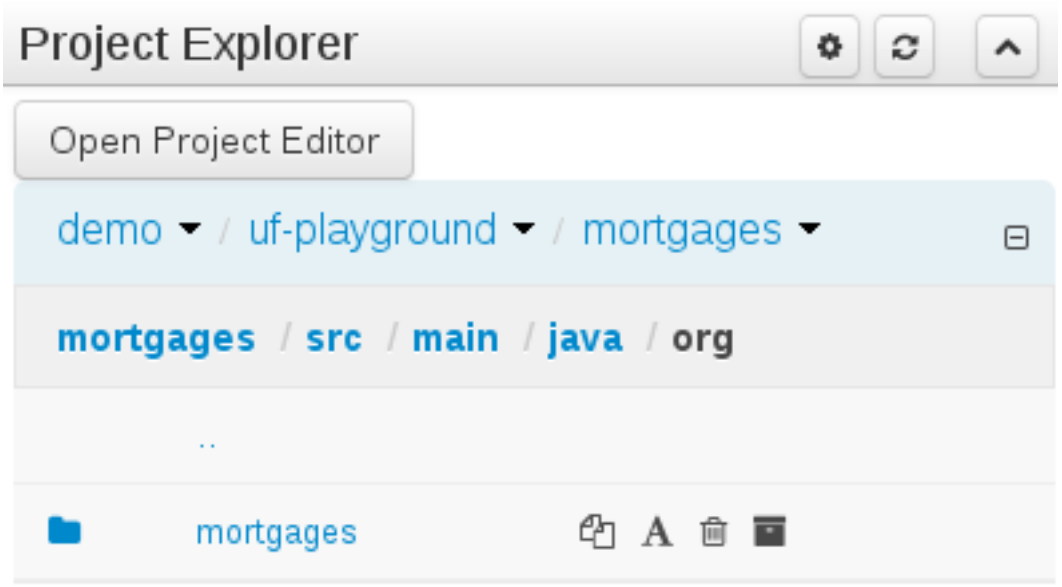


Figure 1.45. Repository View - Files and directories actions

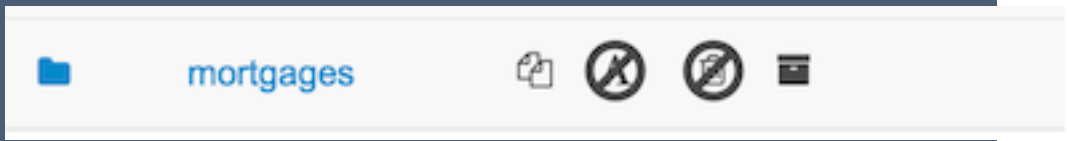
Warning

Workbench roadmap includes a refactoring and an impact analyses tools, but currently doesn't have it. Until both tools are provided make sure that your changes (copy/rename/delete) on packages, files or directories don't have a major impact on your project.

In cases that your change had an unexpected impact, Workbench allows you to restore your repository using the Repository editor.

Important

Files locked by other users as well as directories that contain such files cannot be renamed or deleted until the corresponding locks are released. If that is the case the rename and delete symbols will be deactivated. To learn more about locking see Section 1.7.2, “Asset Editor” for details.



1.7.5. Project Editor

The Project Editor screen can be accessed from Project Explorer. Project Editor shows the settings for the currently active project.

Unlike most of the workbench editors, project editor edits more than one file. Showing everything that is needed for configuring the KIE project in one place.

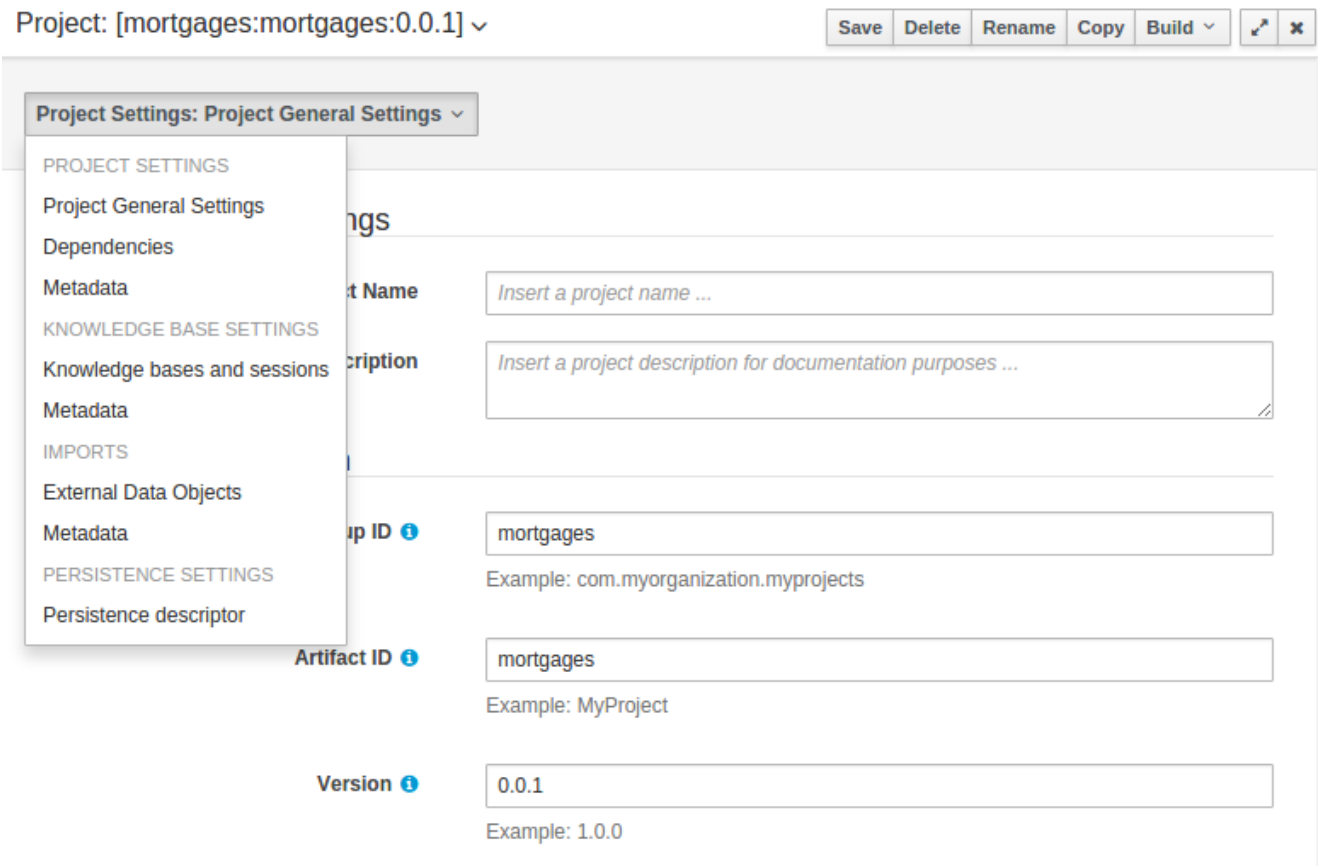


Figure 1.46. Project Screen and the different views

1.7.5.1. Build & Deploy

Build & Depoy builds the current project and deploys the KJAR into the workbench internal Maven repository.

1.7.5.2. Project Settings

Project Settings edits the pom.xml file used by Maven.

1.7.5.2.1. Project General Settings

General settings provide tools for project name and GAV-data (Group, Artifact, Version). GAV values are used as identifiers to differentiate projects and versions of the same project.

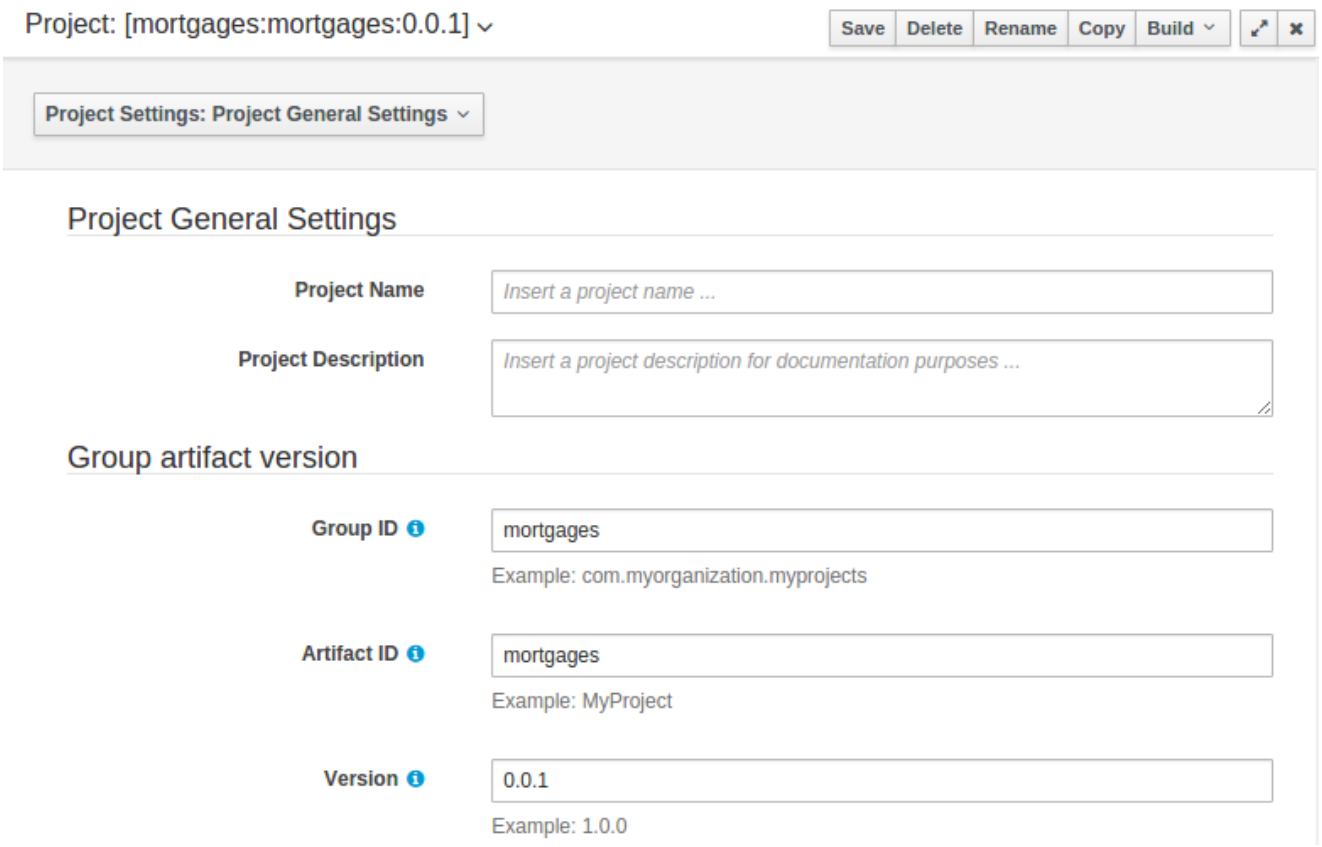


Figure 1.47. Project Settings

1.7.5.2.2. Dependencies

The project may have any number of either internal or external dependencies. Dependency is a project that has been built and deployed to a Maven repository. Internal dependencies are projects built and deployed in the same workbench as the project. External dependencies are retrieved from repositories outside of the current workbench. Each dependency uses the GAV-values to specify the project name and version that is used by the project.

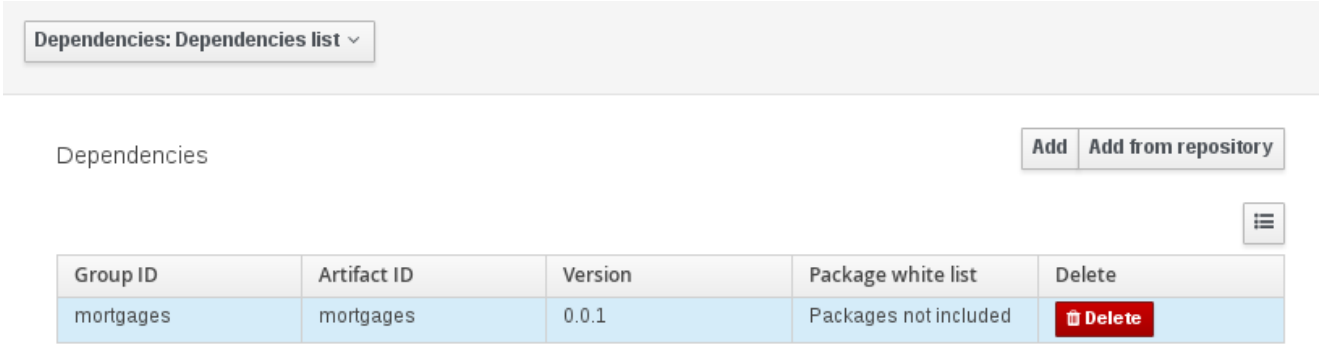


Figure 1.48. Dependencies

1.7.5.2.2.1. Package Name White List

Classes and declared types in white listed packages show up as Data Objects that can be imported in assets. The full list is stored in package-name-white-list file that is stored in each project root.

Package white list has three modes:

- All packages included: Every package defined in this jar is white listed.
- Packages not included: None of the packages listed in this jar are white listed.
- Some packages included: Only part of the packages in the jar are white listed.

1.7.5.2.3. Metadata

Metadata for the pom.xml file.

1.7.5.3. Knowledge Base Settings

Knowledge Base Settings edits the kmodule.xml file used by Drools.

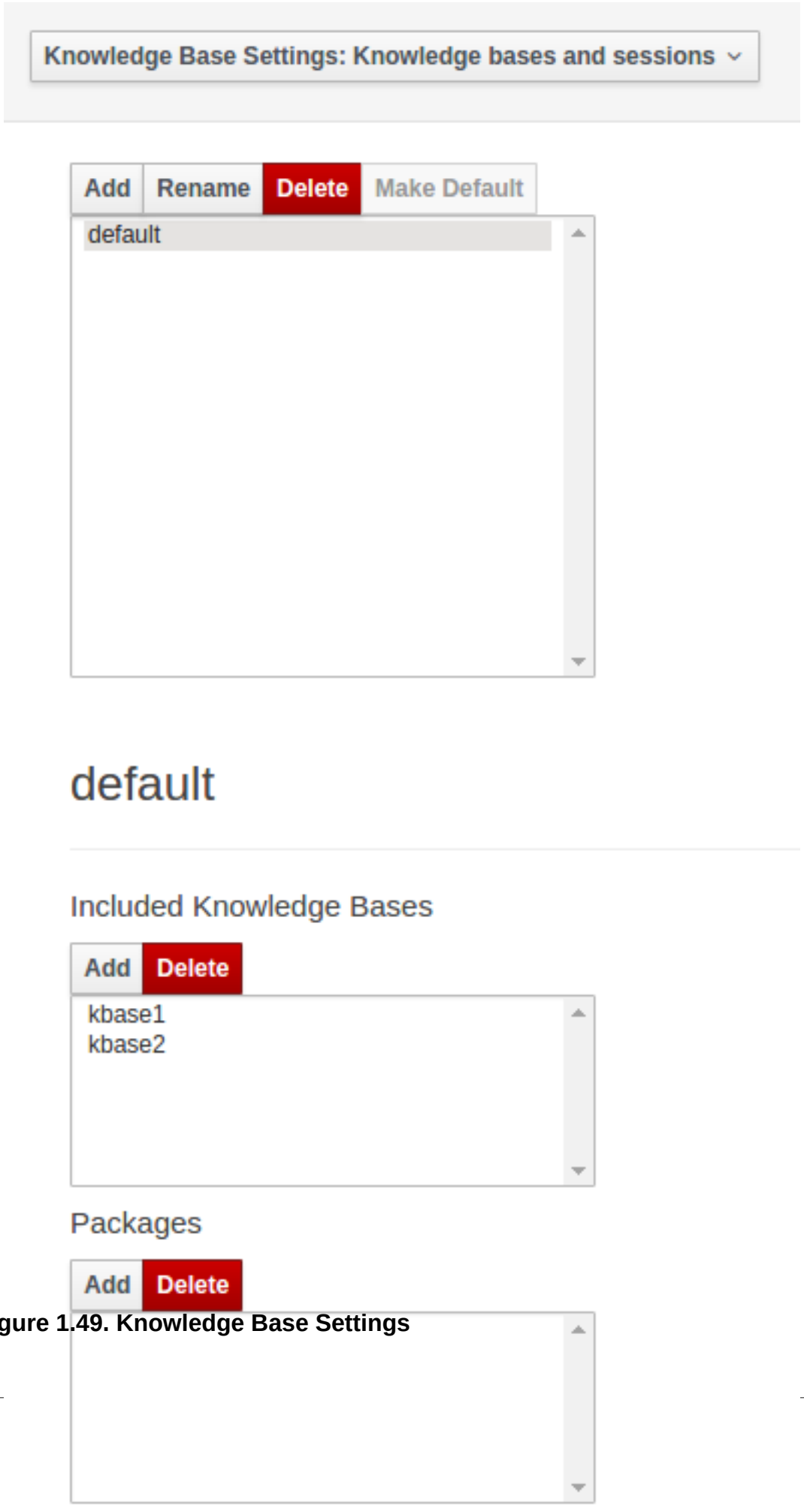


Figure 1.49. Knowledge Base Settings

Note

For more information about the Knowledge Base properties, check the Drools Expert documentation for kmodule.xml.

1.7.5.3.1. Knowledge bases and sessions

Knowledge bases and sessions lists the knowledge bases and the knowledge sessions specified for the project.

1.7.5.3.1.1. Knowledge base list

Lists all the knowledge bases by name. Only one knowledge base can be set as default.

1.7.5.3.1.2. Knowledge base properties

Knowledge base can include other knowledge bases. The models, rules and any other content in the included knowledge base will be visible and usable by the currently selected knowledge base.

Rules and models are stored in packages. The packages property specifies what packages are included into this knowledge base.

Equals behavior is explained in the Drools Expert part of the documentation.

Event processing mode is explained in the Drools Fusion part of the documentation.

1.7.5.3.1.3. Knowledge sessions

The table lists all the knowledge sessions in the selected knowledge base. There can be only one default of each type. The types are stateless and stateful. Clicking the pen-icon opens a popup that shows more properties for the knowledge session.

1.7.5.3.2. Metadata

Metadata for the kmodule.xml

1.7.5.4. Imports

Settings edits the project.imports file used by the workbench editors.

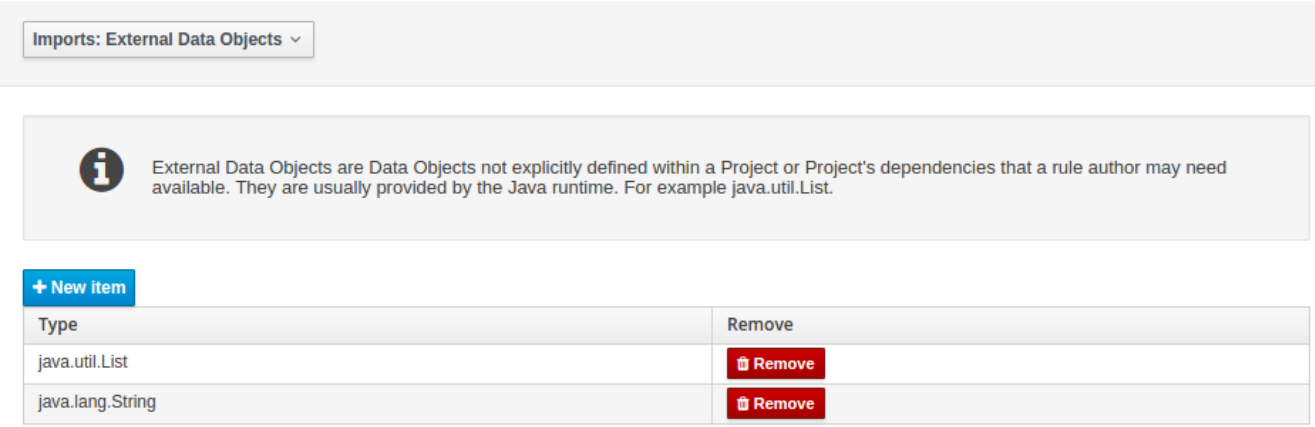


Figure 1.50. Imports

1.7.5.4.1. External Data Objects

Data Objects provided by the Java Runtime environment may need to be registered to be available to rule authoring where such Data Objects are not implicitly available as part of an existing Data Object defined within the Workbench or a Project dependency. For example an Author may want to define a rule that checks for `java.util.ArrayList` in Working Memory. If a domain Data Object has a field of type `java.util.ArrayList` there is no need create a registration.

1.7.5.4.2. Metadata

Metadata for the project.imports file.

1.7.5.5. Duplicate GAV detection

When performing any of the following operations a check is now made against all Maven Repositories, resolved for the Project, for whether the Project's GroupId, ArtifactId and Version pre-exist. If a clash is found the operation is prevented; although this can be overridden by Users with the `admin` role.

Note

The feature can be disabled by setting the System Property `org.guvnor.project.gav.check.disabled` to `true`.

Resolved repositories are those discovered in:-

- The Project's `POM` `<repositories>` section (or any parent `POM`).
- The Project's `POM` `<distributionManagement>` section.
- Maven's global `settings.xml` configuration file.

Affected operations:-

- Creation of new Managed Repositories.
- Saving a Project defintion with the Project Editor.
- Adding new Modules to a Managed Multi-Module Repository.
- Saving the `pom.xml` file.
- Build & installing a Project with the Project Editor.
- Build & deploying a Project with the Project Editor.
- Asset Management operations building, installing or deploying Projects.
- `REST` operations creating, installing or deploying Projects.

Users with the `Admin` role can override the list of Repositories checked using the "Repositories" settings in the Project Editor.

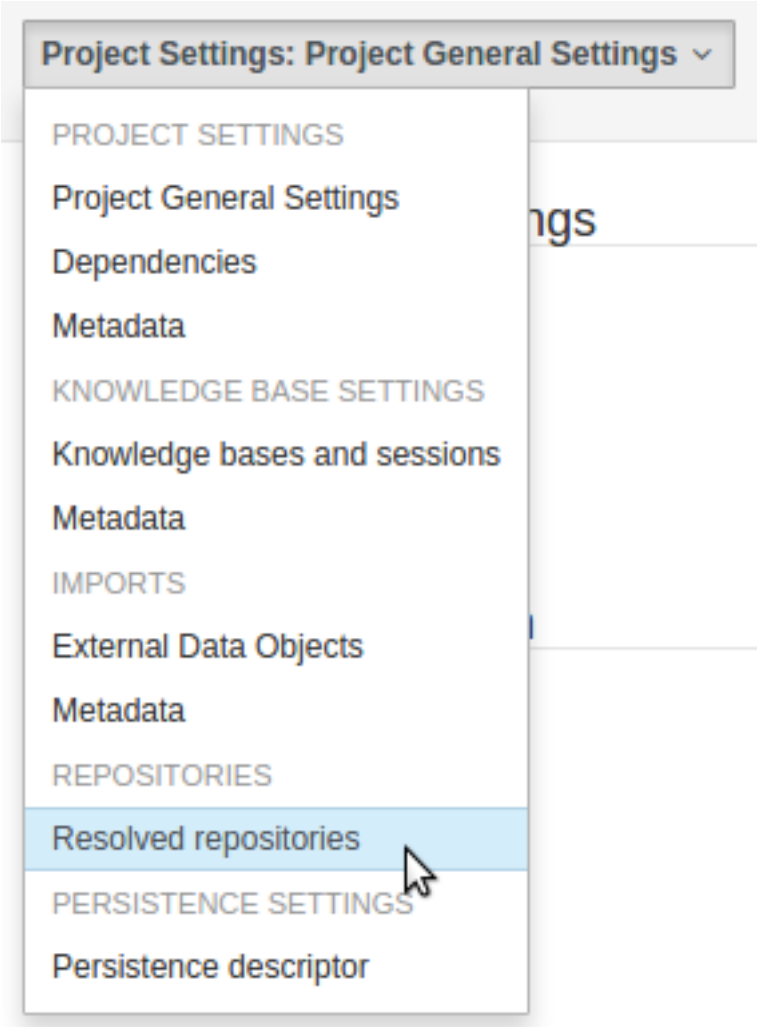


Figure 1.51. Project Editor - Viewing resolved Repositories

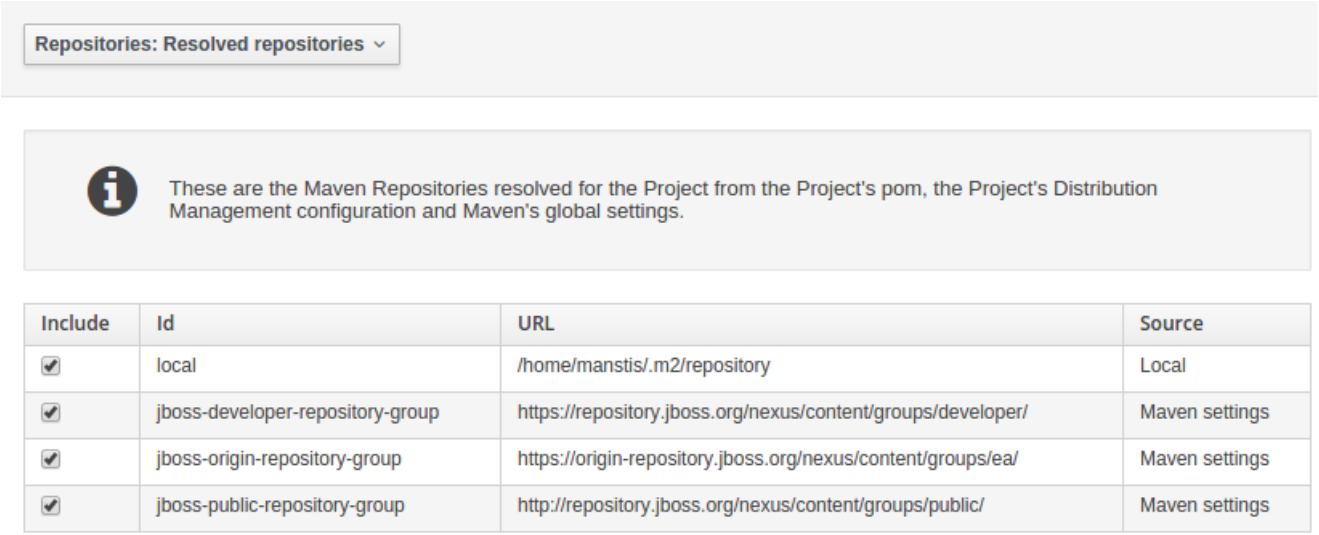


Figure 1.52. Project Editor - The list of resolved Repositories

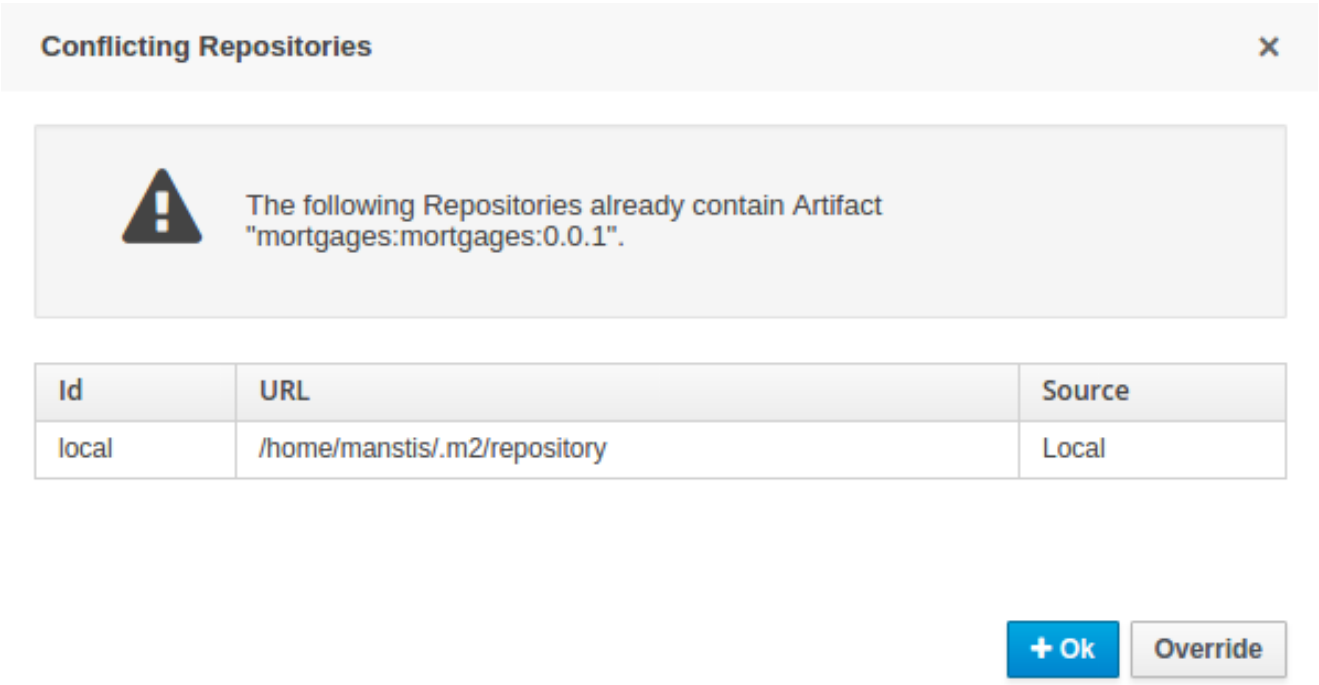


Figure 1.53. Duplicate GAV detected

1.7.6. Validation

The Workbench provides a common and consistent service for users to understand whether files authored within the environment are valid.

1.7.6.1. Problem Panel

The Problems Panel shows real-time validation results of assets within a Project.

When a Project is selected from the Project Explorer the Problems Panel will refresh with validation results of the chosen Project.

When files are created, saved or deleted the Problems Panel content will update to show either new validation errors, or remove existing if a file was deleted.

Here an invalid DRL file has been created and saved.

The Problems Panel shows the validation errors.

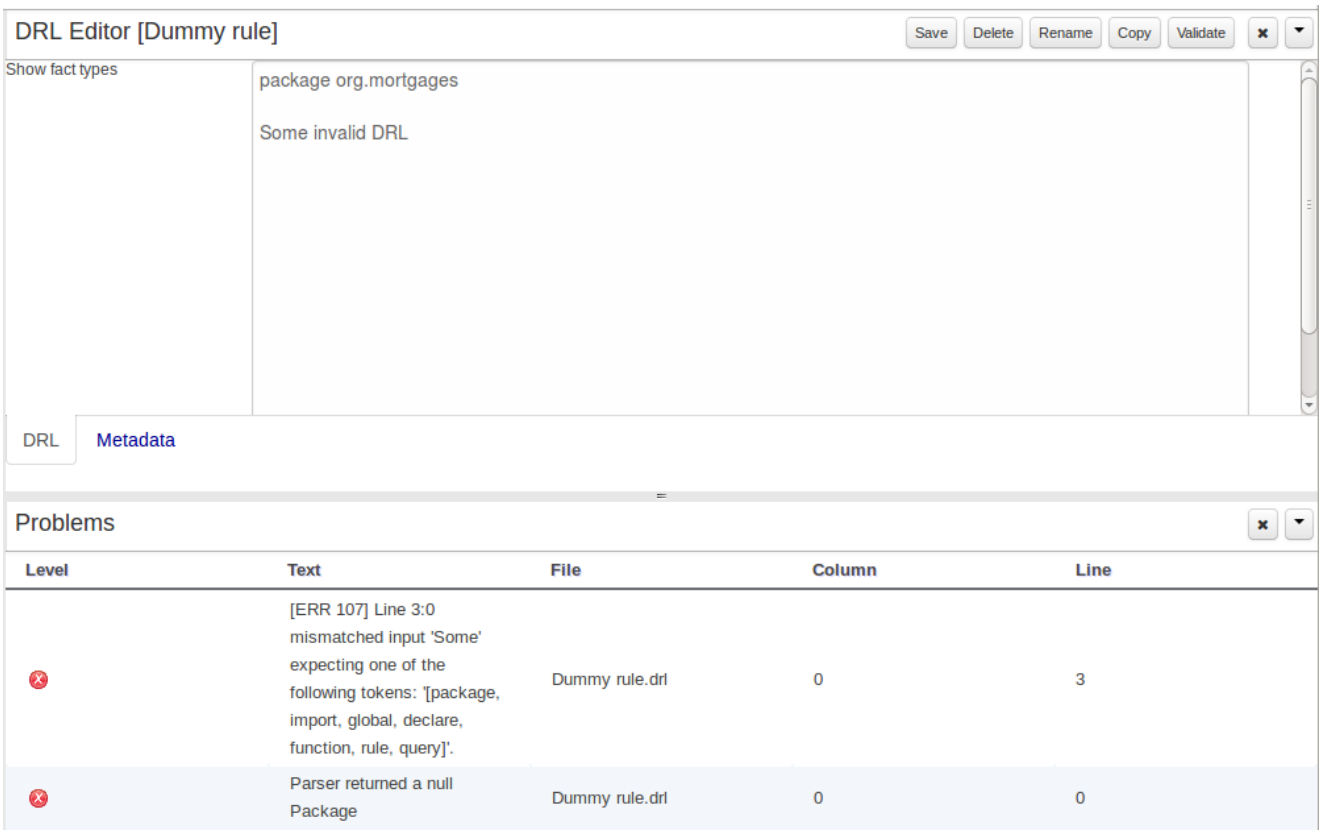


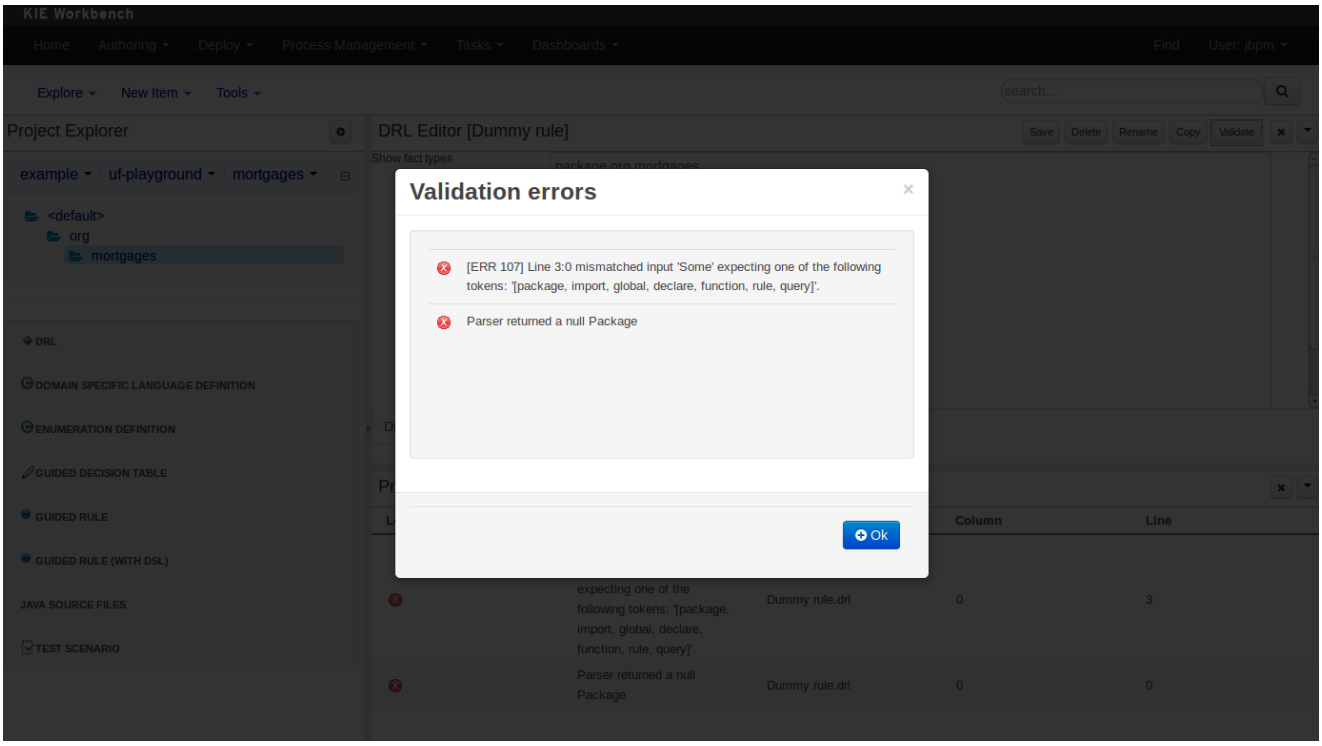
Figure 1.54. The Problems Panel

1.7.6.2. On demand validation

It is not always desirable to save a file in order to determine whether it is in a valid state.

All of the file editors provide the ability to validate the content before it is saved.

Clicking on the 'Validate' button shows validation errors, if any.



1.7.7. Data Modeller

1.7.7.1. First steps to create a data model

By default, a data model is always constrained to the context of a project. For the purpose of this tutorial, we will assume that a correctly configured project already exists and the authoring perspective is open.

To start the creation of a data model inside a project, take the following steps:

1. From the home panel, select the authoring perspective and use the project explorer to browse to the given project.

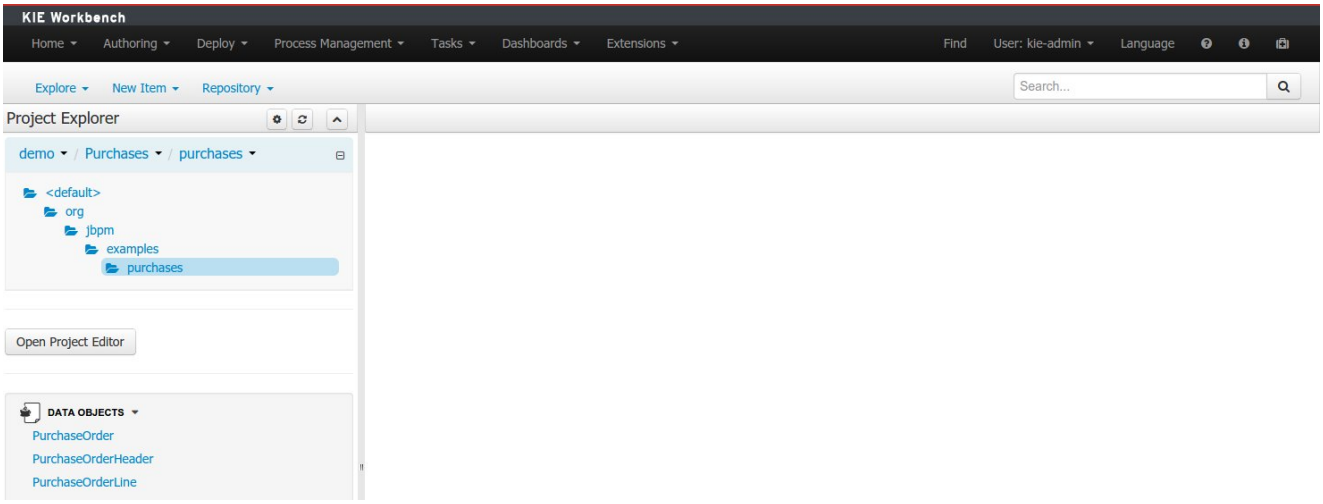


Figure 1.55. Go to authoring perspective and select a project

2. Open the Data Modeller tool by clicking on a Data Object file, or using the "New Item -> Data Object" menu option.

Figure 1.56. Click on a Data Object

This will start up the Data Modeller tool, which has the following general aspect:

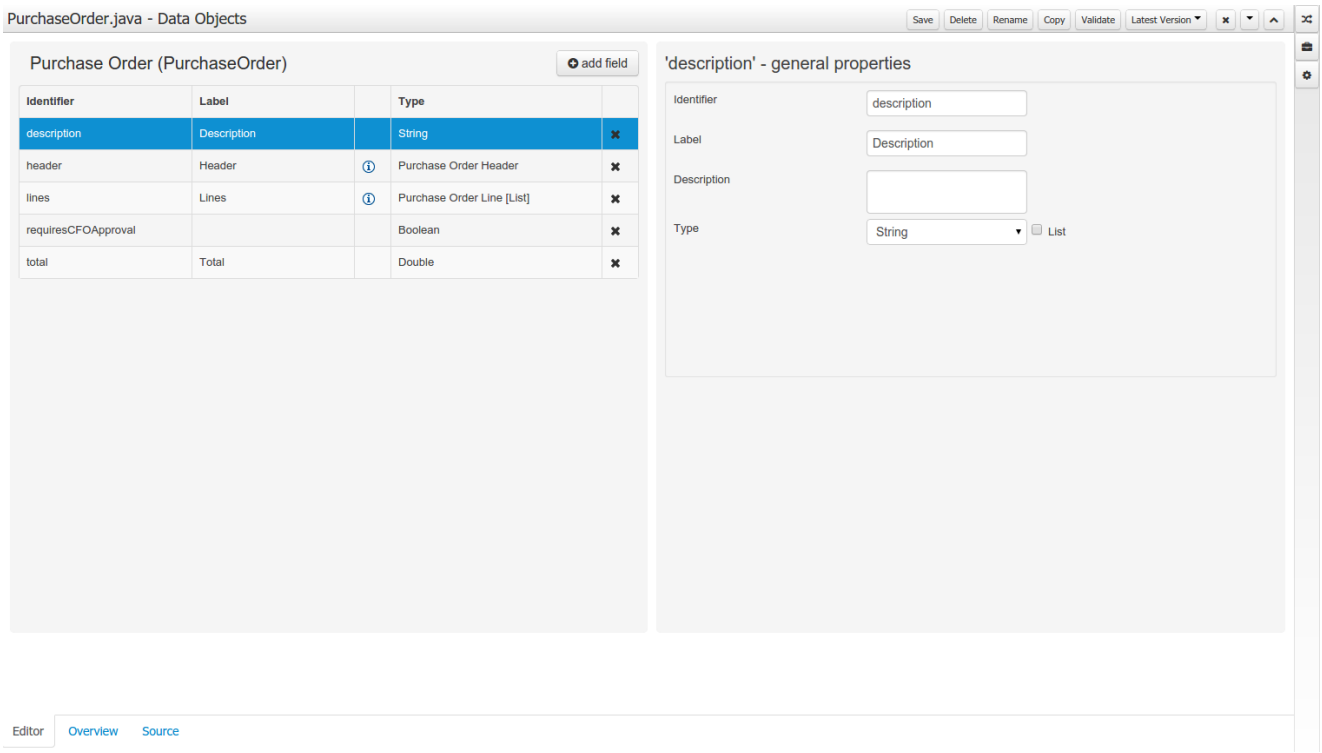


Figure 1.57. Data modeller overview

The "Editor" tab is divided into the following sections:

- The new field section is dedicated to the creation of new fields, and is opened when the "add field" button is pressed.

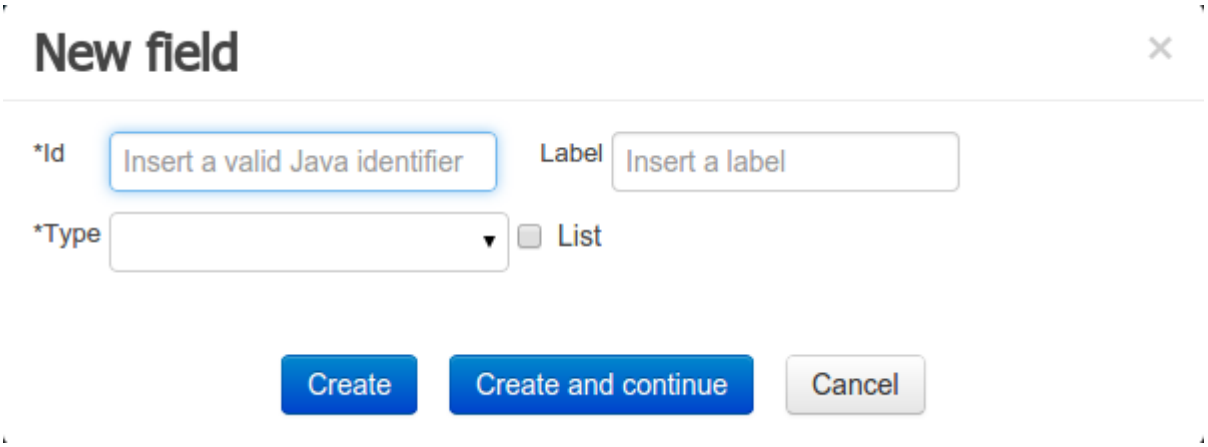


Figure 1.58. New field creation

- The Data Object's "field browser" section displays a list with the data object fields.

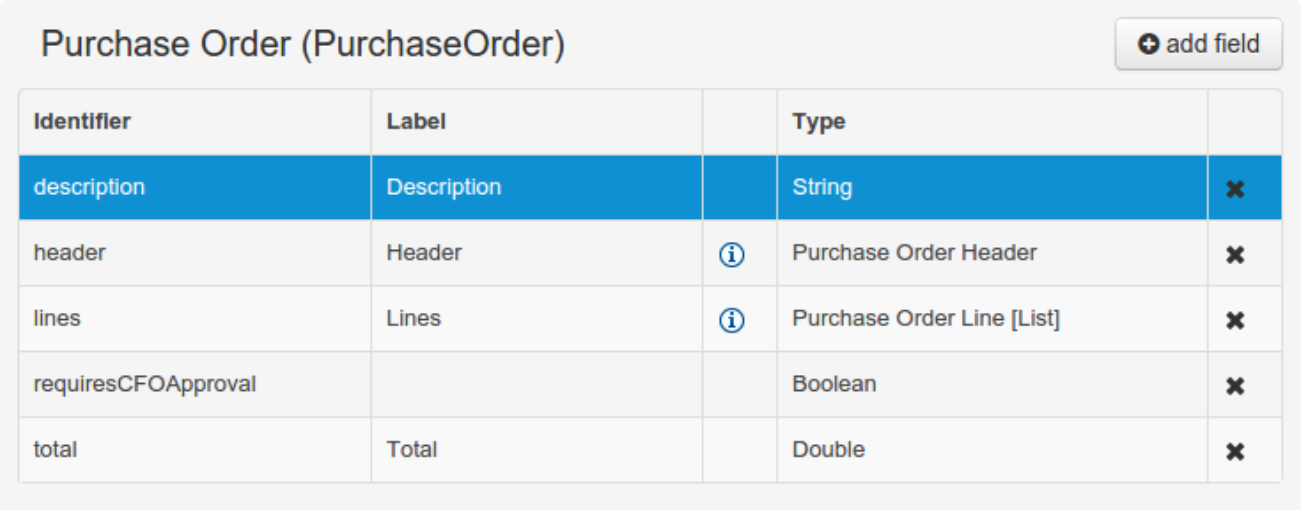


Figure 1.59. The Data Object's field browser

- The "Data Object / Field general properties" section. This is the rightmost section of the Data Modeller editor and visualizes the "Data Object" or "Field" general properties, depending on user selection.

  Data Object general properties can be selected by clicking on the Data Object Selector.

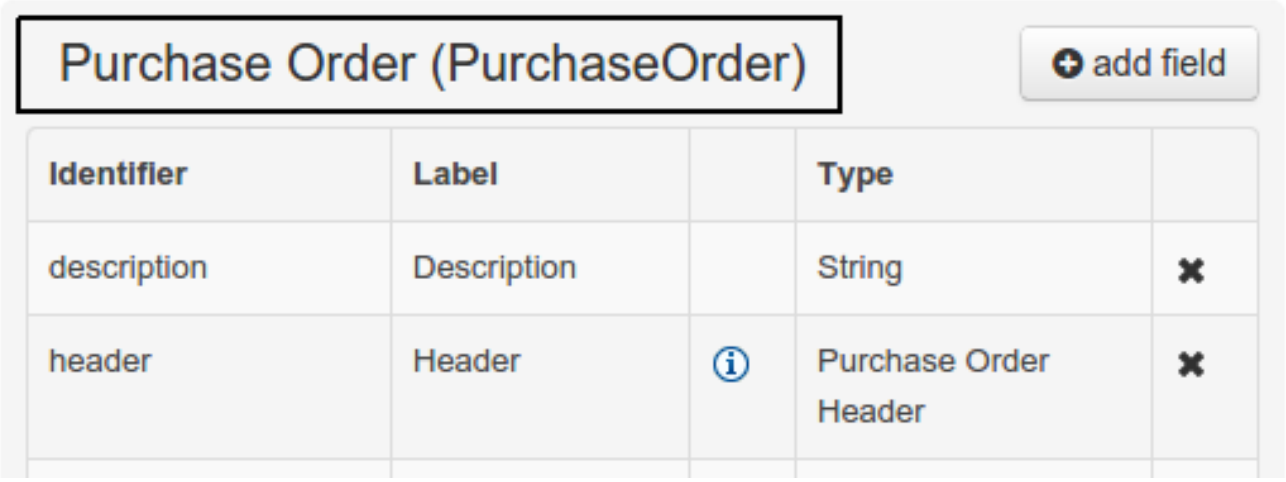


Figure 1.60. Data Object selector

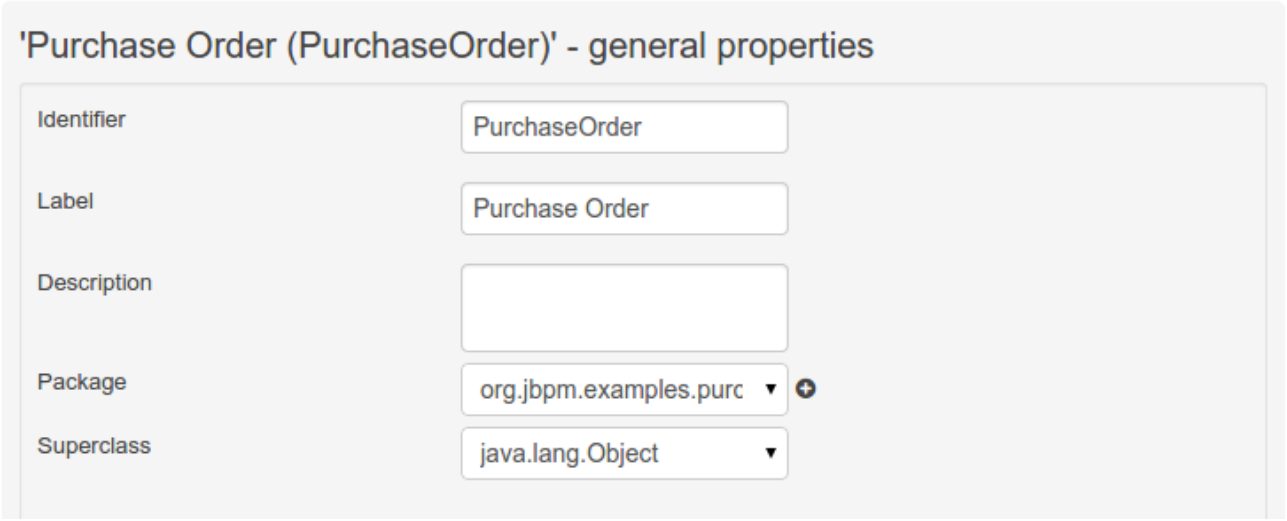


Figure 1.61. Data Object general properties

Field general properties can be selected by clicking on a field.

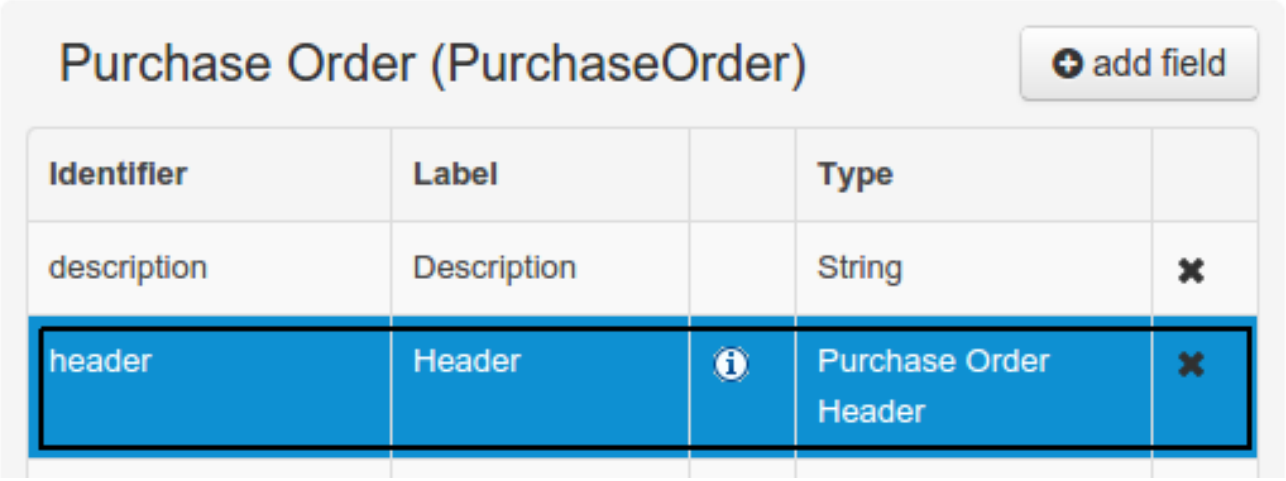


Figure 1.62. Field selector

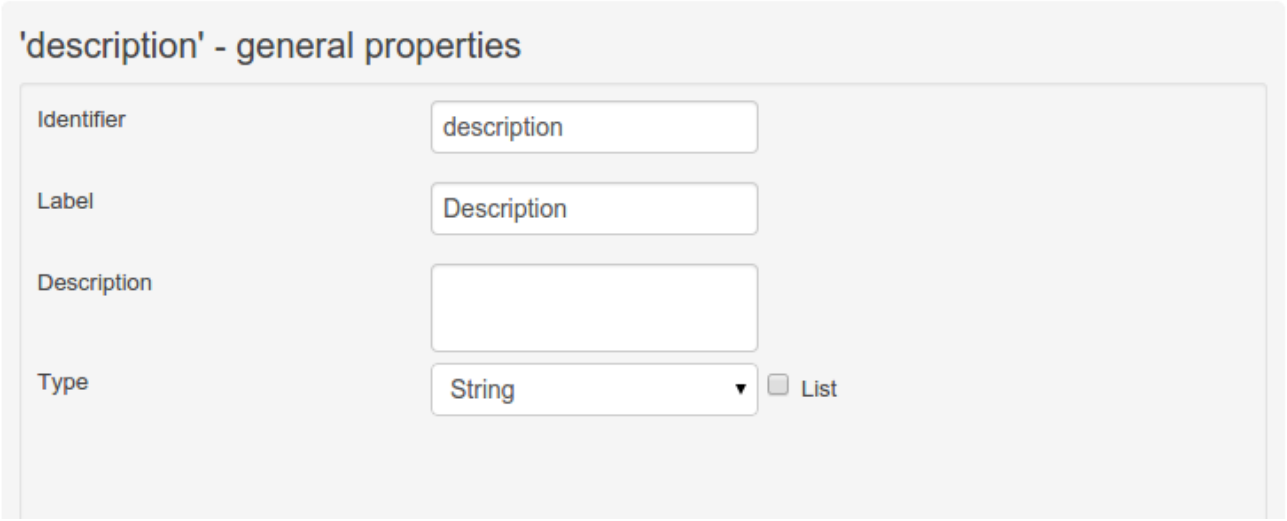


Figure 1.63. Field general properties

- On workbench's right side a new "Tool Bar" is provided that enables the selection of different context sensitive tool windows that will let the user do domain specific configurations. Currently four tool windows are provided for the following domains "Drools & jBPM", "OptaPlanner", "Persistence" and "Advanced" configurations.

Figure 1.64. Data modeller Tool Bar

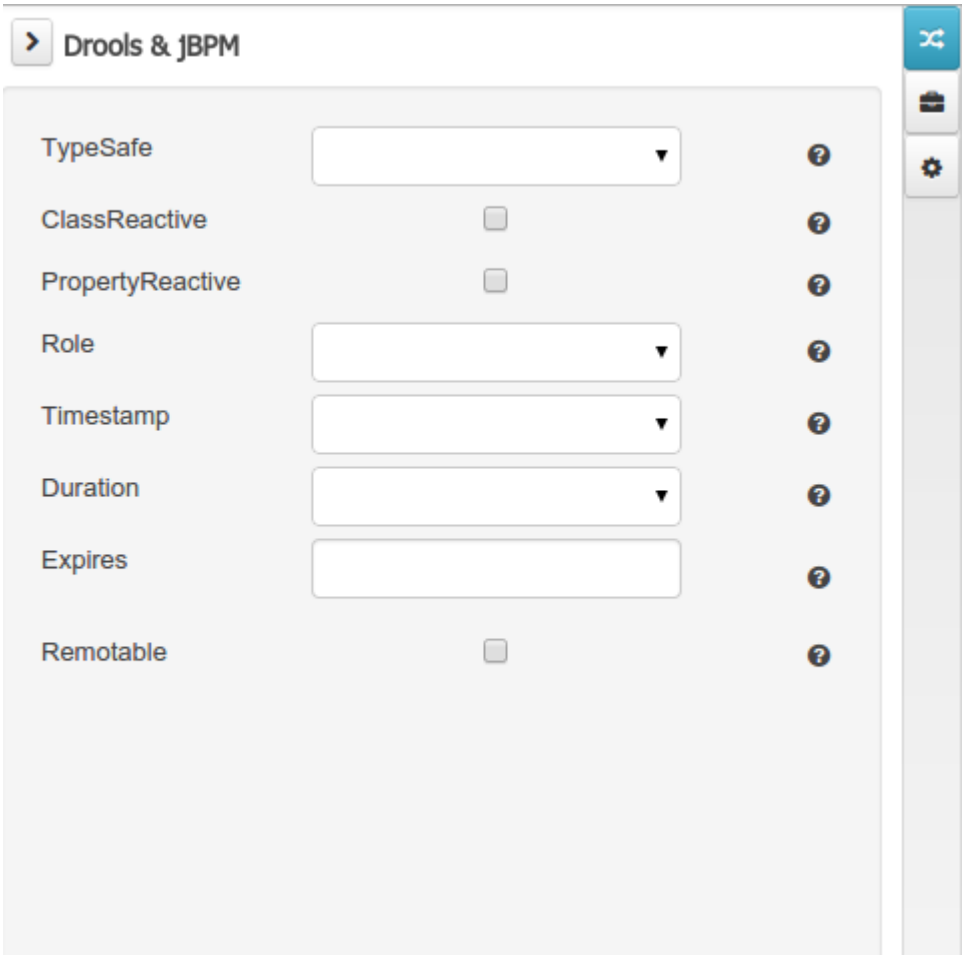


Figure 1.65. Drools & jBPM tool window

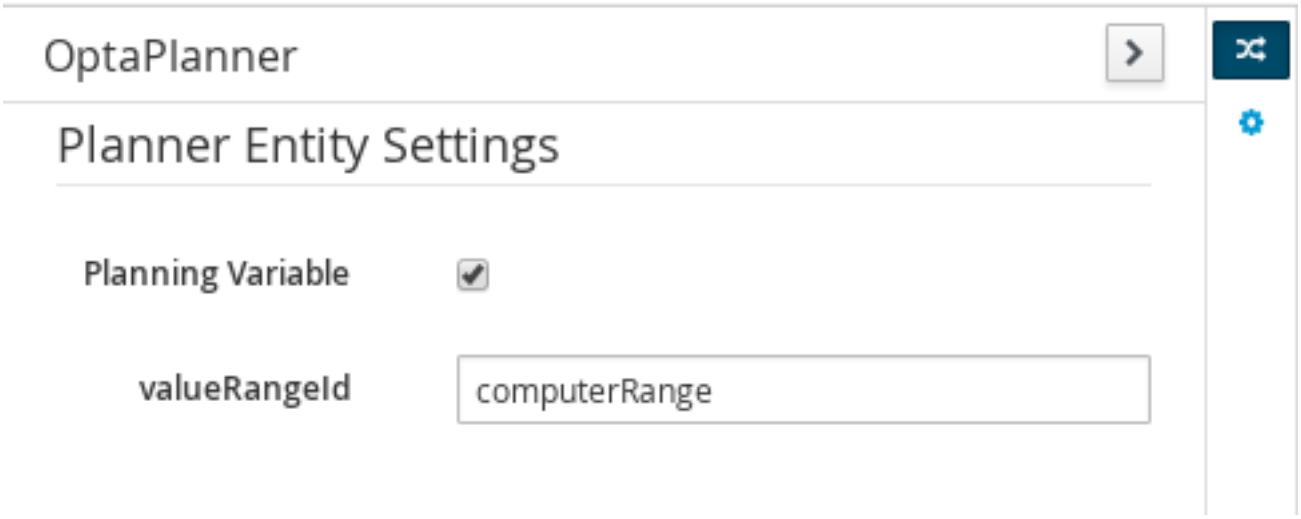


Figure 1.66. OptaPlanner tool window

Note

To see and use the OptaPlanner tool window, the user needs to have the role `plannermgmt`.

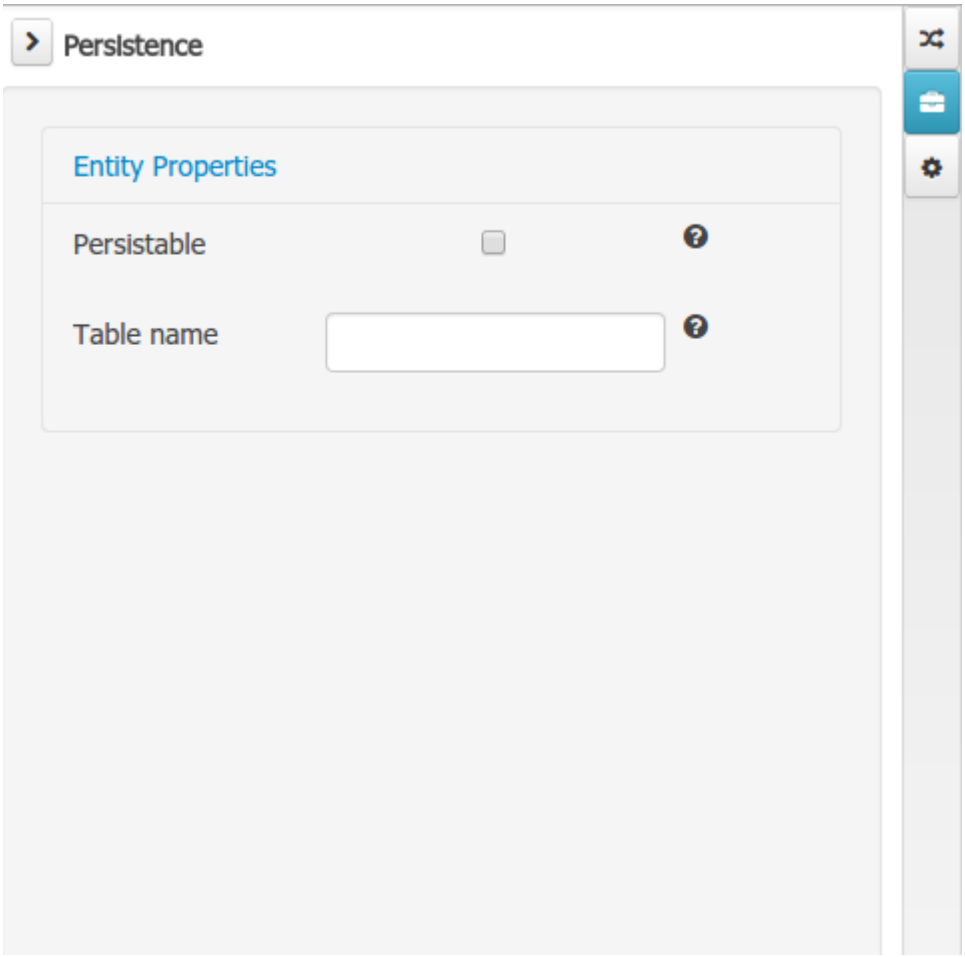


Figure 1.67. Persistence tool window

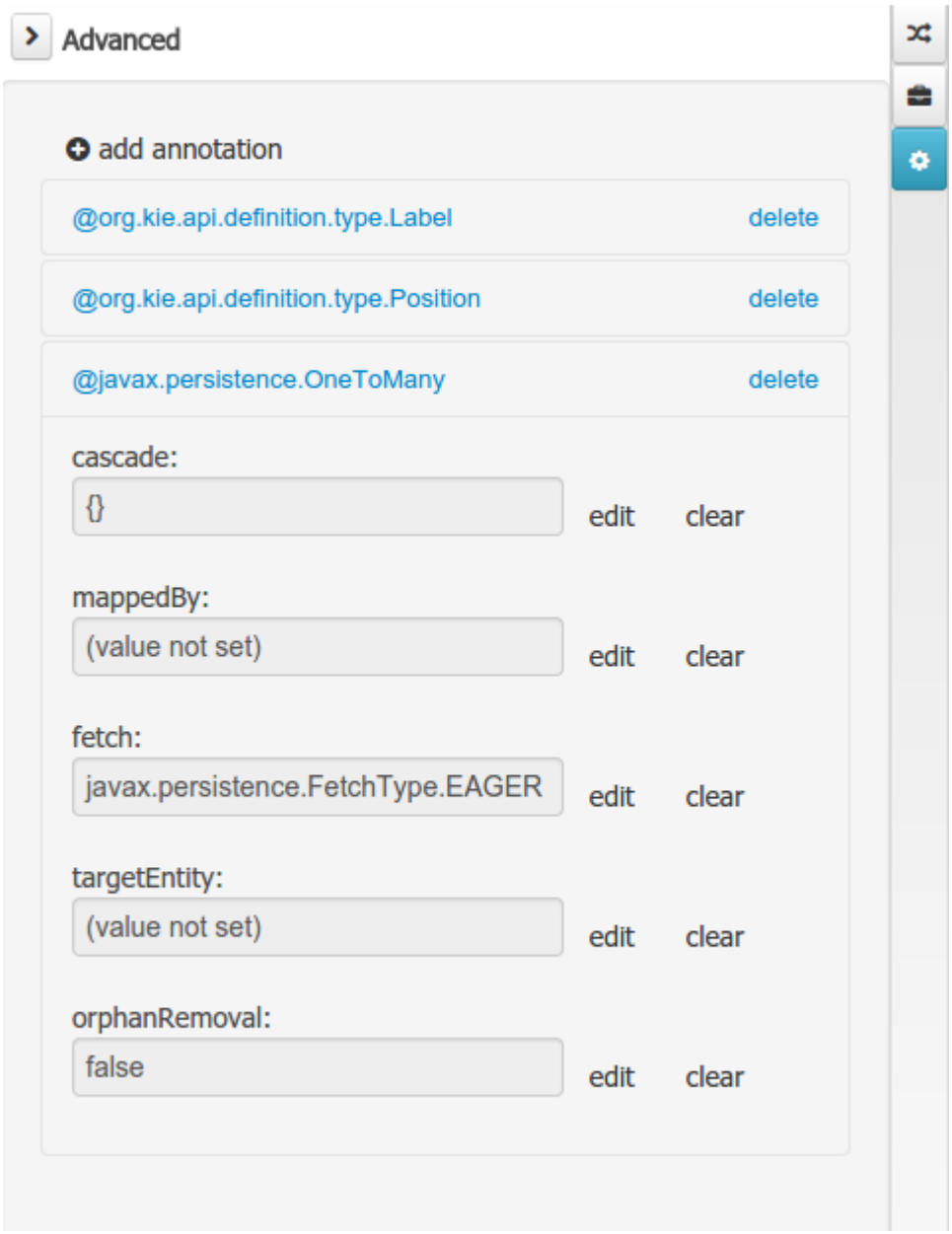


Figure 1.68. Advanced tool window

The "Source" tab shows an editor that allows the visualization and modification of the generated java code.

- Round trip between the "Editor" and "Source" tabs is possible, and also source code preservation is provided. It means that no matter where the Java code was generated (e.g. Eclipse, Data modeller), the data modeller will only update the necessary code blocks to maintain the model updated.

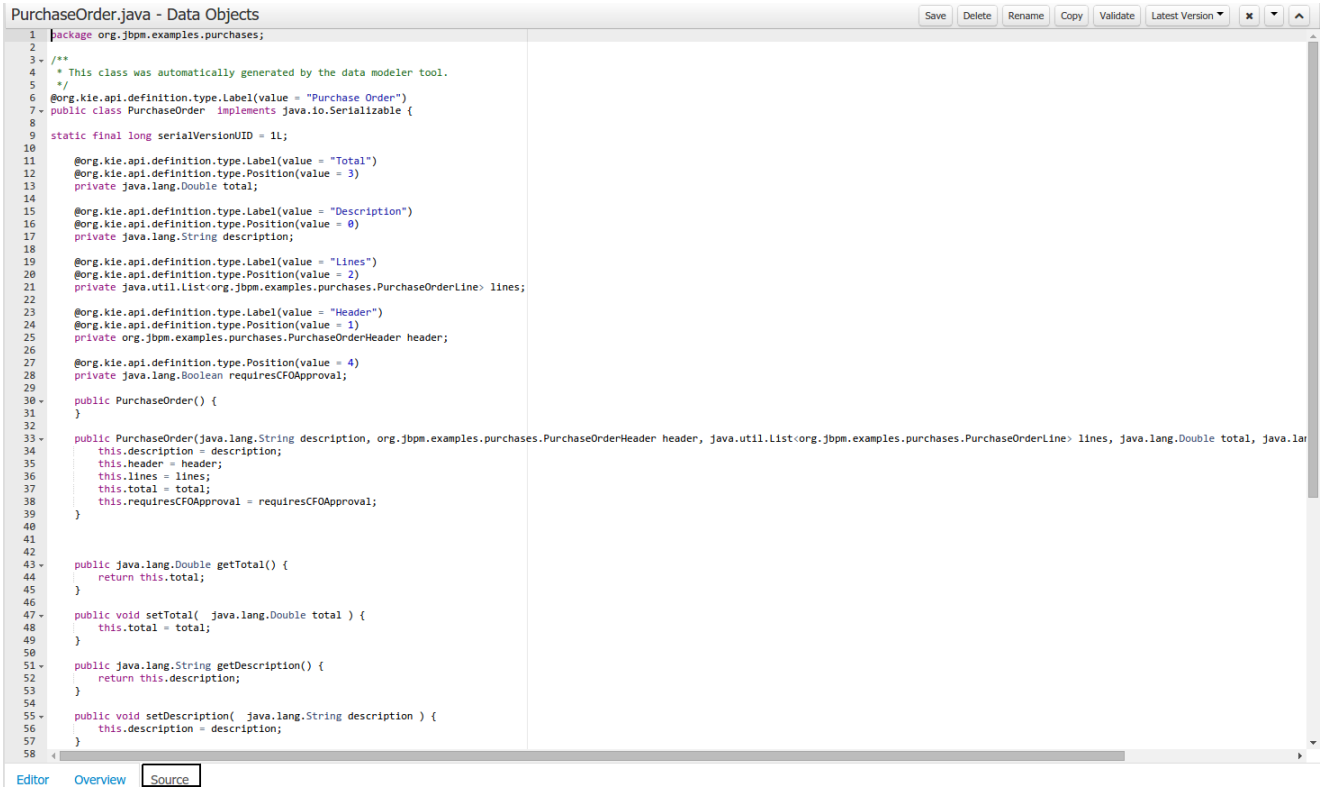


Figure 1.69. Source editor

The "Overview" tab shows the standard metadata and version information as the other workbench editors.

1.7.7.2. Data Objects

A data model consists of data objects which are a logical representation of some real-world data. Such data objects have a fixed set of modeller (or application-owned) properties, such as its internal identifier, a label, description, package etc. Besides those, a data object also has a variable set of user-defined fields, which are an abstraction of a real-world property of the type of data that this logical data object represents.

Creating a data object can be achieved using the workbench "New Item - Data Object" menu option.

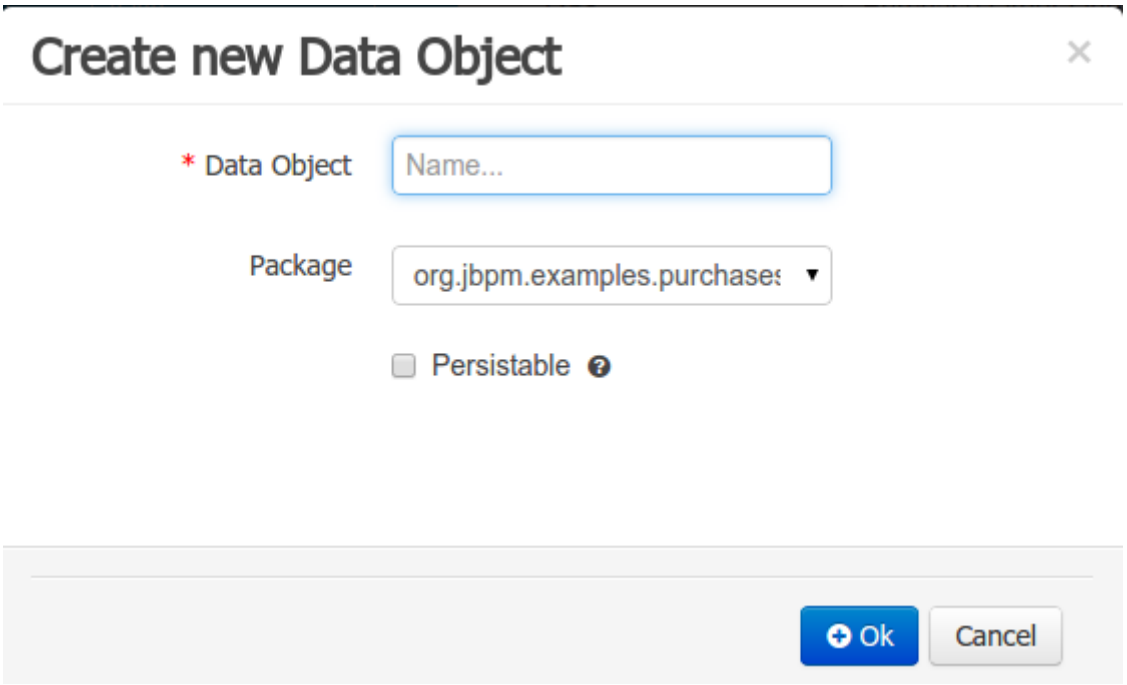


Figure 1.70. New Data Object menu option

Both resource name and location are mandatory parameters. When the "Ok" button is pressed a new Java file will be created and a new editor instance will be opened for the file edition. The optional "Persistable" attribute will add by default configurations on the data object in order to make it a JPA entity. Use this option if your jBPM project needs to store data object's information in a data base.

1.7.7.3. Properties & relationships

Once the data object has been created, it now has to be completed by adding user-defined properties to its definition. This can be achieved by pressing the "add field" button. The "New Field" dialog will be opened and the new field can be created by pressing the "Create" button. The "Create and continue" button will also add the new field to the Data Object, but won't close the dialog. In this way multiple fields can be created avoiding the popup opening multiple times. The following fields can (or must) be filled out:

- The field's internal identifier (mandatory). The value of this field must be unique per data object, i.e. if the proposed identifier already exists within current data object, an error message will be displayed.
- A label (optional): as with the data object definition, the user can define a user-friendly label for the data object field which is about to be created. This has no further implications on how fields from objects of this data object will be treated. If a label is defined, then this is how the field will be displayed throughout the data modeller tool.
- A field type (mandatory): each data object field needs to be assigned with a type.

This type can be either of the following:

1. A 'primitive java object' type: these include most of the object equivalents of the standard Java primitive types, such as Boolean, Short, Float, etc, as well as String, Date, BigDecimal and BigInteger.

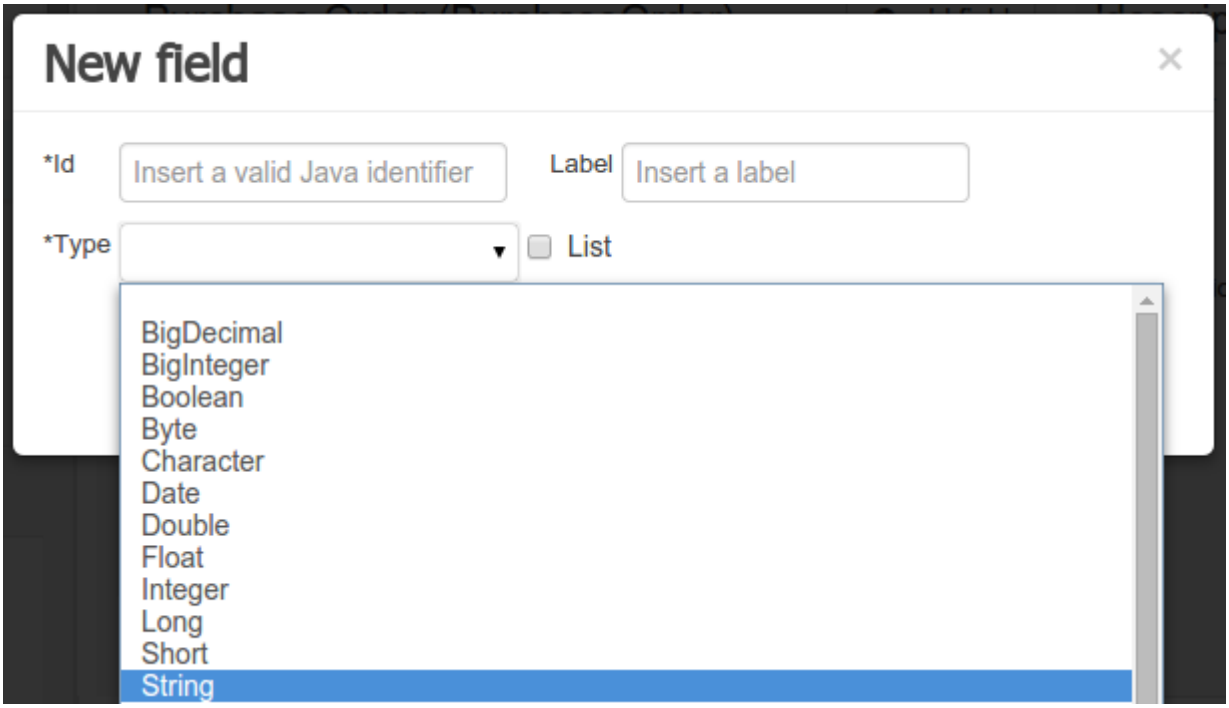


Figure 1.71. Primitive object field types

2. A 'data object' type: any user defined data object automatically becomes a candidate to be defined as a field type of another data object, thus enabling the creation of relationships between them. A data object field can be created either in 'single' or in 'multiple' form, the latter implying that the field will be defined as a collection of this type, which will be indicated by selecting "List" checkbox.

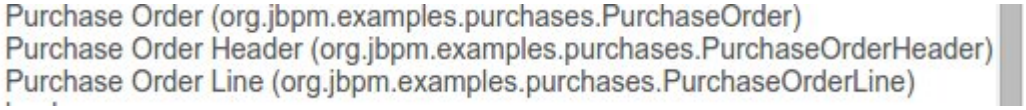


Figure 1.72. Data object field types

3. A 'primitive java' type: these include java primitive types byte, short, int, long, float, double, char and boolean.

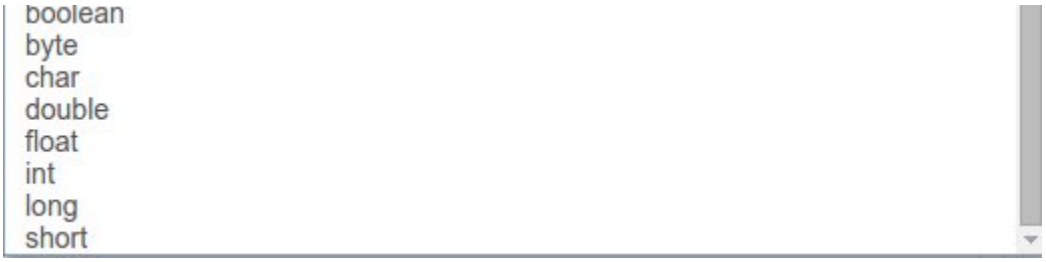


Figure 1.73. Primitive field types

When finished introducing the initial information for a new field, clicking the 'Create' button will add the newly created field to the end of the data object's fields table below:

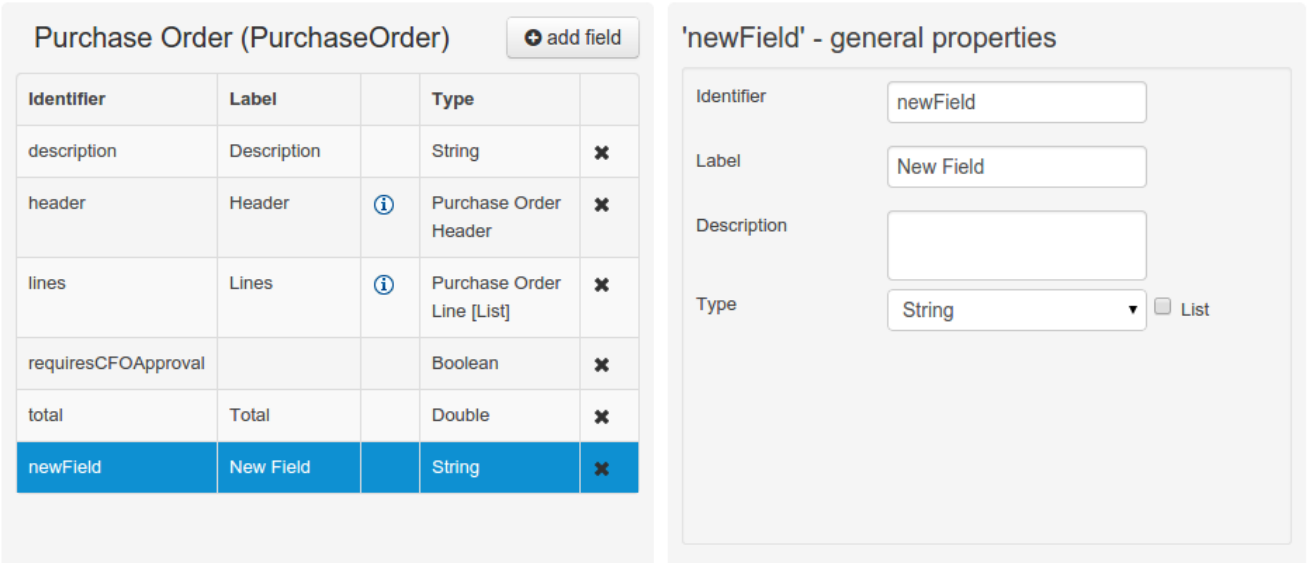


Figure 1.74. New field has been created

The new field will also automatically be selected in the data object's field list, and its properties will be shown in the Field general properties editor. Additionally the field properties will be loaded in the different tool windows, in this way the field will be ready for edition in whatever selected tool window.

At any time, any field (without restrictions) can be deleted from a data object definition by clicking on the corresponding 'x' icon in the data object's fields table.

1.7.7.4. Additional options

As stated before, both Data Objects as well as Fields require some of their initial properties to be set upon creation. Additionally there are three domains of properties that can be configured for a given Data Object. A domain is basically a set of properties related to a given business area.

Current available domains are, "Drools & jJBPM", "Persistence" and the "Advanced" domain. To work on a given domain the user should select the corresponding "Tool window" (see below) on the right side toolbar. Every tool window usually provides two editors, the "Data Object" level editor and the "Field" level editor, that will be shown depending on the last selected item, the Data Object or the Field.

1.7.7.4.1. Drools & jBPM domain

The Drools & jBPM domain editors manages the set of Data Object or Field properties related to drools applications.

1.7.7.4.1.1. Drools & jBPM object editor

The Drools & jBPM object editor manages the object level drools properties

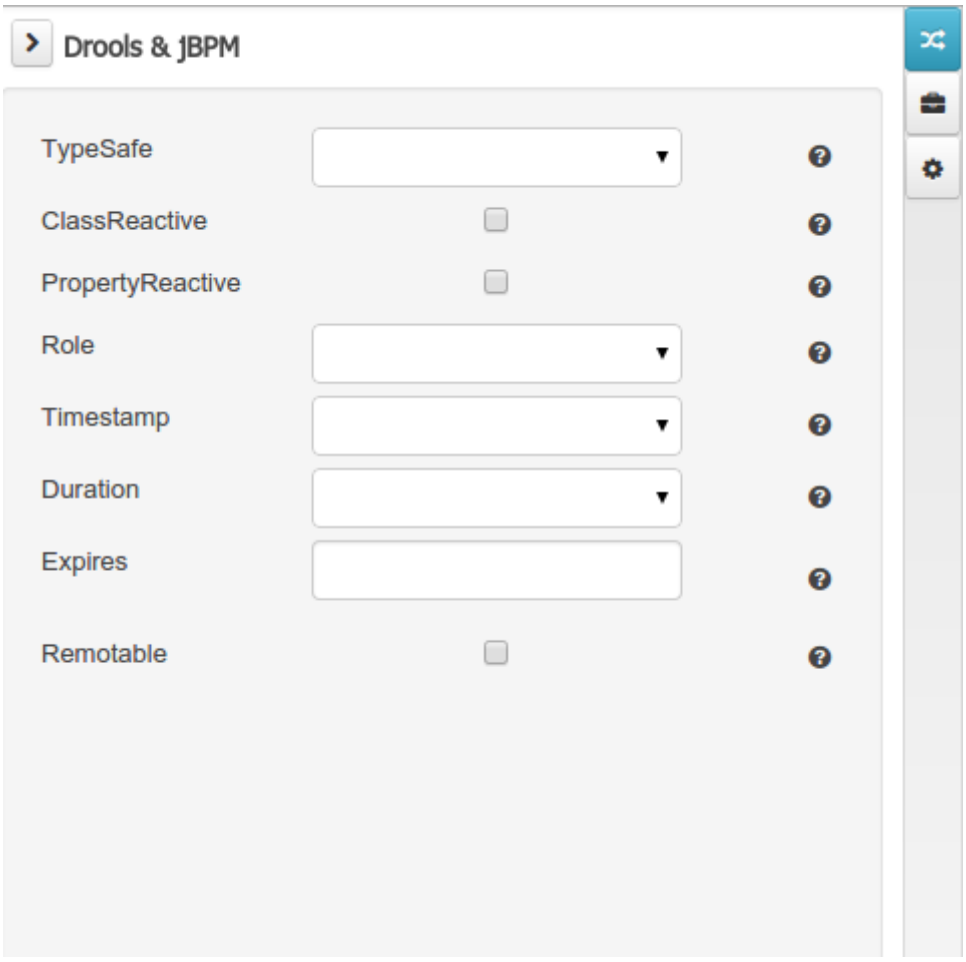


Figure 1.75. The data object's properties

- TypeSafe: this property allows to enable/disable the type safe behaviour for current type. By default all type declarations are compiled with type safety enabled. (See Drools for more information on this matter).

- ClassReactive: this property allows to mark this type to be treated as "Class Reactive" by the Drools engine. (See Drools for more information on this matter).
- PropertyReactive: this property allows to mark this type to be treated as "Property Reactive" by the Drools engine. (See Drools for more information on this matter).
- Role: this property allows to configure how the Drools engine should handle instances of this type: either as regular facts or as events. By default all types are handled as a regular fact, so for the time being the only value that can be set is "Event" to declare that this type should be handled as an event. (See Drools Fusion for more information on this matter).
- Timestamp: this property allows to configure the "timestamp" for an event, by selecting one of his attributes. If set the engine will use the timestamp from the given attribute instead of reading it from the Session Clock. If not, the engine will automatically assign a timestamp to the event. (See Drools Fusion for more information on this matter).
- Duration: this property allows to configure the "duration" for an event, by selecting one of his attributes. If set the engine will use the duration from the given attribute instead of using the default event duration = 0. (See Drools Fusion for more information on this matter).
- Expires: this property allows to configure the "time offset" for an event expiration. If set, this value must be a temporal interval in the form: [#d][#h][#m][#s][#[ms]] Where [ ] means an optional parameter and # means a numeric value. e.g.: 1d2h, means one day and two hours. (See Drools Fusion for more information on this matter).
- Remotable: If checked this property makes the Data Object available to be used with jBPM remote services as REST, JMS and WS. (See jBPM for more information on this matter).

1.7.7.4.1.2. Drools & jBPM field editor

The Drools & jBPM object editor manages the field level drools properties

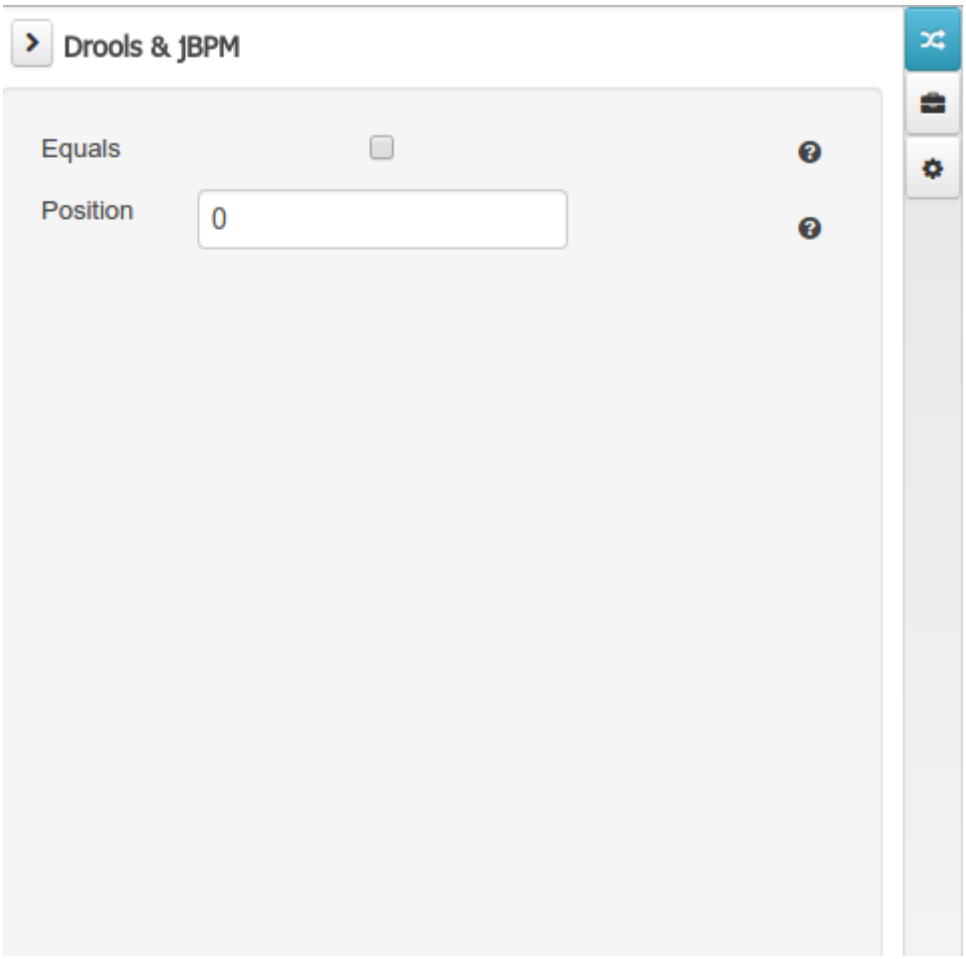


Figure 1.76. The data object's field properties

- Equals: checking this property for a Data Object field implies that it will be taken into account, at the code generation level, for the creation of both the equals() and hashCode() methods in the generated Java class. We will explain this in more detail in the following section.
- Position: this field requires a zero or positive integer. When set, this field will be interpreted by the Drools engine as a positional argument (see the section below and also the Drools documentation for more information on this subject).

1.7.7.4.2. Persistence domain

The Persistence domain editors manages the set of Data Object or Field properties related to persistence.

1.7.7.4.2.1. Persistence domain object editor

Persistence domain object editor manages the object level persistence properties

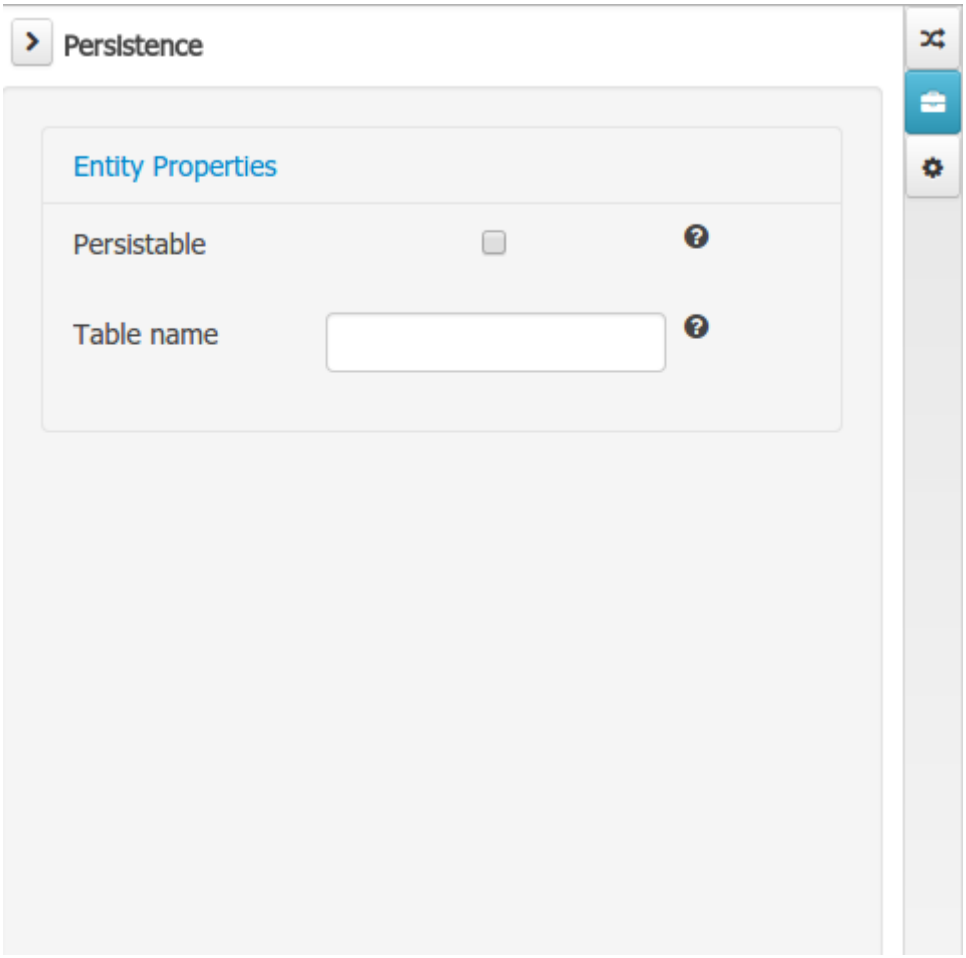


Figure 1.77. The data object's properties

- Persistable: this property allows to configure current Data Object as persistable.
- Table name: this property allows to set a user defined database table name for current Data Object.

1.7.7.4.2.2. Persistence domain field editor

The persistence domain field editor manages the field level persistence properties and is divided in three sections.

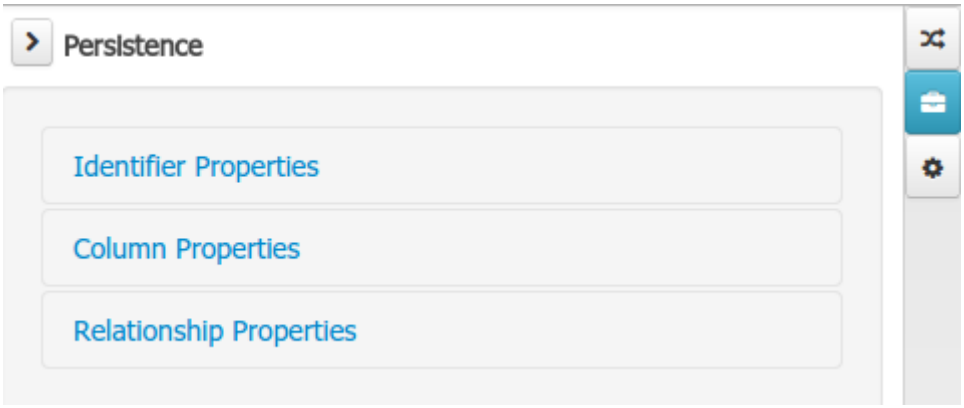
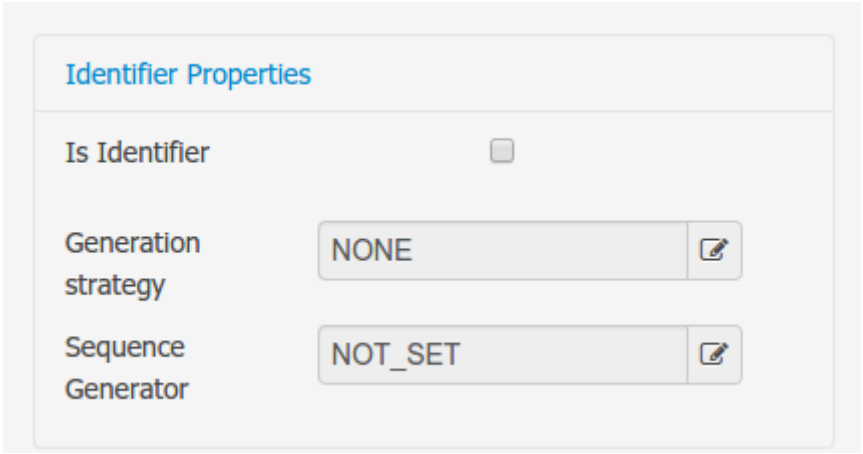


Figure 1.78. Persistence domain field editor sections

1.7.7.4.2.2.1. Identifier:



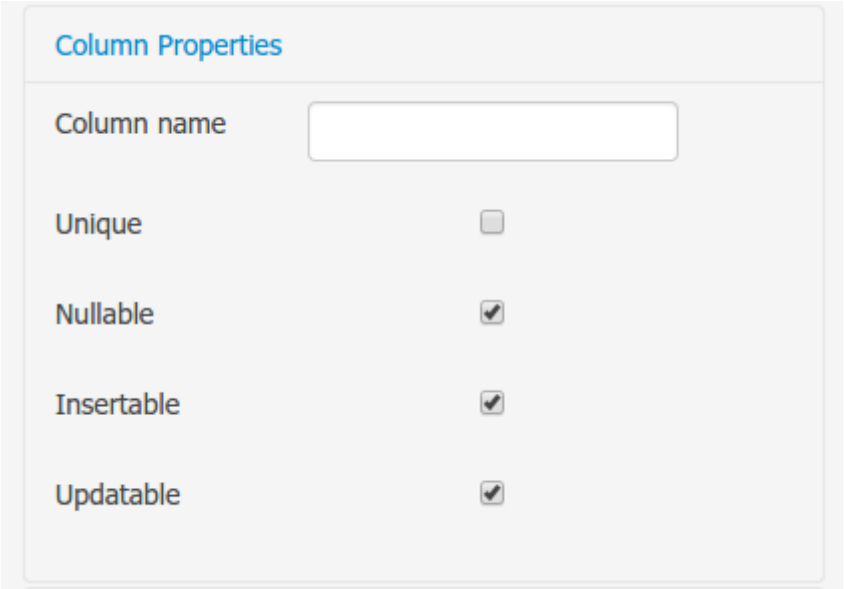
A persistable Data Object should have one and only one field defined as the Data Object identifier. The identifier is typically a unique number that distinguishes a given Data Object instance from all other instances of the same class.

- Is Identifier: marks current field as the Data Object identifier. A persistable Data Object should have one and only one field marked as identifier, and it should be a base java type, like String, Integer, Long, etc. A field that references a Data Object, or is a multiple field can not be marked as identifier. And also composite identifiers are not supported in this version. When a persistable Data Object is created an identifier field is created by default with the properly initializations, it's strongly recommended to use this identifier.
- Generation Strategy: the generation strategy establishes how the identifier values will be automatically generated when the Data Object instances are created and stored in a database. (e.g. by the forms associated to jBPM processes human tasks.) When the by default Identifier field is created, the generation strategy will be also automatically set and it's strongly recommended to use this configuration.

- Sequence Generator: the generator represents the seed for the values that will be used by the Generation Strategy. When the by default Identifier field is created the Sequence Generator will be also automatically generated and properly configured to be used by the Generation Strategy.

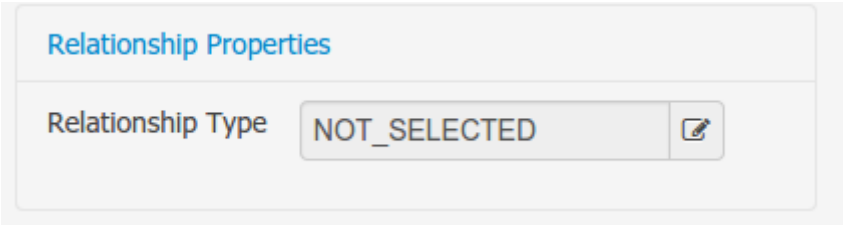
1.7.7.4.2.2.2. Column Properties:

The column properties section enables the customization of some properties of the database column that will store the field value.



- Column name: optional value that sets the database column name for the given field.
- Unique: When checked the unique property establishes that current field value should be a unique key when stored in the database. (if not set the default value is false)
- Nullable: When checked establishes that current field value can be null when stored in a database. (if not set the default value is true)
- Insertable: When checked establishes that column will be included in SQL INSERT statements generated by the persistence provider. (if not set the default value is true)
- Updatable: When checked establishes that the column will be included SQL UPDATE statements generated by the persistence provider. (if not set the default value is true)

1.7.7.4.2.2.3. Relationship Properties:



When the field's type is a Data Object type, or a list of a Data Object type a relationship type should be set in order to let the persistence provider to manage the relation. Fortunately this relation type is automatically set when such kind of fields are added to an already marked as persistable Data Object. The relationship type is set by the following popup.

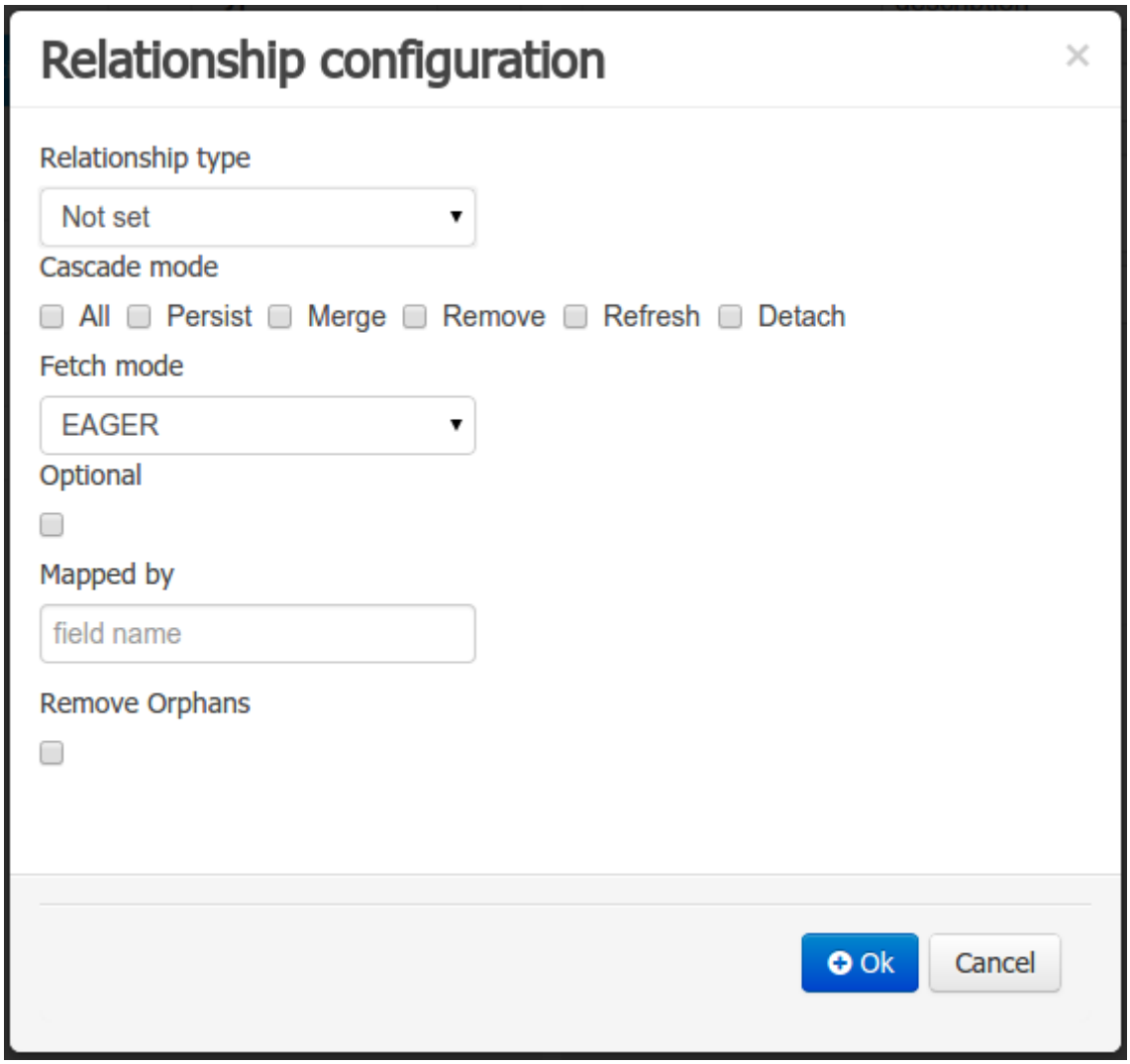


Figure 1.79. Relationship configuration popup

- Relationship type: sets the type of relation from one of the following options:

  One to one: typically used for 1:1 relations where "A is related to one instance of B", and B exists only when A exists. e.g. PurchaseOrder -> PurchaseOrderHeader (a PurchaseOrderHeader exists only if the PurchaseOrder exists)

  One to many: typically used for 1:N relations where "A is related to N instances of B", and the related instances of B exists only when A exists. e.g. PurchaseOrder -> PurchaseOrderLine (a PurchaseOrderLine exists only if the PurchaseOrder exists)

Many to one: typically used for 1:1 relations where "A is related to one instance of B", and B can exist even without A. e.g. PurchaseOrder -> Client (a Client can exist in the database even without an associated PurchaseOrder)

Many to many: typically used for N:N relations where "A can be related to N instances of B, and B can be related to M instances of A at the same time", and both B an A instances can exits in the database independently of the related instances. e.g. Course -> Student. (Course can be related to N Students, and a given Student can attend to M courses)

When a field of type "Data Object" is added to a given persistable Data Object, the "Many to One" relationship type is generated by default.

And when a field of type "list of Data Object" is added to a given persistable Data Object , the "One to Many" relationship is generated by default.

- Cascade mode: Defines the set of cascadable operations that are propagated to the associated entity. The value cascade=ALL is equivalent to cascade={PERSIST, MERGE, REMOVE, REFRESH}. e.g. when A -> B, and cascade "PERSIST or ALL" is set, if A is saved, then B will be also saved.

  The by default cascade mode created by the data modeller is "ALL" and it's strongly recommended to use this mode when Data Objects are being used by jBPM processes and forms.

- Fetch mode: Defines how related data will be fetched from database at reading time.

  EAGER: related data will be read at the same time. e.g. If A -> B, when A is read from database B will be read at the same time.

  LAZY: reading of related data will be delayed usually to the moment they are required. e.g. If PurchaseOrder -> PurchaseOrderLine the lines reading will be postponed until a method "getLines()" is invoked on a PurchaseOrder instance.

  The default fetch mode created by the data modeller is "EAGER" and it's strongly recommended to use this mode when Data Objects are being used by jBPM processes and forms.

- Optional: establishes if the right side member of a relationship can be null.

- Mapped by: used for reverse relations.

1.7.7.4.3. Advanced domain

The advanced domain enables the configuration of whatever parameter set by the other domains as well as the adding of arbitrary parameters. As it will be shown in the code generation section every "Data Object / Field" parameter is represented by a java annotation. The advanced mode enables the configuration of this annotations.

1.7.7.4.3.1. Advanced domain Data Object / Field editor.

The advanced domain editor has the same shape for both Data Object and Field.

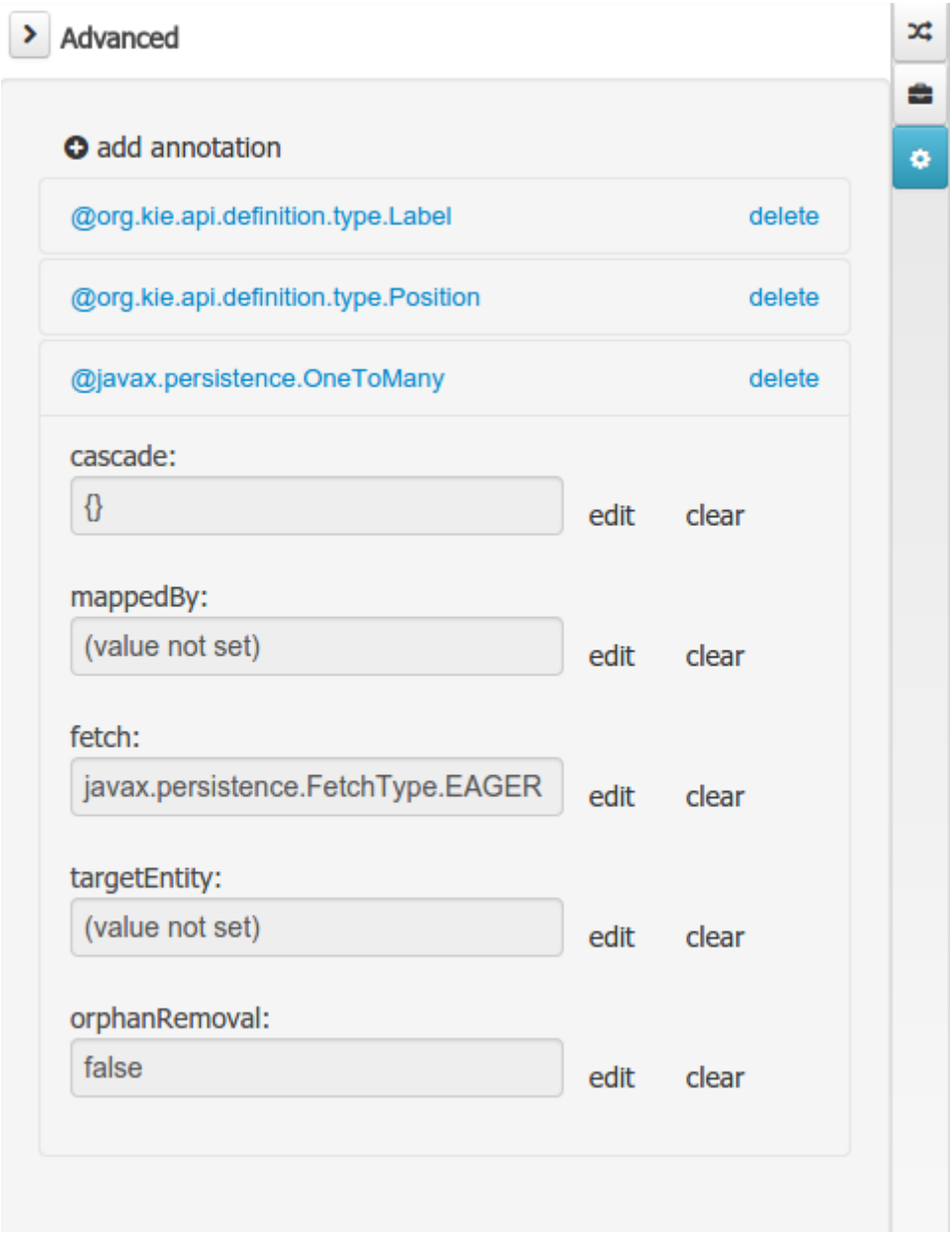


Figure 1.80. Advanced domain editor.

The following operations are available

- delete: enables the deletion of a given Data Object or Field annotation.
- clear: clears a given annotation parameter value.
- edit: enables the edition of a given annotation parameter value.
- add annotation: The add annotation button will start a wizard that will let the addition of whatever java annotation available in the project dependencies.

Add annotation wizard step #1: the first step of the wizard requires the entering of a fully qualified class name of an annotation, and by pressing the "search" button the annotation definition will be loaded into the wizard. Additionally when the annotation definition is loaded, different wizard steps will be created in order to enable the completion of the different annotation parameters. Required parameters will be marked with "*".

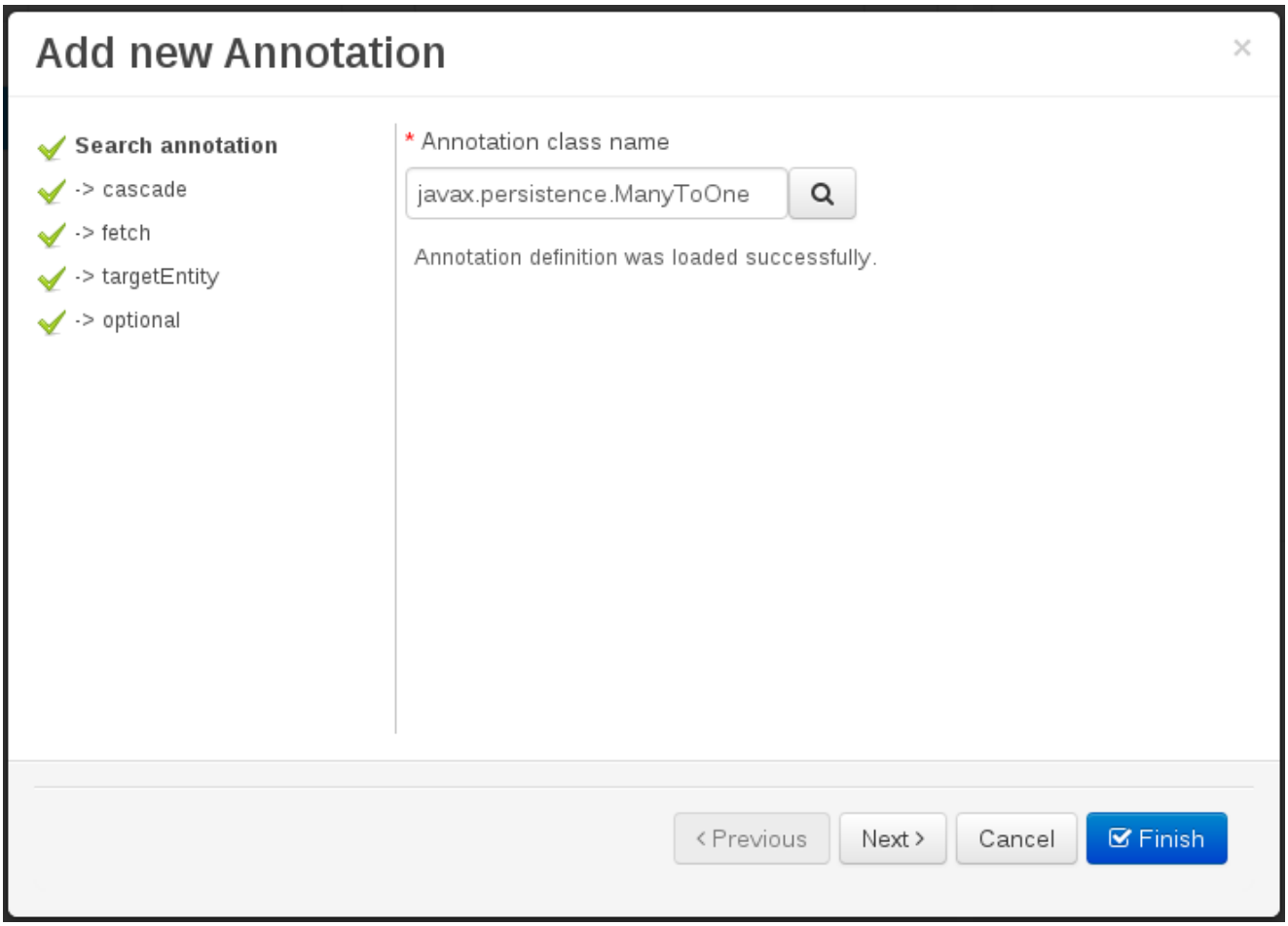


Figure 1.81. Annotation definition loaded into the wizard.

Whenever it's possible the wizard will provide a suitable editor for the given parameters.

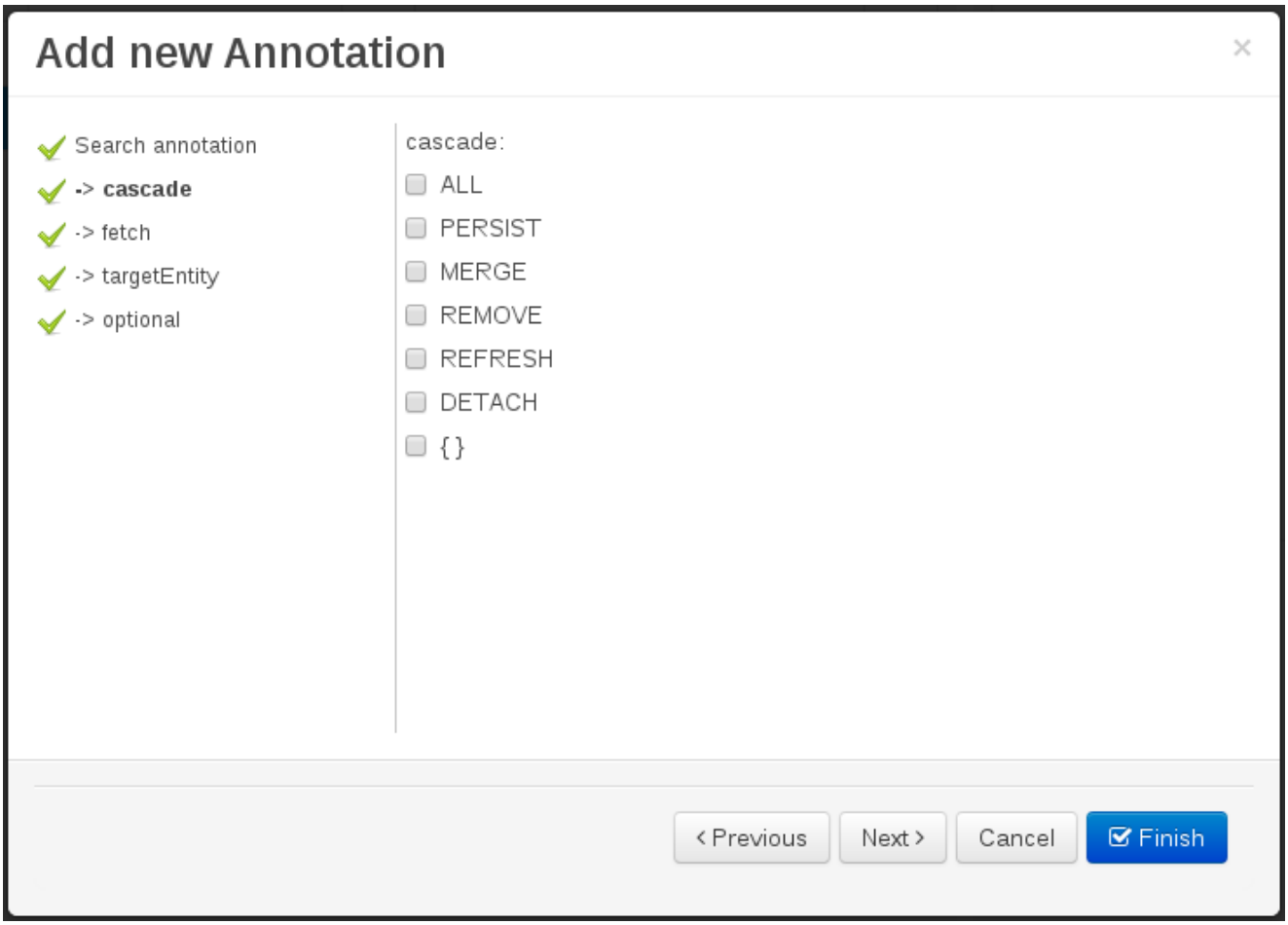


Figure 1.82. Automatically generated enum values editor for an Enumeration annotation parameter.

A generic parameter editor will be provided when it's not possible to calculate a customized editor

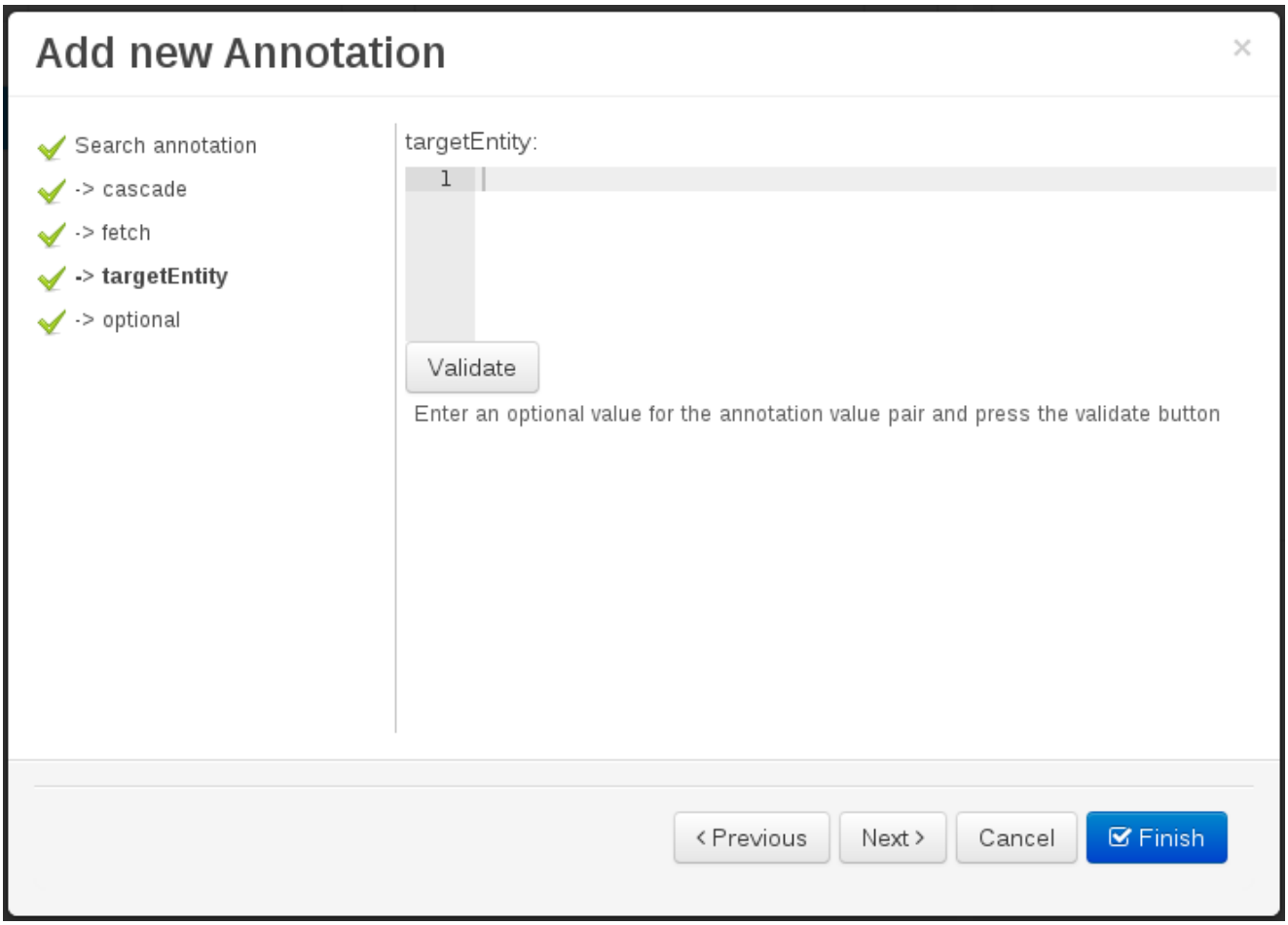


Figure 1.83. Generic annotation parameter editor

When all required parameters have been entered and validated, the finish button will be enabled and the wizard can be completed by adding the annotation to the given Data Object or Field.

1.7.7.5. Generate data model code.

The data model in itself is merely a visual tool that allows the user to define high-level data structures, for them to interact with the Drools Engine on the one hand, and the jBPM platform on the other. In order for this to become possible, these high-level visual structures have to be transformed into low-level artifacts that can effectively be consumed by these platforms. These artifacts are Java POJOs (Plain Old Java Objects), and they are generated every time the data model is saved, by pressing the "Save" button in the top Data Modeller Menu. Additionally when the user round trip between the "Editor" and "Source" tab, the code is auto generated to maintain the consistency with the Editor view and vice versa.

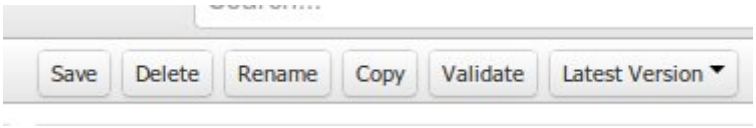


Figure 1.84. Save the data model from the top menu

The resulting code is generated according to the following transformation rules:

- The data object's identifier property will become the Java class's name. It therefore needs to be a valid Java identifier.
- The data object's package property becomes the Java class's package declaration.
- The data object's superclass property (if present) becomes the Java class's extension declaration.
- The data object's label and description properties will translate into the Java annotations "@org.kie.api.definition.type.Label" and "@org.kie.api.definition.type.Description", respectively. These annotations are merely a way of preserving the associated information, and as yet are not processed any further.
- The data object's role property (if present) will be translated into the "@org.kie.api.definition.type.Role" Java annotation, that *IS* interpreted by the application platform, in the sense that it marks this Java class as a Drools Event Fact-Type.
- The data object's type safe property (if present) will be translated into the "@org.kie.api.definition.type.TypeSafe Java annotation. (see Drools)
- The data object's class reactive property (if present) will be translated into the "@org.kie.api.definition.type.ClassReactive Java annotation. (see Drools)
- The data object's property reactive property (if present) will be translated into the "@org.kie.api.definition.type.PropertyReactive Java annotation. (see Drools)
- The data object's timestamp property (if present) will be translated into the "@org.kie.api.definition.type.Timestamp Java annotation. (see Drools)
- The data object's duration property (if present) will be translated into the "@org.kie.api.definition.type.Duration Java annotation. (see Drools)
- The data object's expires property (if present) will be translated into the "@org.kie.api.definition.type.Expires Java annotation. (see Drools)
- The data object's remotable property (if present) will be translated into the "@org.kie.api.remote.Remotable Java annotation. (see jBPM)

A standard Java default (or no parameter) constructor is generated, as well as a full parameter constructor, i.e. a constructor that accepts as parameters a value for each of the data object's user-defined fields.

The data object's user-defined fields are translated into Java class fields, each one of them with its own getter and setter method, according to the following transformation rules:

- The data object field's identifier will become the Java field identifier. It therefore needs to be a valid Java identifier.
- The data object field's type is directly translated into the Java class's field type. In case the field was declared to be multiple (i.e. 'List'), then the generated field is of the "java.util.List" type.
- The equals property: when it is set for a specific field, then this class property will be annotated with the "@org.kie.api.definition.type.Key" annotation, which is interpreted by the Drools Engine, and it will 'participate' in the generated equals() method, which overwrites the equals() method of the Object class. The latter implies that if the field is a 'primitive' type, the equals method will simply compare its value with the value of the corresponding field in another instance of the class. If the field is a sub-entity or a collection type, then the equals method will make a method-call to the equals method of the corresponding data object's Java class, or of the java.util.List standard Java class, respectively.

  If the equals property is checked for *ANY* of the data object's user defined fields, then this also implies that in addition to the default generated constructors another constructor is generated, accepting as parameters all of the fields that were marked with Equals. Furthermore, generation of the equals() method also implies that also the Object class's hashCode() method is overwritten, in such a manner that it will call the hashCode() methods of the corresponding Java class types (be it 'primitive' or user-defined types) for all the fields that were marked with Equals in the Data Model.
- The position property: this field property is automatically set for all user-defined fields, starting from 0, and incrementing by 1 for each subsequent new field. However the user can freely change the position among the fields. At code generation time this property is translated into the "@org.kie.api.definition.type.Position" annotation, which can be interpreted by the Drools Engine. Also, the established property order determines the order of the constructor parameters in the generated Java class.

As an example, the generated Java class code for the Purchase Order data object, corresponding to its definition as shown in the following figure purchase_example.jpg is visualized in the figure at the bottom of this chapter. Note that the two of the data object's fields, namely 'header' and 'lines' were marked with Equals, and have been assigned with the positions 2 and 1, respectively).

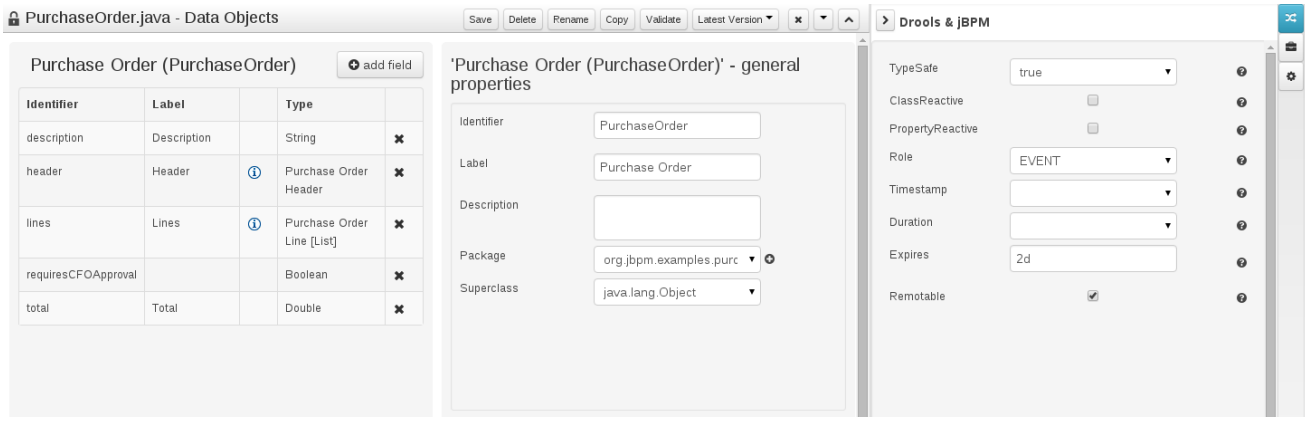


Figure 1.85. Purchase Order configuration

```
package org.jbpm.examples.purchases;

/**
* This class was automatically generated by the data modeler tool.
*/
@org.kie.api.definition.type.Label("Purchase Order")
@org.kie.api.definition.type.TypeSafe(true)
@org.kie.api.definition.type.Role(org.kie.api.definition.type.Role.Type.EVENT)
@org.kie.api.definition.type.Expires("2d")
@org.kie.api.remote.Remotable
public class PurchaseOrder implements java.io.Serializable
{

static final long serialVersionUID = 1L;

@org.kie.api.definition.type.Label("Total")
@org.kie.api.definition.type.Position(3)
private java.lang.Double total;

@org.kie.api.definition.type.Label("Description")
@org.kie.api.definition.type.Position(0)
private java.lang.String description;

@org.kie.api.definition.type.Label("Lines")
@org.kie.api.definition.type.Position(2)
@org.kie.api.definition.type.Key
private java.util.List<org.jbpm.examples.purchases.PurchaseOrderLine> lines;

@org.kie.api.definition.type.Label("Header")
@org.kie.api.definition.type.Position(1)
@org.kie.api.definition.type.Key
private org.jbpm.examples.purchases.PurchaseOrderHeader header;

@org.kie.api.definition.type.Position(4)
private java.lang.Boolean requiresCFOApproval;

public PurchaseOrder()
```

```
    {
    }

    public java.lang.Double getTotal()
    {
    return this.total;
    }

    public void setTotal(java.lang.Double total)
    {
    this.total = total;
    }

    public java.lang.String getDescription()
    {
    return this.description;
    }

    public void setDescription(java.lang.String description)
    {
    this.description = description;
    }

    public java.util.List<org.jbpm.examples.purchases.PurchaseOrderLine> getLines()
    {
    return this.lines;
    }

    public void setLines(java.util.List<org.jbpm.examples.purchases.PurchaseOrderLine> lines)
    {
    this.lines = lines;
    }

    public org.jbpm.examples.purchases.PurchaseOrderHeader getHeader()
    {
    return this.header;
    }

    public void setHeader(org.jbpm.examples.purchases.PurchaseOrderHeader header)
    {
    this.header = header;
    }

    public java.lang.Boolean getRequiresCFOApproval()
    {
    return this.requiresCFOApproval;
    }

    public void setRequiresCFOApproval(java.lang.Boolean requiresCFOApproval)
    {
    this.requiresCFOApproval = requiresCFOApproval;
    }

    public PurchaseOrder(java.lang.Double total, java.lang.String description,
    java.util.List<org.jbpm.examples.purchases.PurchaseOrderLine> lines,
    org.jbpm.examples.purchases.PurchaseOrderHeader header,
    java.lang.Boolean requiresCFOApproval)
    {
    this.total = total;
```

```
this.description = description;
this.lines = lines;
this.header = header;
this.requiresCFOApproval = requiresCFOApproval;
}

public PurchaseOrder(java.lang.String description,
org.jbpm.examples.purchases.PurchaseOrderHeader header,
java.util.List<org.jbpm.examples.purchases.PurchaseOrderLine> lines,
java.lang.Double total, java.lang.Boolean requiresCFOApproval)
{
this.description = description;
this.header = header;
this.lines = lines;
this.total = total;
this.requiresCFOApproval = requiresCFOApproval;
}

public PurchaseOrder(
java.util.List<org.jbpm.examples.purchases.PurchaseOrderLine> lines,
org.jbpm.examples.purchases.PurchaseOrderHeader header)
{
this.lines = lines;
this.header = header;
}

@Override
public boolean equals(Object o)
{
if (this == o)
return true;
if (o == null || getClass() != o.getClass())
return false;
org.jbpm.examples.purchases.PurchaseOrder that = (org.jbpm.examples.purchases.PurchaseOrder) o;
if (lines != null ? !lines.equals(that.lines) : that.lines != null)
return false;
if (header != null ? !header.equals(that.header) : that.header != null)
return false;
return true;
}

@Override
public int hashCode()
{
int result = 17;
result = 31 * result + (lines != null ? lines.hashCode() : 0);
result = 31 * result + (header != null ? header.hashCode() : 0);
return result;
}

}
```

1.7.7.6. Using external models

Using an external model means the ability to use a set for already defined POJOs in current project context. In order to make those POJOs available a dependency to the given JAR should be added. Once the dependency has been added the external POJOs can be referenced from current project data model.

There are two ways to add a dependency to an external JAR file:

- Dependency to a JAR file already installed in current local M2 repository (typically associated the the user home).
- Dependency to a JAR file installed in current KIE Workbench/Drools Workbench "Guvnor M2 repository". (internal to the application)

1.7.7.6.1. Dependency to a JAR file in local M2 repository

To add a dependency to a JAR file in local M2 repository follow these steps.

1.7.7.6.1.1. Open the Project Editor for current project and select the Dependencies view.

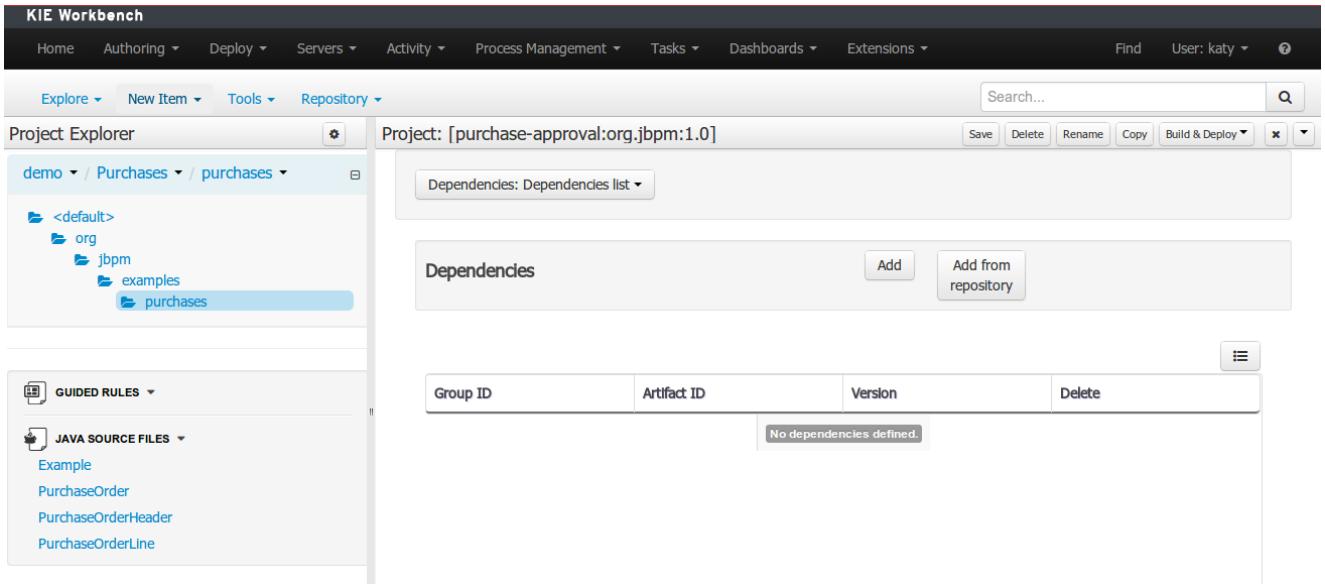


Figure 1.86. Project editor.

1.7.7.6.1.2. Click on the "Add" button to add a new dependency line.

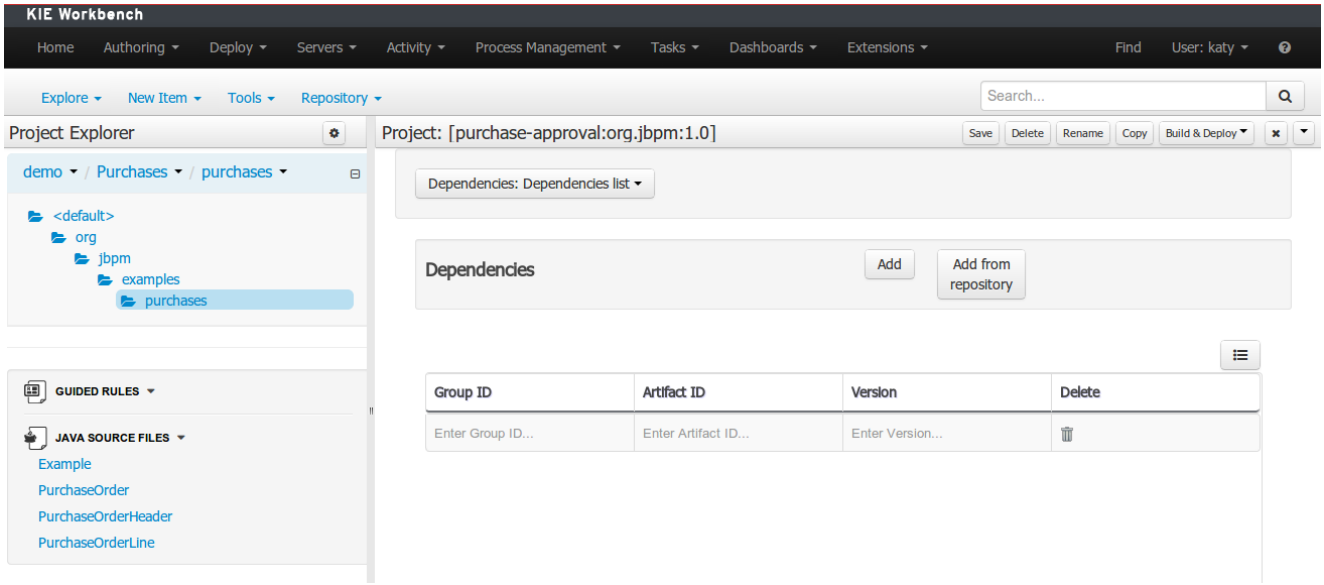


Figure 1.87. New dependency line.

1.7.7.6.1.3. Complete the GAV for the JAR file already installed in local M2 repository.

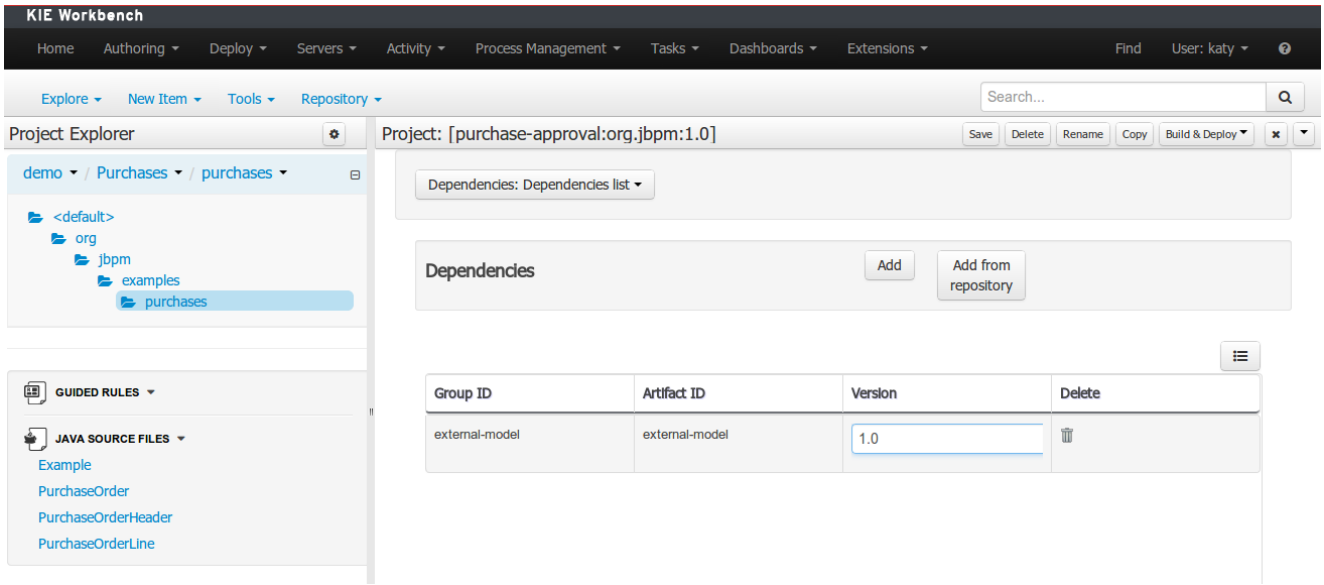


Figure 1.88. Dependency line edition.

1.7.7.6.1.4. Save the project to update its dependencies.

When project is saved the POJOs defined in the external file will be available.

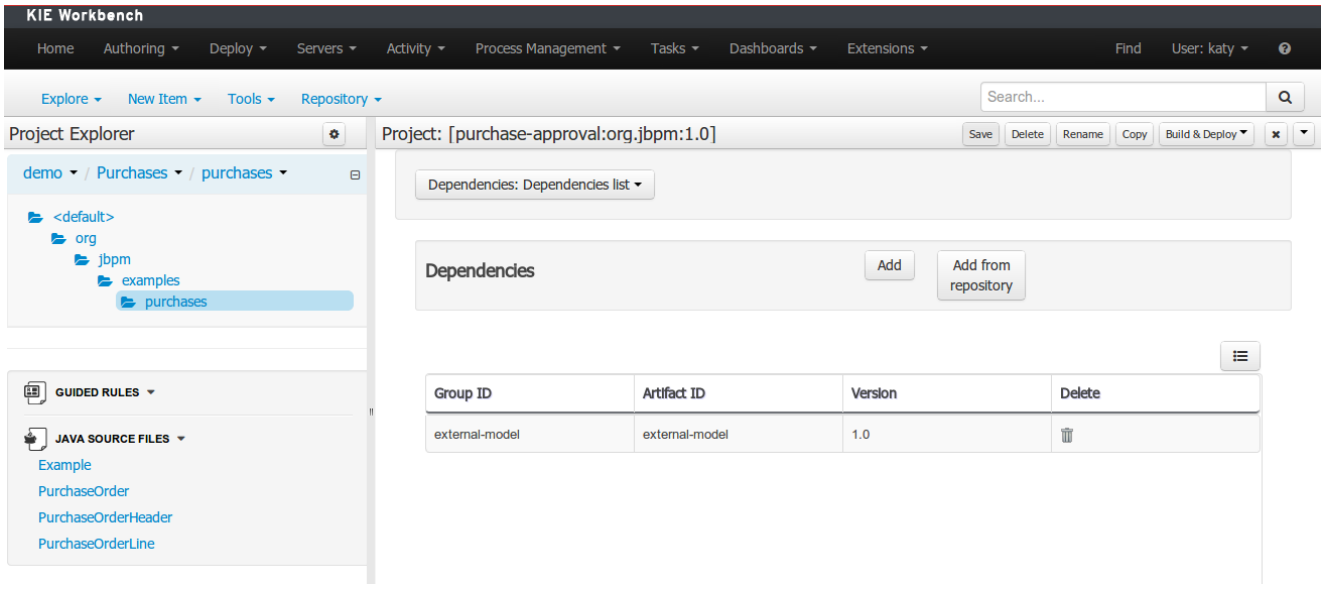


Figure 1.89. Save project.

1.7.7.6.2. Dependency to a JAR file in current "Guvnor M2 repository".

To add a dependency to a JAR file in current "Guvnor M2 repository" follow these steps.

1.7.7.6.2.1. Open the Maven Artifact Repository editor.

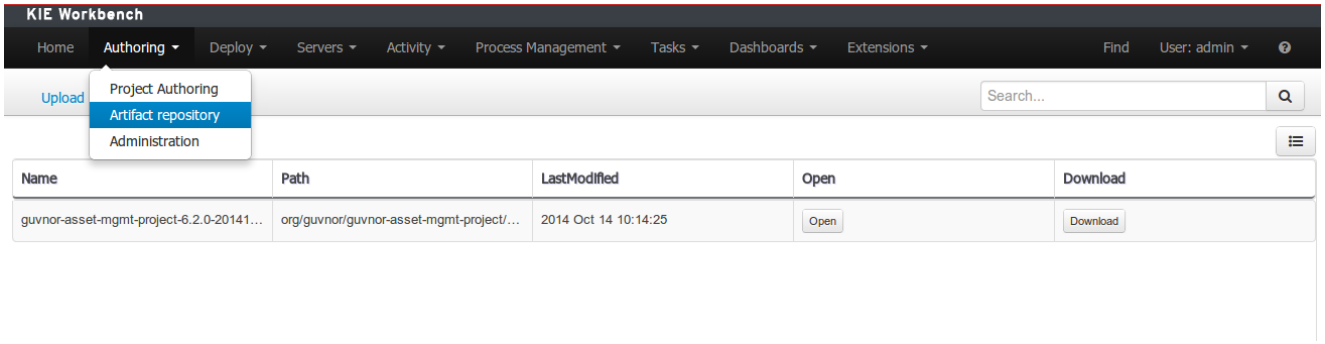


Figure 1.90. Guvnor M2 Repository editor.

1.7.7.6.2.2. Browse your local file system and select the JAR file to be uploaded using the Browse button.

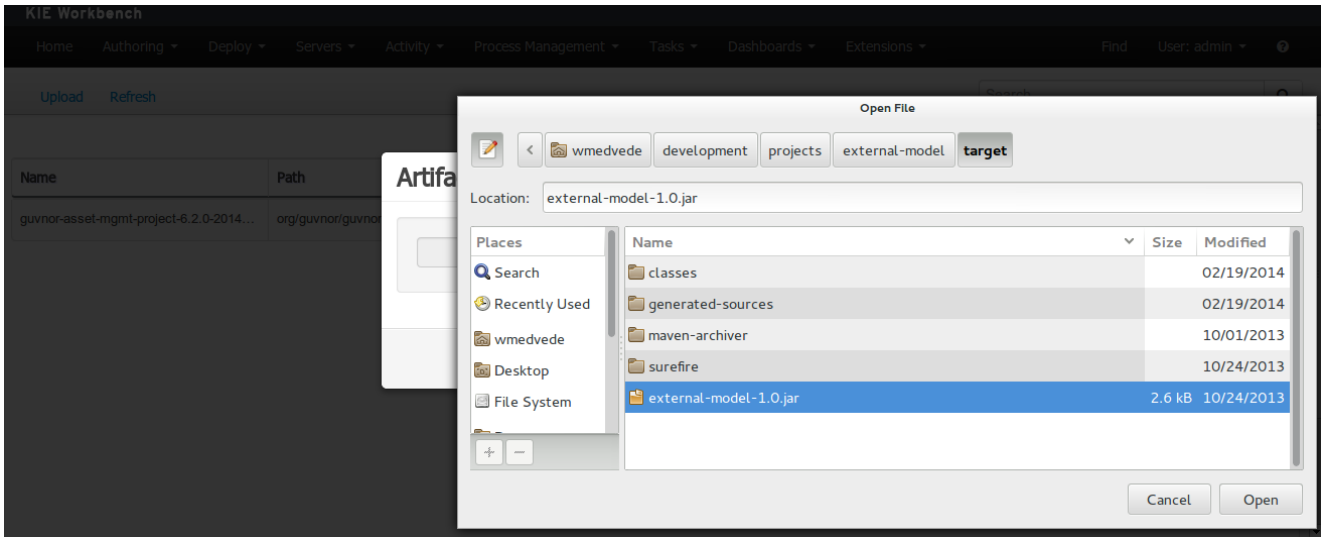


Figure 1.91. File browser.

1.7.7.6.2.3. Upload the file using the Upload button.

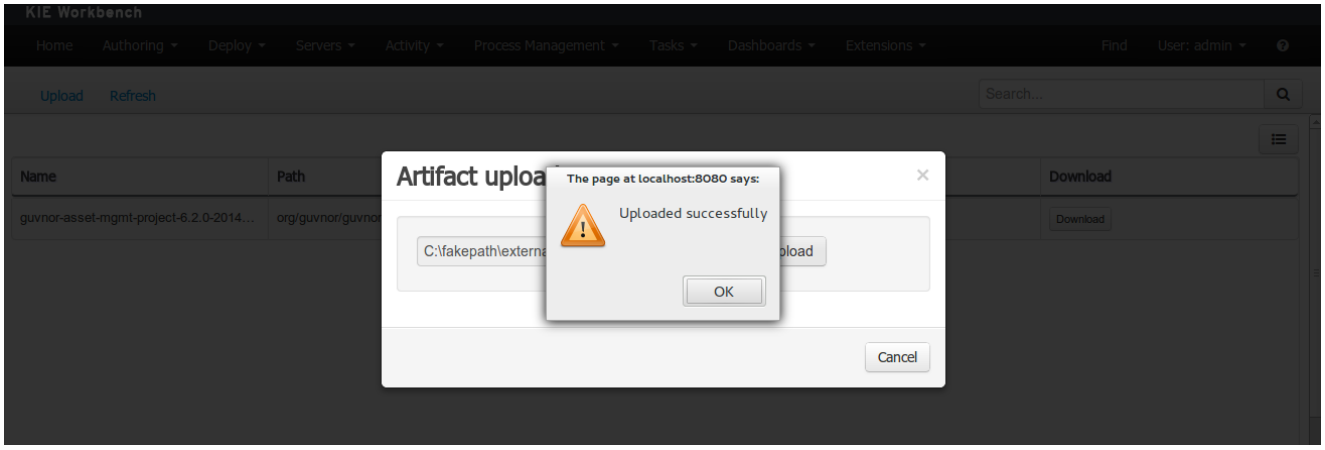


Figure 1.92. File upload success.

1.7.7.6.2.4. Guvnor M2 repository files.

Once the file has been loaded it will be displayed in the repository files list.

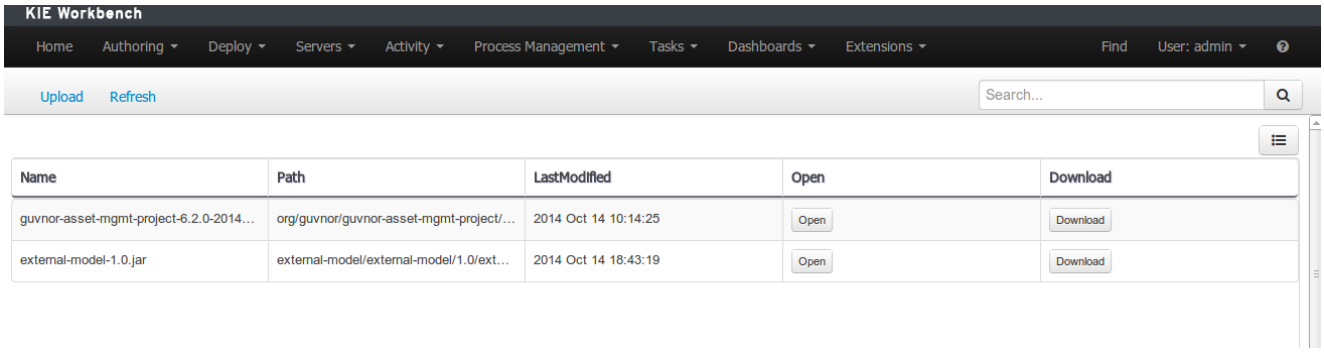


Figure 1.93. Files list.

1.7.7.6.2.5. Provide a GAV for the uploaded file (optional).

If the uploaded file is not a valid Maven JAR (don't have a pom.xml file) the system will prompt the user in order to provide a GAV for the file to be installed.

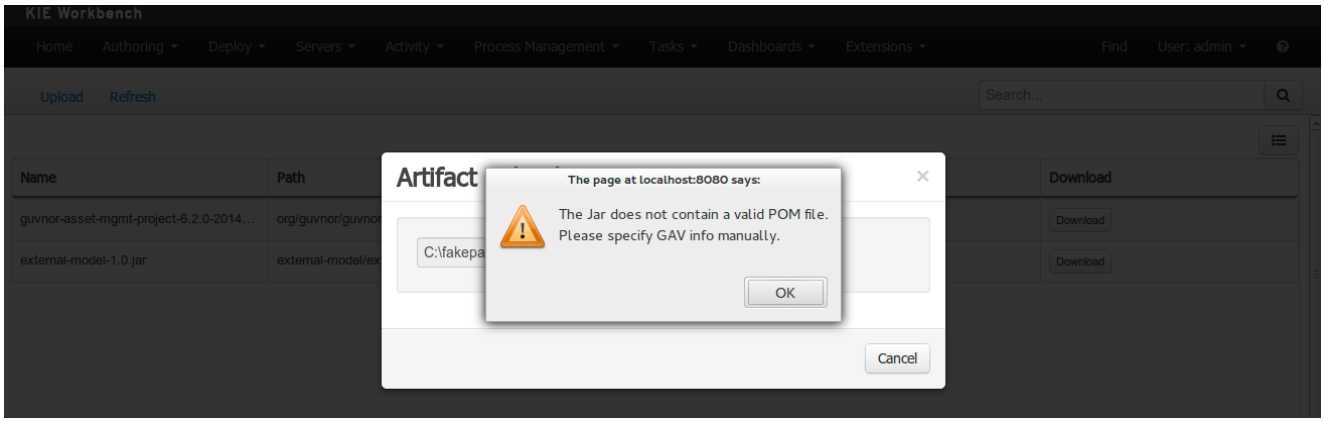


Figure 1.94. Not valid POM.

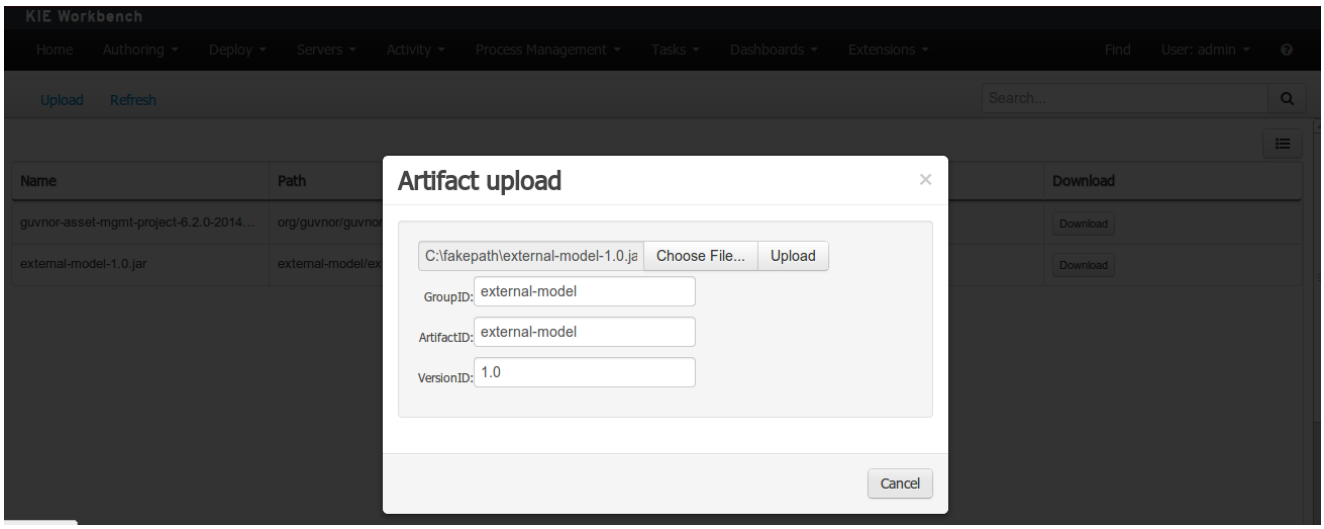


Figure 1.95. Enter GAV manually.

1.7.7.6.2.6. Add dependency from repository.

Open the project editor (see below) and click on the "Add from repository" button to open the JAR selector to see all the installed JAR files in current "Guvnor M2 repository". When the desired file is selected the project should be saved in order to make the new dependency available.

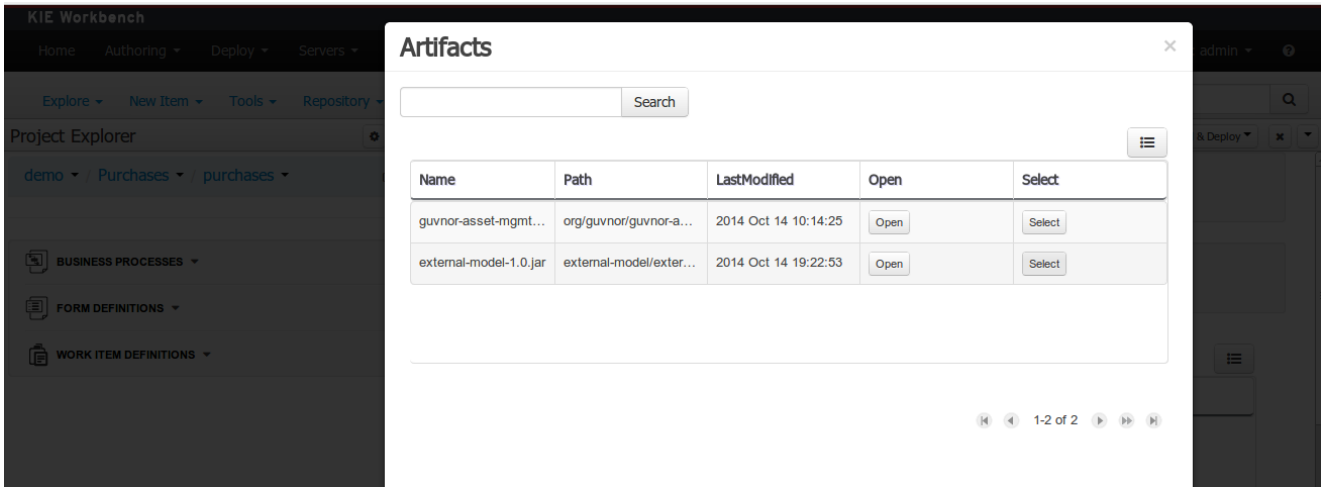


Figure 1.96. Select JAR from "Maven Artifact Repository".

1.7.7.6.3. Using the external objects

When a dependency to an external JAR has been set, the external POJOs can be used in the context of current project data model in the following ways:

- External POJOs can be extended by current model data objects.
- External POJOs can be used as field types for current model data objects.

The following screenshot shows how external objects are prefixed with the string " -ext- " in order to be quickly identified.

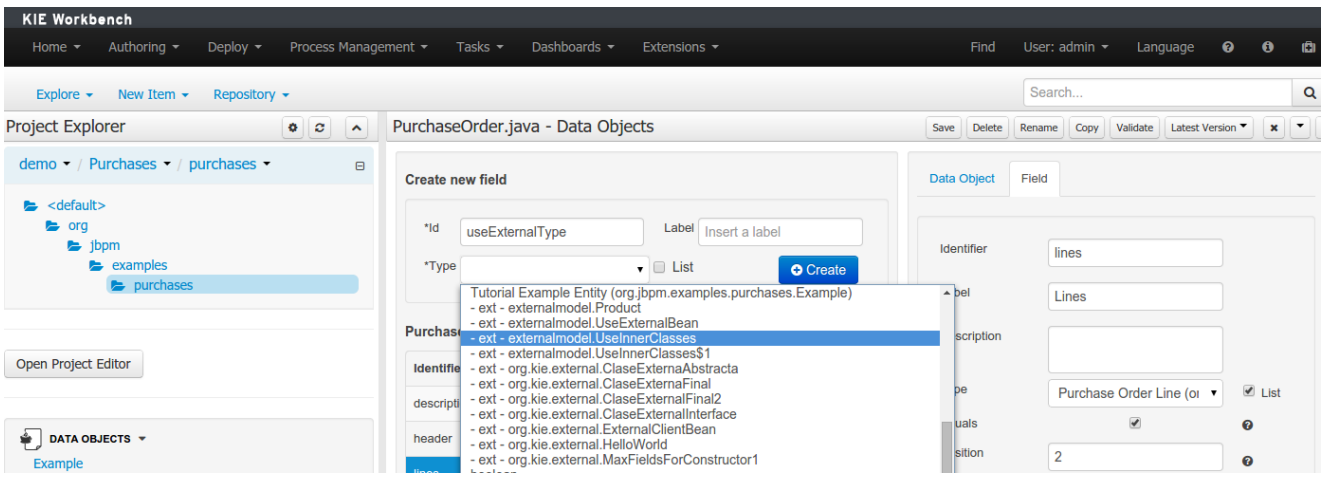


Figure 1.97. Identifying external objects.

1.7.7.7. Roundtrip and concurrency

Current version implements roundtrip and code preservation between Data modeller and Java source code. No matter where the Java code was generated (e.g. Eclipse, Data modeller), the data modeller will only create/delete/update the necessary code elements to maintain the model updated, i.e, fields, getter/setters, constructors, equals method and hashCode method. Also whatever Type or Field annotation not managed by the Data Modeler will be preserved when the Java sources are updated by the Data modeller.

Aside from code preservation, like in the other workbench editors, concurrent modification scenarios are still possible. Common scenarios are when two different users are updating the model for the same project, e.g. using the data modeller or executing a 'git push command' that modifies project sources.

From an application context's perspective, we can basically identify two different main scenarios:

1.7.7.7.1. No changes have been undertaken through the application

In this scenario the application user has basically just been navigating through the data model, without making any changes to it. Meanwhile, another user modifies the data model externally.

In this case, no immediate warning is issued to the application user. However, as soon as the user tries to make any kind of change, such as add or remove data objects or properties, or change any of the existing ones, the following pop-up will be shown:

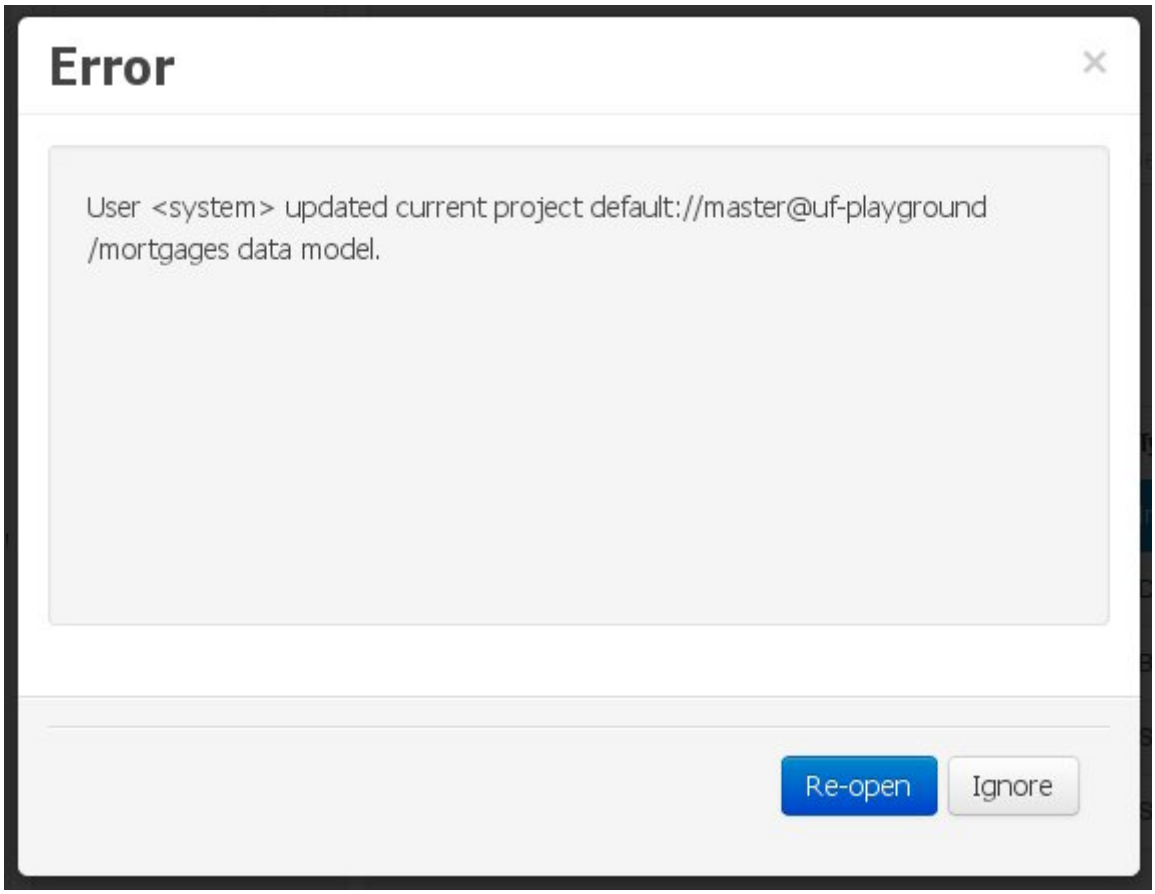


Figure 1.98. External changes warning

The user can choose to either:

- Re-open the data model, thus loading any external changes, and then perform the modification he was about to undertake, or
- Ignore any external changes, and go ahead with the modification to the model. In this case, when trying to persist these changes, another pop-up warning will be shown:

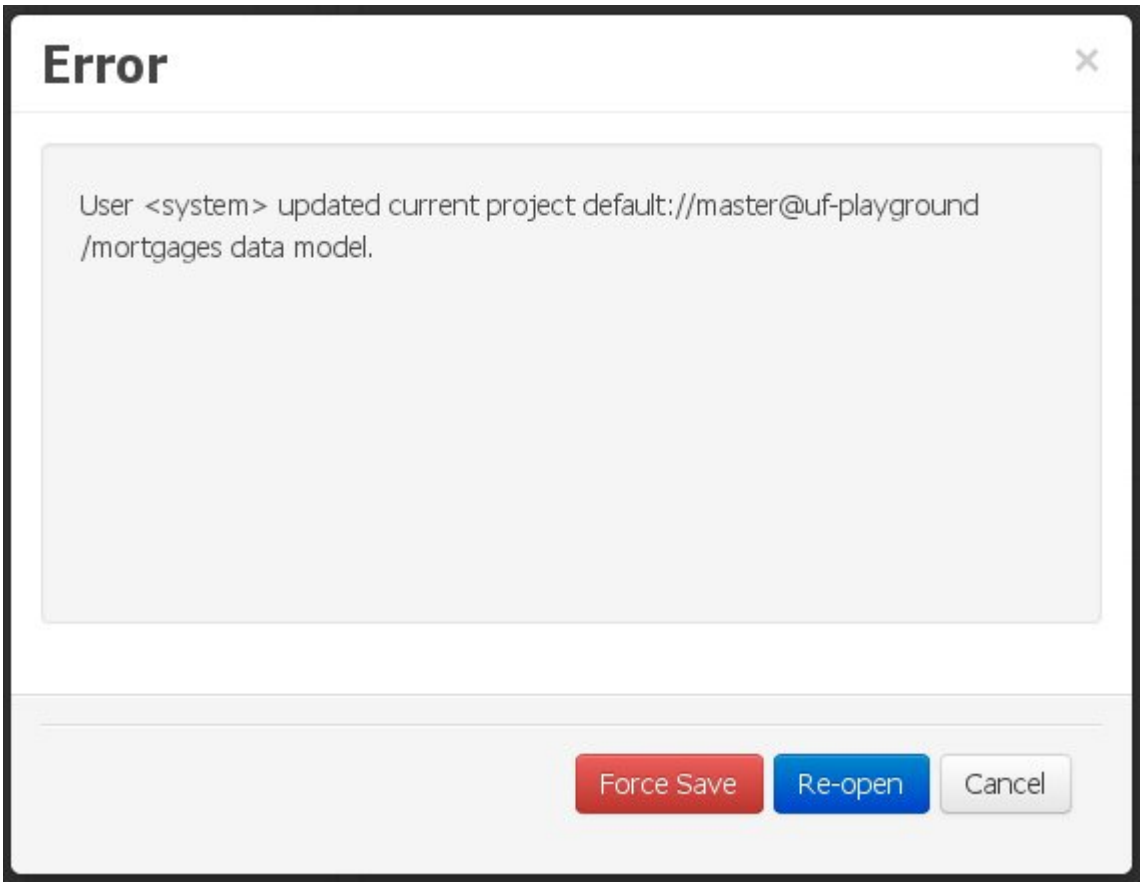


Figure 1.99. Force save / re-open

The "Force Save" option will effectively overwrite any external changes, while "Re-open" will discard any local changes and reload the model.

Warning

"Force Save" overwrites any external changes!

1.7.7.7.2. Changes have been undertaken through the application

The application user has made changes to the data model. Meanwhile, another user simultaneously modifies the data model from outside the application context.

In this alternative scenario, immediately after the external user commits his changes to the asset repository (or e.g. saves the model with the data modeller in a different session), a warning is issued to the application user:

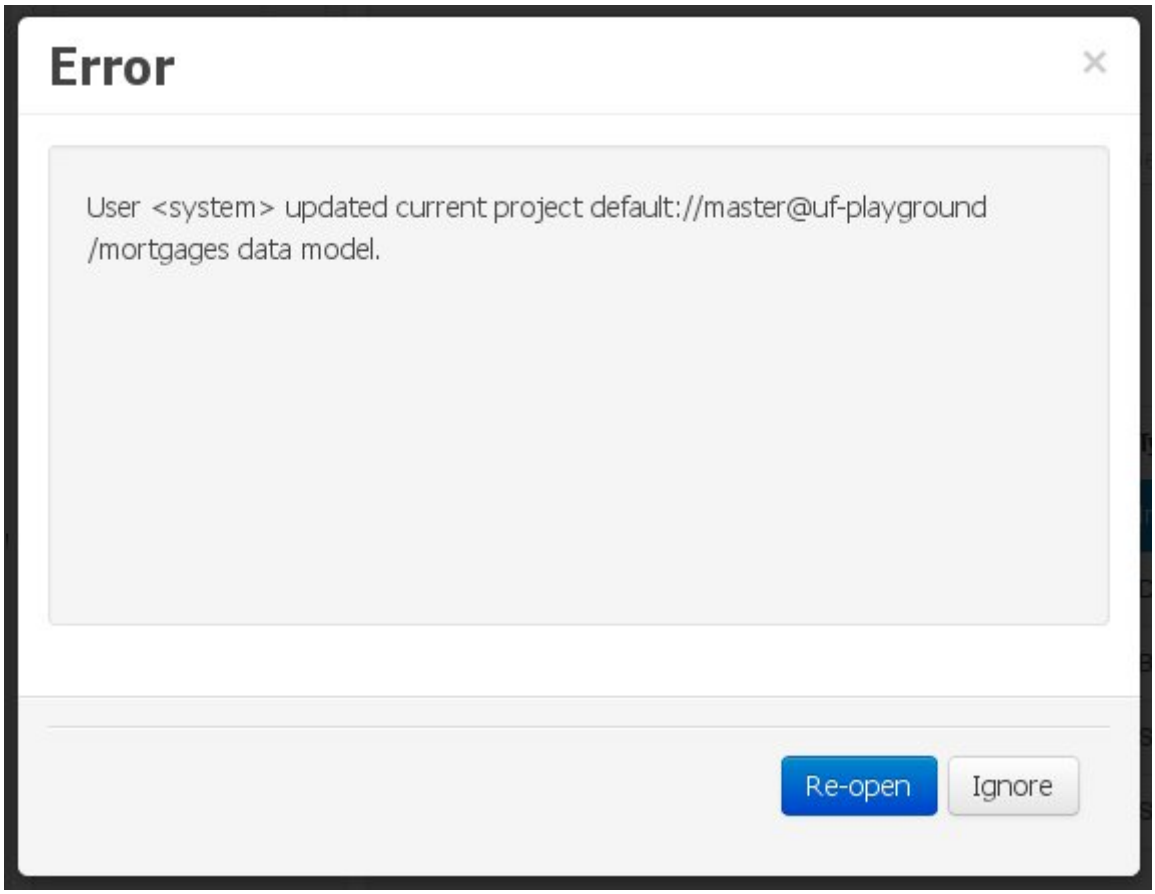


Figure 1.100. External changes warning

As with the previous scenario, the user can choose to either:

- Re-open the data model, thus losing any modifications that where made through the application, or
- Ignore any external changes, and continue working on the model.

  One of the following possibilities can now occur:

  - The user tries to persist the changes he made to the model by clicking the "Save" button in the data modeller top level menu. This leads to the following warning message:

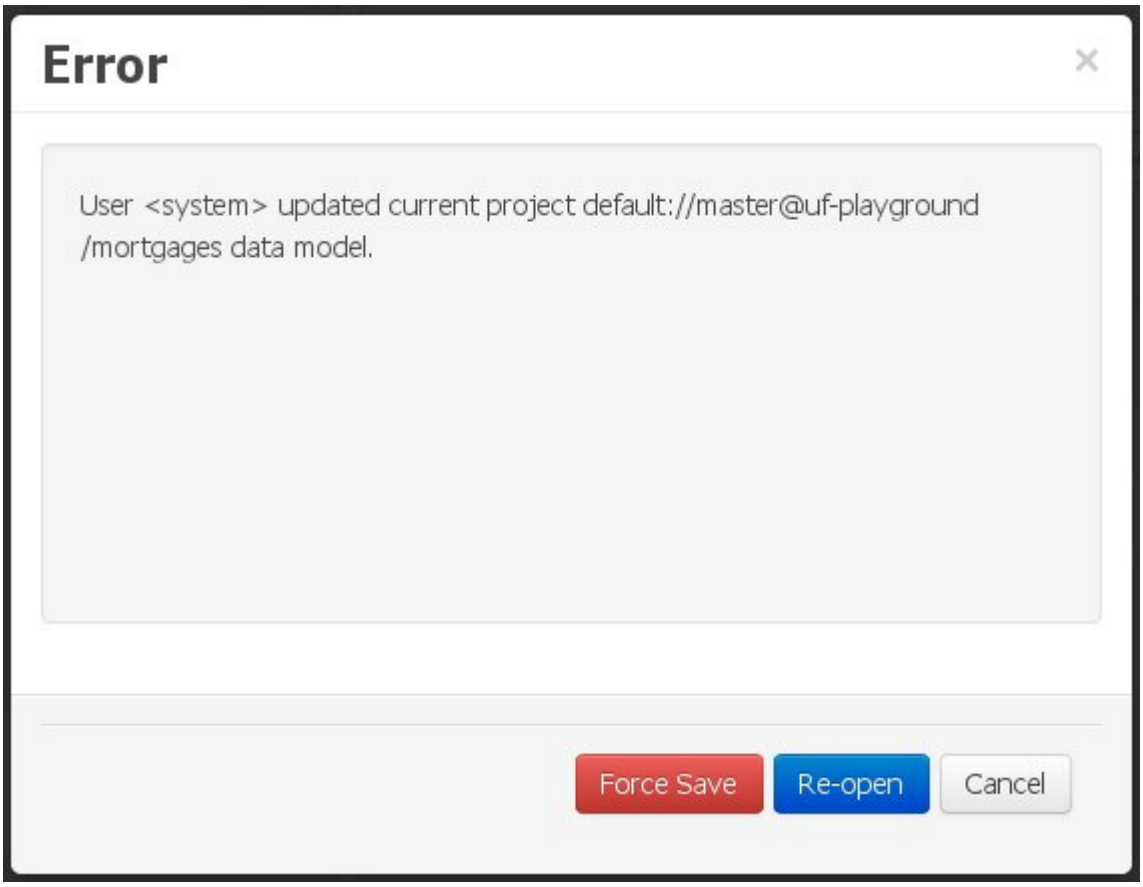


Figure 1.101. Force save / re-open

The "Force Save" option will effectively overwrite any external changes, while "Re-open" will discard any local changes and reload the model.

1.7.8. Data Sets

A **data set** is basically a set of columns populated with some rows, a matrix of data composed of timestamps, texts and numbers. A data set can be stored in different systems: a database, an excel file, in memory or in a lot of other different systems. On the other hand, a **data set definition** tells the workbench modules how such data can be accessed, read and parsed.

Notice, it's very important to make crystal clear the difference between a data set and its definition since the workbench does not take care of storing any data, it just provides a standard way to define access to those data sets regardless where the data is stored.

Let's take for instance the data stored in a remote database. A valid data set could be, for example, an entire database table or the result of an SQL query. In both cases, the database will return a bunch of columns and rows. Now, imagine we want to get access to such data to feed some charts in a new workbench perspective. First thing is to create and register a data set definition in order to indicate the following:

- where the data set is stored,
- how can be accessed, read and parsed and
- what columns contains and of which type.

This chapter introduces the available workbench tools for registering and handling data set definitions and how these definitions can be consumed in other workbench modules like, for instance, the Perspective Editor.

Note

For simplicity sake we will be using the term *data set* to refer to the actual data set definitions as *Data set* and *Data set definition* can be considered synonyms under the data set authoring context.

1.7.8.1. Data Set Authoring Perspective

Everything related to the authoring of data sets can be found under the *Data Set Authoring* perspective which is accessible from the following top level menu entry: *Extensions>Data Sets*, as shown in the following screenshot.

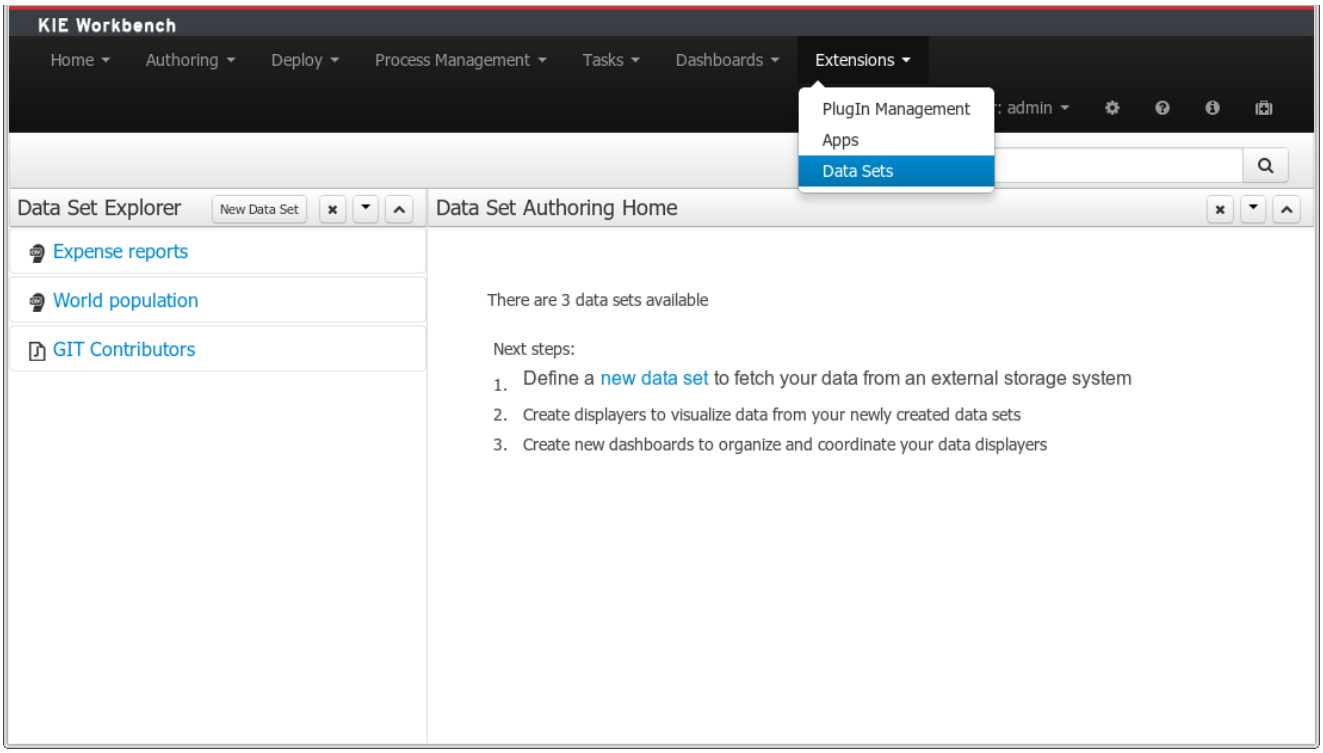


Figure 1.102. Data Set Authoring Perspective

The center panel, shows a welcome screen, whilst the left panel contains the *Data Set Explorer* listing all the data sets available

Note

This perspective is only intended to Administrator users, since defining data sets can be considered a low level task.

1.7.8.2. Data Set Explorer

The *Data Set Explorer* lists the data sets present in the system. Every time the user clicks on the data set it shows a brief summary alongside the following information:

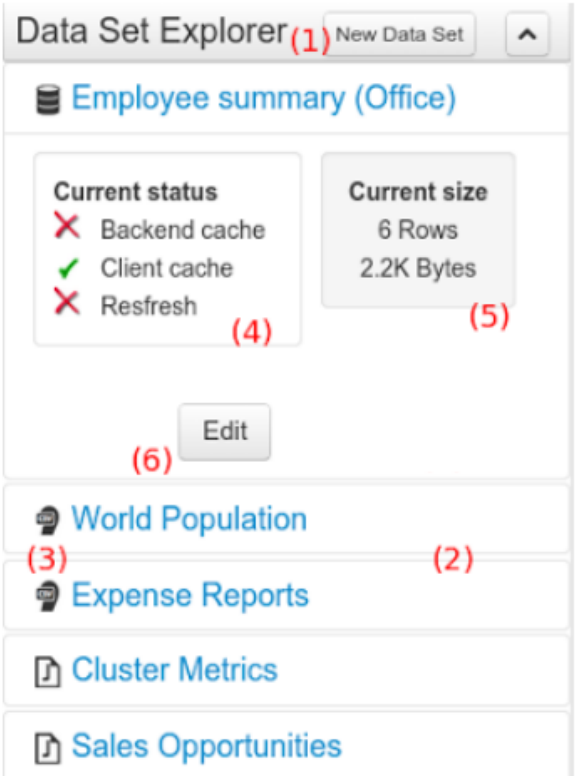


Figure 1.103. Data Set Explorer

- (1) A button for creating a new Data set
- (2) The list of currently available Data sets
- (3) An icon that represents the Data set's provider type (Bean, SQL, CSV, etc)
- (4) Details of current cache and refresh policy status
- (5) Details of current size on backend (unit as rows) and current size on client side (unit in bytes)
- (6) The button for editing the Data set. Once clicked the Data set editor screen is opened on the center panel

The next sections explain how to create, edit and fine tune data set definitions.

1.7.8.3. Data Set Creation

Clicking on the *New Data Set* button opens a new screen from which the user is able to create a new data set definition in three steps:

- *Provider type selection*

  Specify the kind of the remote storage system (BEAN, SQL, CSV, ElasticSearch)

- *Provider configuration*

  Specify the attributes for being able to look up data from the remote system. The configuration varies depending on the data provider type selected.

- *Data set columns & filter*

  Live data preview, column types and initial filter configuration.

1.7.8.3.1. Step 1: Provider type selection

Allows the user's specify the type of data provider of the data set being created.

This screen lists all the current available data provider types and helper popovers with descriptions. Each data provider is represented with a descriptive image:

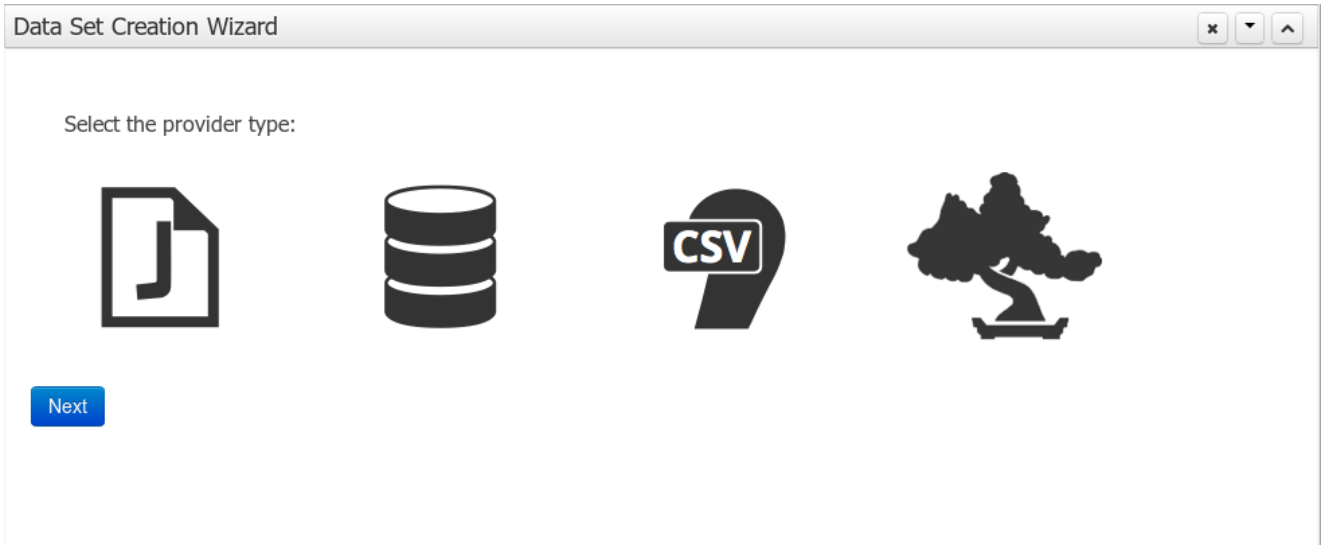


Figure 1.104. Provider type selection

Four types are currently supported:

- Bean (Java class) - To generate a data set directly from Java

- SQL - For getting data from any ANSI-SQL compliant database
- CSV - To upload the contents of a remote or local CSV file
- Elastic Search - To query and get documents stored on Elastic Search nodes as data sets

Once a type is selected, click on Next button to continue with the next workflow step.

1.7.8.3.2. Step 2: Configuration

The screenshot below shows a CSV data set configuration form. Once all the required settings are filled click on Test button. The system will try to fetch a small amount of data before moving to the next workflow step.

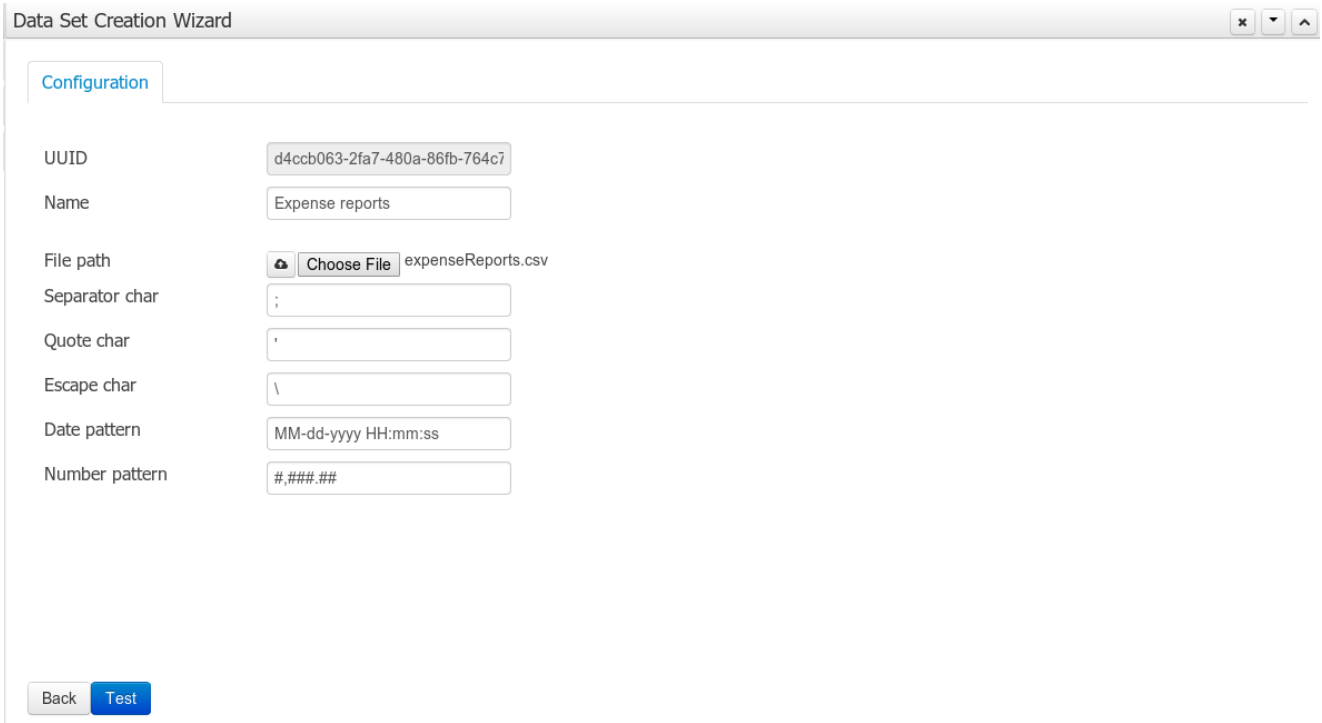


Figure 1.105. CSV Configuration

The provider type selected in the previous step will determine which configuration settings the system asks for.

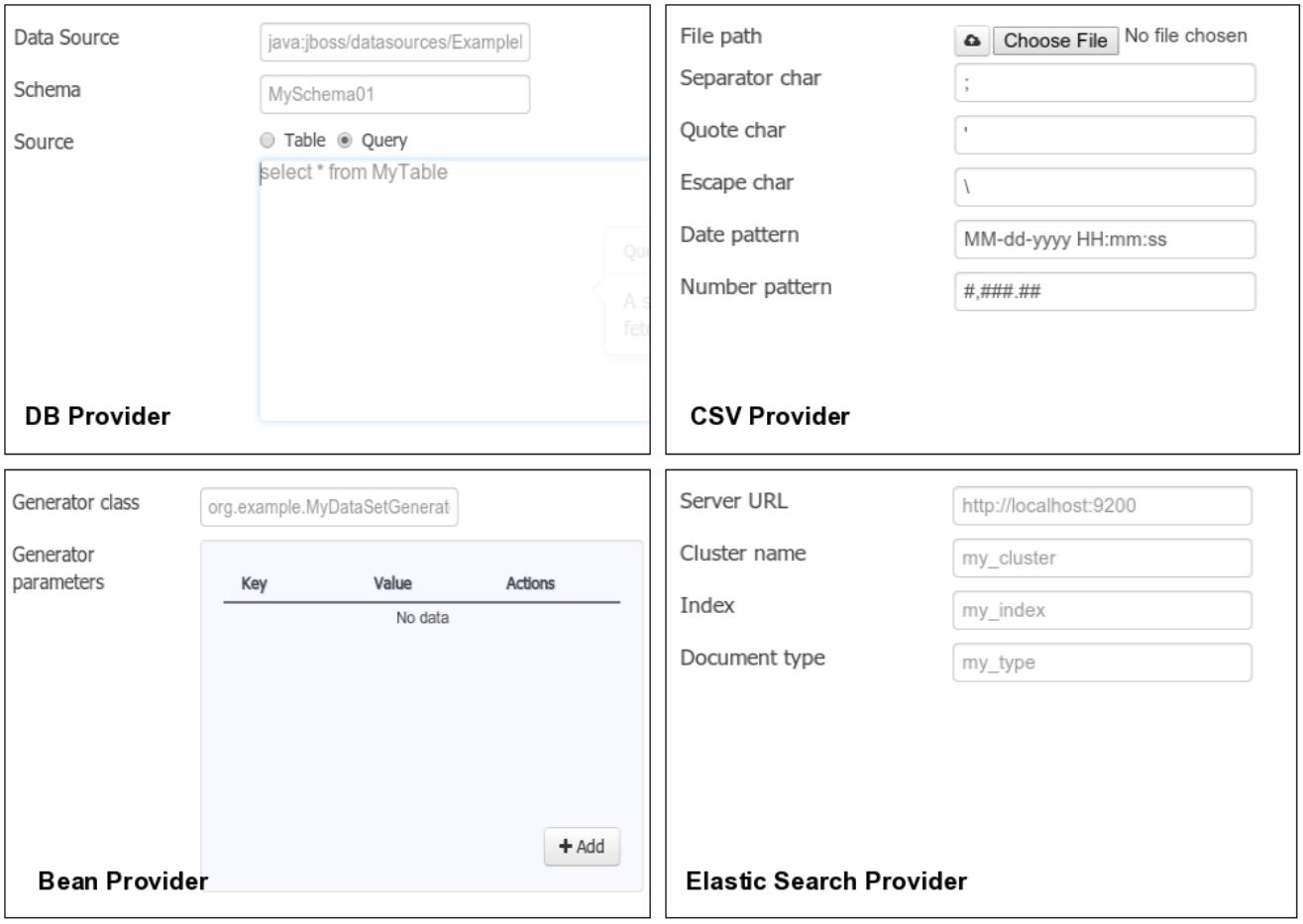


Figure 1.106. Configuration screen per data set type

Note

The UUID attribute is a read only field as it's generated by the system. It's only intended for usage in API calls or specific operations.

1.7.8.3.3. Step 3: Data set columns and preview

After clicking on the *Test* button (see previous step), the system executes a data set lookup test call in order to check if the remote system is up and the data is available. If everything goes ok the user will see the following screen:

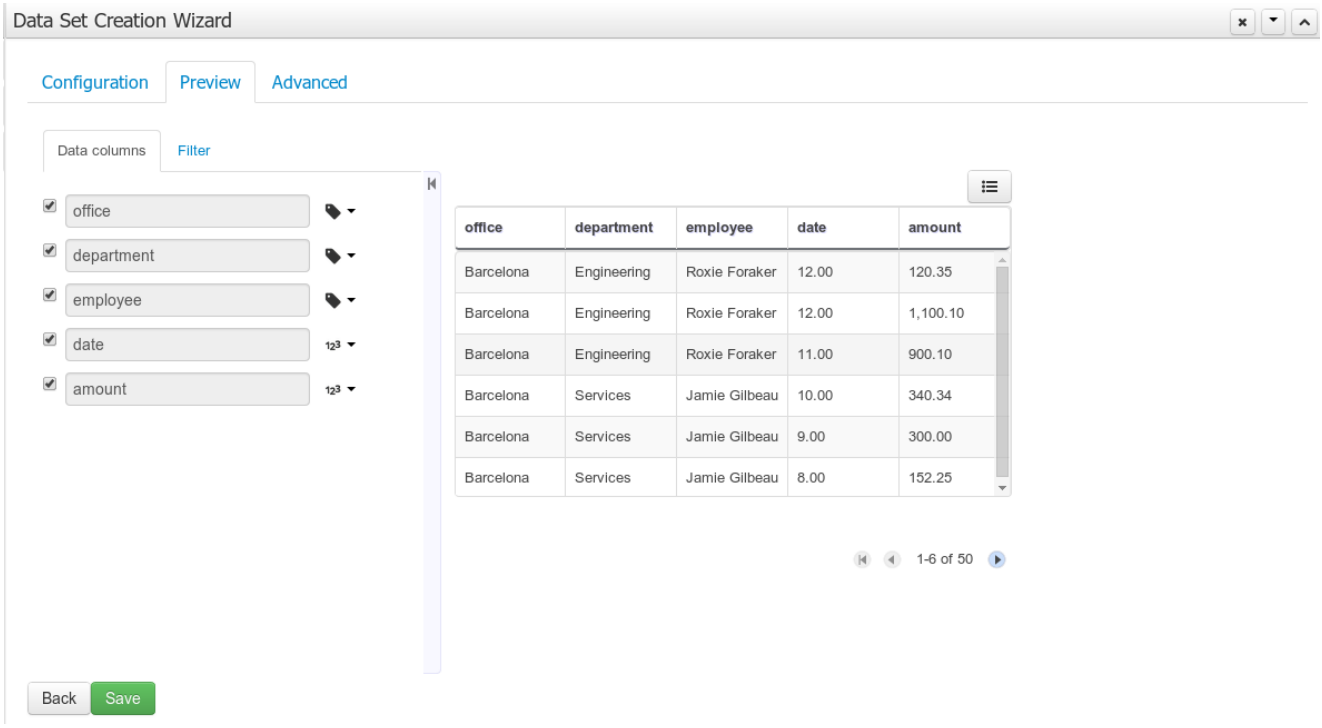


Figure 1.107. Data set preview

This screen shows a live data preview along with the columns the user wants to be part of the resulting data set. The user can also navigate through the data and apply some changes to the data set structure. Once finished, we can click on the *Save* button in order to register the new data set definition.

We can also change the configuration settings at any time just by going back to the configuration tab. We can repeat the *Configuration>Test>Preview* cycle as may times as needed until we consider it's ready to be saved.

Columns

In the *Columns* tab area the user can select what columns are part of the resulting data set definition.

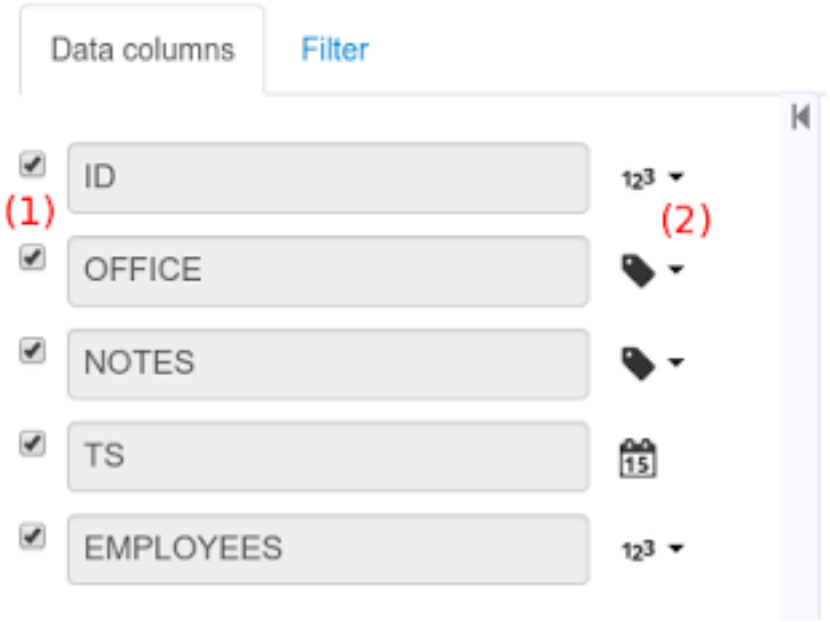


Figure 1.108. Data set columns

- (1) To add or remove columns. Select only those columns you want to be part of the resulting data set
- (2) Use the drop down image selector to change the column type

A data set may only contain columns of any of the following 4 types:

- Label - For text values supporting group operations (similar to the SQL "group by" operator) which means you can perform data lookup calls and get one row per distinct value.
- Text - For text values NOT supporting group operations. Typically for modeling large text columns such as abstracts, descriptions and the like.
- Number - For numeric values. It does support aggregation functions on data lookup calls: sum, min, max, average, count, disctinct.
- Date - For date or timestamp values. It does support time based group operations by different time intervals: minute, hour, day, month, year, ...

No matter which remote system you want to retrieve data from, the resulting data set will always return a set of columns of one of the four types above. There exists, by default, a mapping between the remote system column types and the data set types. The user is able to modify the type for some columns, depending on the data provider and the column type of the remote system. The system supports the following changes to column types:

- Label <> Text - Useful when we want to enable/disable the categorization (grouping) for the target column. For instance, imagine a database table called "document" containing a large text

column called "abstract". As we do not want the system to treat such column as a "label" we might change its column type to "text". Doing so, we are optimizing the way the system handles the data set and

- Number <> Label - Useful when we want to treat numeric columns as labels. This can be used for instance to indicate that a given numeric column is not a numeric value that can be used in aggregation functions. Despite its values are stored as numbers we want to handle the column as a "label". One example of such columns are: an item's code, an appraisal id., ...

Note

BEAN data sets do not support changing column types as it's up to the developer to decide which are the concrete types for each column.

Filter

A data set definition may define a filter. The goal of the filter is to leave out rows the user does not consider necessary. The filter feature works on any data provider type and it lets the user to apply filter operations on any of the data set columns available.

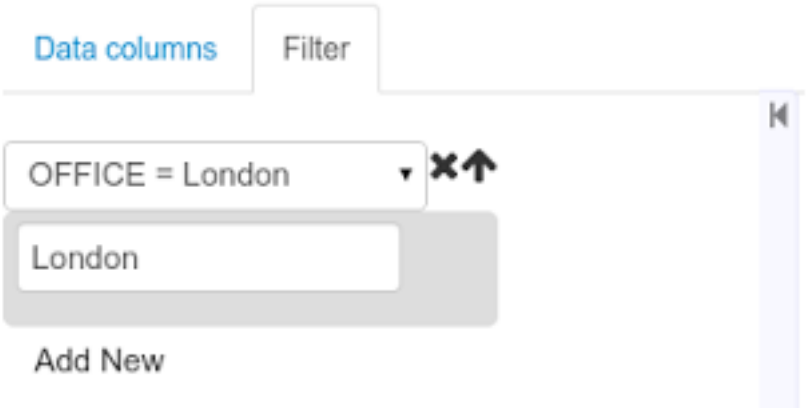


Figure 1.109. Data set filter

While adding or removing filter conditions and operations, the preview table on central area is updated with live data that reflects the current filter status.

There exists two strategies for filtering data sets and it's also important to note that choosing between the two have important implications. Imagine a dashboard with some charts feeding from a expense reports data set where such data set is built on top of an SQL table. Imagine also we only want to retrieve the expense reports from the "London" office. You may define a data set containing the filter "office=London" and then having several charts feeding from such data set. This is the recommended approach. Another option is to define a data set with no initial filter and then let the individual charts to specify their own filter. It's up to the user to decide on the best approach.

Depending on the case it might be better to define the filter at a data set level for reusing across other modules. The decision may also have impact on the performance since a filtered cached data set will have far better performance than a lot of individual non-cached data set lookup requests. (See the next section for more information about caching data sets).

Note

Notice, for SQL data sets, the user can use both the filter feature introduced or, alternatively, just add custom filter criteria to the SQL sentence. Although, the first approach is more appropriated for non technical users since they might not have the required SQL language skills.

1.7.8.4. Data set editor

To edit an existing data set definition go the data set explorer, expand the desired data set definition and click on the *Edit* button. This will cause a new editor panel to be opened and placed on the center of the screen, as shown in the next screenshot:

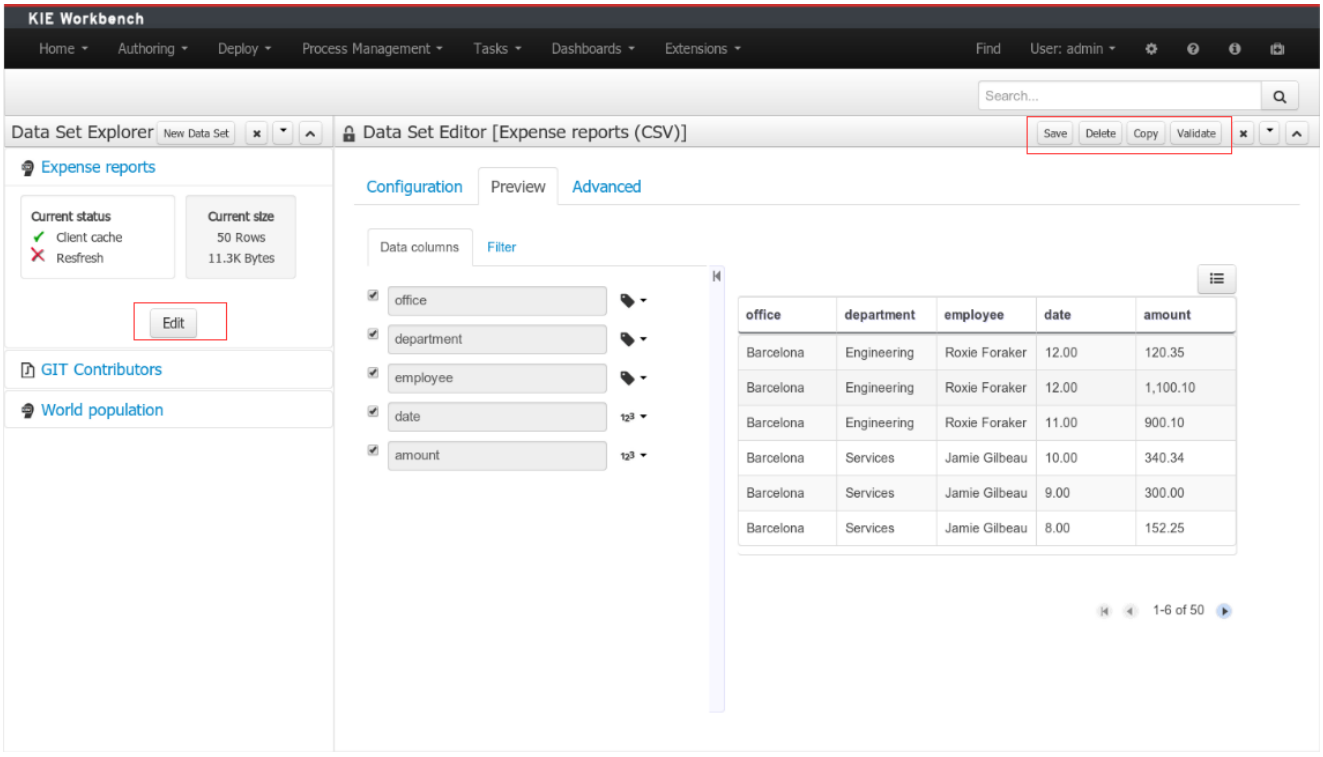


Figure 1.110. Data set definition editor

Every time we edit an item its editor is added to the center panel. We can navigate through the list of opened editors just by clicking on the down arrow icon placed at the editor's toolbar in the top right corner.

Figure 1.111. Editor selector

The editor provides all the features described in previous sections. We can change the configuration settings, test our data set definition and modify the resulting data set structure. Additionally, the editor provides some extra buttons in its toolbar:

- Save - To validate the current changes and store the data set definition.
- Delete - To remove permanently from storage the data set definition. Any client module referencing the data set may be affected.
- Validate - To check that all the required parameters exist and are correct, as well as to validate the data set can be retrieved with no issues.
- Copy - To create a brand new definition as a copy of the current one.

Note

Data set definitions are stored in the underlying GIT repository as JSON files. Any action performed is registered in the repository logs so it is possible to audit the change log later on.

1.7.8.5. Advanced settings

In the *Advanced settings* tab area the user can specify caching and refresh settings. Those are very important for making the most of the system capabilities thus improving the performance and having better application responsive levels.

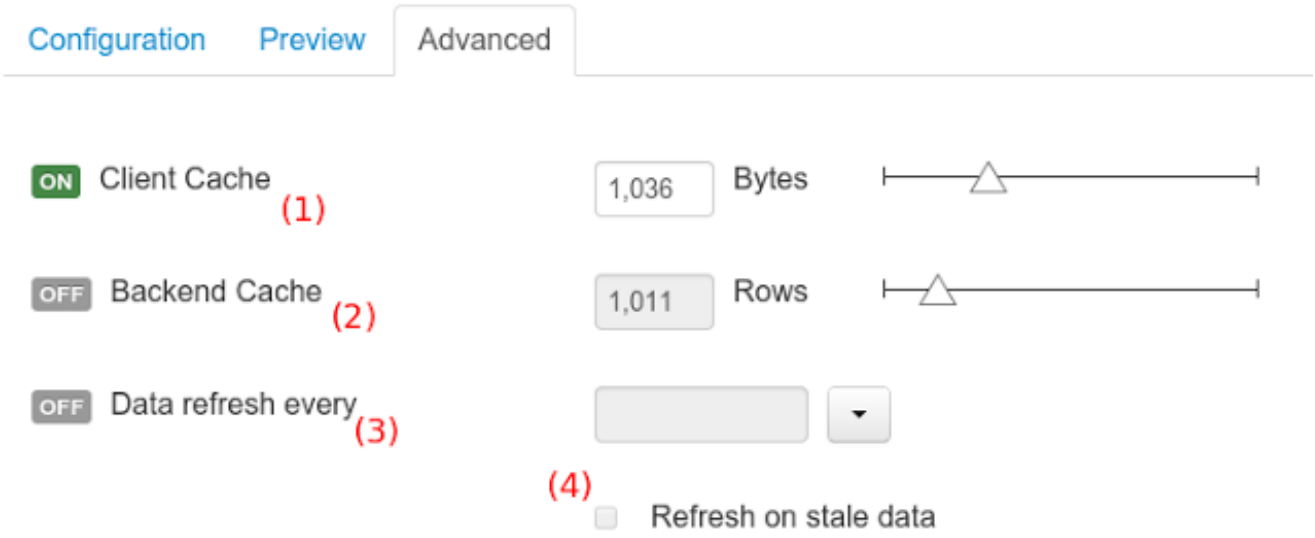


Figure 1.112. Advanced settings

- (1) To enable or disable the client cache and specify the maximum size (bytes).
- (2) To enable or disable the backend cache and specify the maximum cache size (number of rows).
- (3) To enable or disable automatic refresh for the Data set and the refresh period.
- (4) To enable or disable the refresh on stale data setting.

Let's dig into more details about the meaning of these settings.

1.7.8.6. Caching

The system provides caching mechanisms out-of-the-box for holding data sets and performing data operations using in-memory strategies. The use of these features brings a lot of advantages, like reducing the network traffic, remote system payload, processing times etc. On the other hand, it's up to the user to fine tune properly the caching settings to avoid hitting performance issues.

Two cache levels are supported:

- Client level
- Backend level

The following diagram shows how caching is involved in any data set operation:

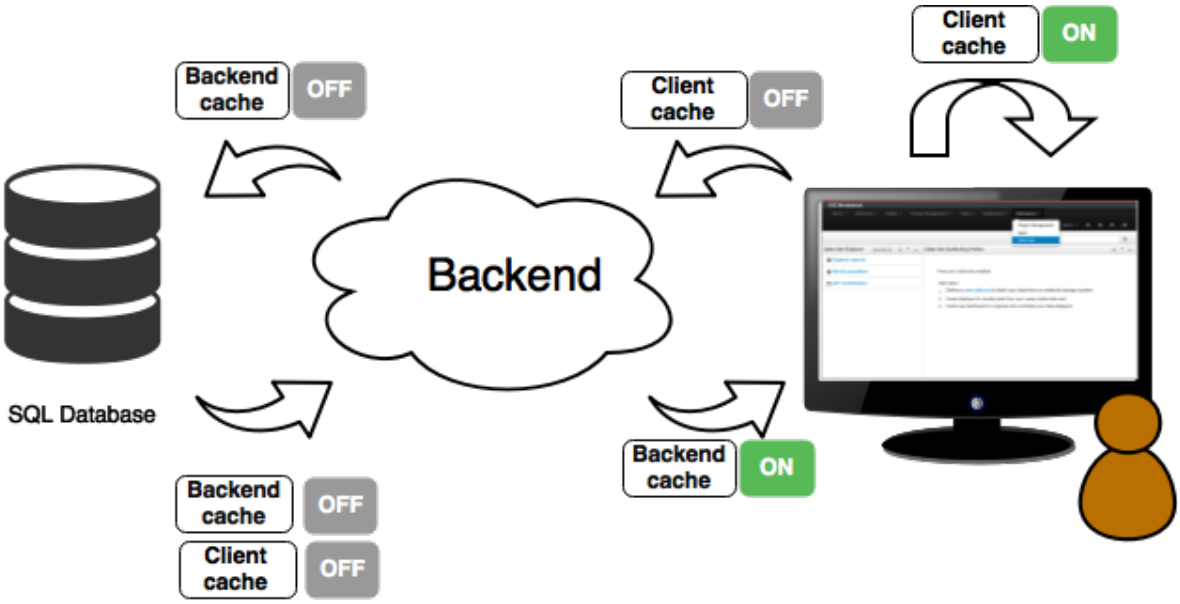


Figure 1.113. Data set caching

Any data look up call produces a resulting data set, so the use of the caching techniques determines where the data lookup calls are executed and where the resulting data set is located.

Client cache

If ON then the data set involved in a look up operation is pushed into the web browser so that all the components that feed from this data set **do not need to perform any requests to the backend** since data set operations are resolved at a client side:

- The data set is stored in the web browser's memory
- The client components feed from the data set stored in the browser
- Data set operations (grouping, aggregations, filters and sort) are processed within the web browser, by means of a Javascript data set operation engine.

If you know beforehand that your data set will remain small, you can enable the client cache. It will reduce the number of backend requests, including the requests to the storage system. On the other hand, if you consider that your data set will be quite big, disable the client cache so as to not hitting with browser issues such as slow performance or intermittent hangs.

Backend cache

Its goal is to provide a caching mechanism for data sets on backend side.

This feature allows to **reduce the number of requests to the remote storage system** , by holding the data set in memory and performing group, filter and sort operations using the in-memory engine.

It's useful for data sets that do not change very often and their size can be considered acceptable to be held and processed in memory. It can be also helpful on low latency connectivity issues with

the remote storage. On the other hand, if your data set is going to be updated frequently, it's better to disable the backend cache and perform the requests to the remote storage on each look up request, so the storage system is in charge of resolving the data set lookup request.

Note

BEAN and CSV data providers relies by default on the backend cache, as in both cases the data set must be always loaded into memory in order to resolve any data lookup operation using the in-memory engine. This is the reason why the backend settings are not visible in the Advanced settings tab.

1.7.8.7. Refresh

The refresh feature allows for the invalidation of any cached data when certain conditions are meet.

Figure 1.114. Refresh settings

- (1) To enable or disable the refresh feature.
- (2) To specify the refresh interval.
- (3) To enable or disable data set invalidation when the data is outdated.

The data set refresh policy is tightly related to data set caching, detailed in previous section. This invalidation mechanism determines the cache life-cycle.

Depending on the nature of the data there exist three main use cases:

- **Source data changes predictable** - Imagine a database being updated every night. In that case, the suggested configuration is to use a "refresh interval = 1 day" and disable "refresh on stale data". That way, the system will always invalidate the cached data set every day. This is the right configuration when we know in advance that the data is going to change.
- **Source data changes unpredictable** - On the other hand, if we do not know whether the database is updated every day, the suggested configuration is to use a "refresh interval = 1 day" and enable "refresh on stale data". If so the system, before invalidating any data, will check for modifications. On data modifications, the system will invalidate the current stale data set so that the cache is populated with fresh data on the next data set lookup call.

- **Real time scenarios** - In real time scenarios caching makes no sense as data is going to be updated constantly. In this kind of scenarios the data sent to the client has to be constantly updated, so rather than enabling the refresh settings (remember this settings affect the caching, and caching is not enabled) it's up to the clients consuming the data set to decide when to refresh. When the client is a dashboard then it's just a matter of modifying the refresh settings in the Displayer Editor configuration screen and set a proper refresh period, "refresh interval = 1 second" for example.

1.8. User and group management

1.8.1. Introduction

This section describes a feature that allows the administration of the application's users and groups using an intuitive and friendly user interface that comes integrated in both jBPM and Drools Workbenches.

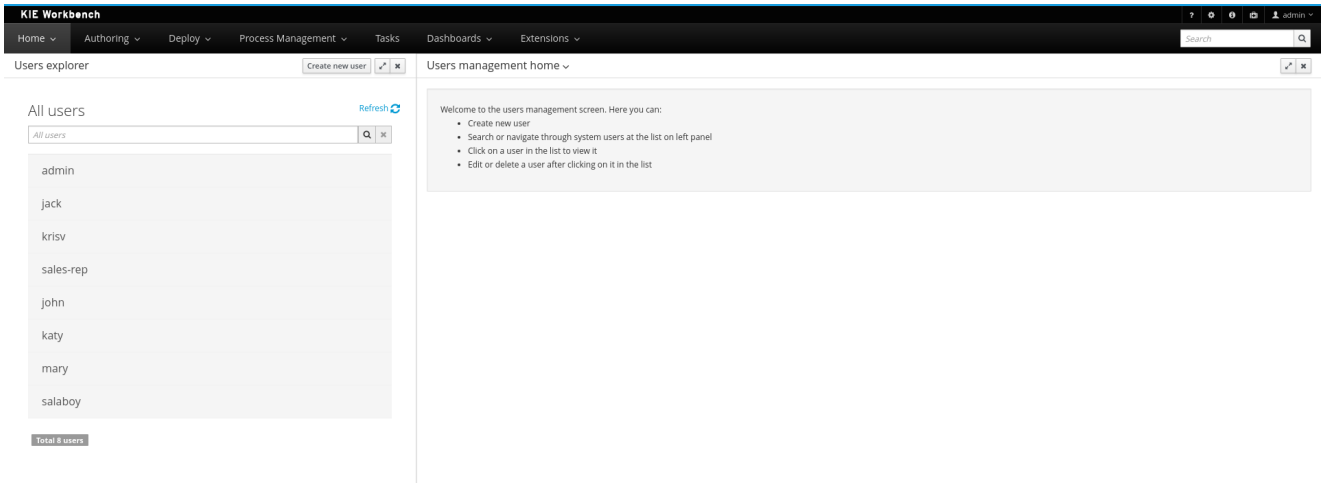


Figure 1.115.

Before the installation, setup and usage of this feature, this section talks about some previous concepts that need to be completely understood for the further usage:

- Security management providers and capabilities
- Installation and setup
- Usage

1.8.2. Security management providers

A security environment is usually provided by the use of a *realm*. Realms are used to restrict the access for the different application's resources. So realms contains information about the users, groups, roles, permissions and and any other related information.

In most of the typical scenarios the application's security is delegated to the container's security mechanism, which consumes a given realm at same time. It's important to consider that there

exist several realm implementations, for example Wildfly provides a realm based on the *application-users.properties*/*application-roles.properties* files, Tomcat provides a realm based on the *tomcat-users.xml* file, etc. So keep in mind that there is no single security realm to rely on, it can be different in each installation.

The jBPM and Drools workbenches are not an exception, they're build on top Uberfire framework (aka UF), which delegates the authorization and authentication to the underlying container's security environment as well, so the consumed realm is given by the concrete deployment configuration.

1.8.2.1. Security management providers

Due to the potential different security environments that have to be supported, the users and groups management provides a well defined management services API with some default built-in security management providers. A **security management provider** is the formal name given to a concrete user and group management service implementation for a given realm.

At this moment, by default there are two security management providers available:

- **Wildfly / EAP security management provider** - For Wildfly or EAP realms based on properties files.
- **Tomcat security management provider** - For Tomcat realms based on XML files.

If the built-in providers do not fit with the application's security realm, it is easy to build and register your own security management provider.

1.8.2.2. Secutiry management provider capabilities

Each security realm can provide support different operations. For example consider the use of a Wildfly's realm based on properties files, The contents for the applications-users.properties is like:

```
admin=207b6e0cc556d7084b5e2db7d822555c
salaboy=d4af256e7007fea2e581d539e05edd1b
maciej=3c8609f5e0c908a8c361ca633ed23844
kris=0bfd0f47d4817f2557c91cbab38bb92d
katy=fd37b5d0b82ce027bfad677a54fbccee
john=afda4373c6021f3f5841cd6c0a027244
jack=984ba30e11dda7b9ed86ba7b73d01481
director=6b7f87a92b62bedd0a5a94c98bd83e21
user=c5568adea472163dfc00c19c6348a665
guest=b5d048a237bfd2874b6928e1f37ee15e
kiewb=78541b7b451d8012223f29ba5141bcc2
kieserver=16c6511893651c9b4b57e0c027a96075
```

Note that it's based on key-value pairs where the key is the *username*, and the value is the hashed value for the user's *password*. So a user is just defined by the key, by its username, it does not have a name nor address or any other meta information.

On the other hand, consider the use of a realm provided by a Keycloak server. The information for a user is composed by more user meta-data, such as surname, address, etc, as in the following image:

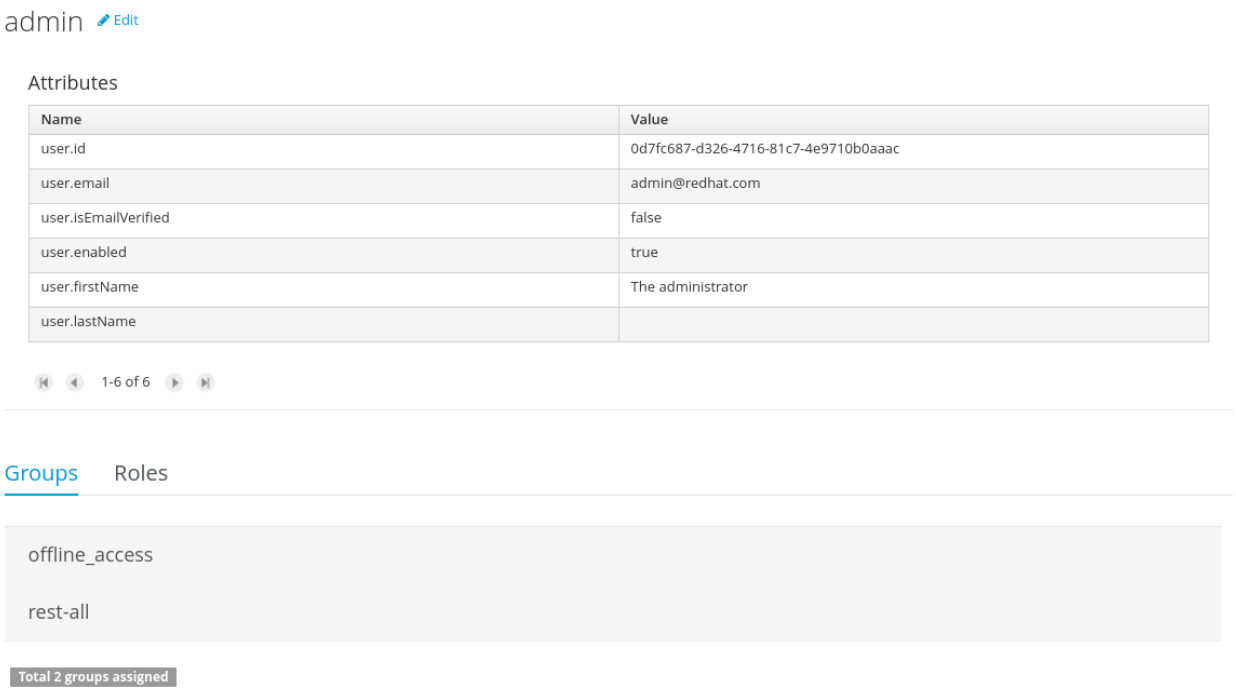


Figure 1.116.

So the different services and client side components from the users and group management API are based on *capabilities*.**Capabilities** are used to expose or restrict the available functionality provided by the different services and client side components. Examples of capabilities are:

- Create a user
- Update a user
- Delete a user
- Update user's attributes
- Create a group
- Update a group
- Assign groups to a user
- Assign roles to a user

Each security management provider must specify a set of capabilities supported. From the previous examples you can note that the Wildfly security management provider does not support the

capability for the management of the attributes for a user - the user is only composed by the user name. On the other hand the Keycloak provider does support this capability.

The different views and user interface components rely on the capabilities supported by each provider, so if a capability is not supported by the provider in use, the UI does not provide the views for the management of that capability. As an example, consider that a concrete provider does not support deleting users - the delete user button on the user interface will be not available.

Please take a look at the concrete service provider documentation to check all the supported capabilities for each one, the default ones can be found here [https://github.com/uberfire/uberfire-extensions/tree/master/uberfire-security/uberfire-security-management].

1.8.3. Installation and setup

Before considering the installation and setup steps please note the following Drools and jBPM distributions come with built-in, pre-installed security management providers by default:

- **Wildfly / EAP distribution** - Both distributions use the Wildfly security management provider [https://github.com/uberfire/uberfire-extensions/tree/master/uberfire-security/uberfire-security-management/uberfire-security-management-wildfly] configured for the use of the default realm files *application-users.properties* and *application-roles.properties*
- **Tomcat distribution** - It uses the Tomcat security management provider [https://github.com/uberfire/uberfire-extensions/tree/master/uberfire-security/uberfire-security-management/uberfire-security-management-tomcat] configured for the use of the default realm file *tomcat-users.xml*

Please read each provider's documentation [https://github.com/uberfire/uberfire-extensions/tree/master/uberfire-security/uberfire-security-management] in order to apply the concrete settings for the target deployment environment.

On the other hand, if using a custom security management provider or need to include it on an existing application, consider the following installation options:

- Enable the security management feature on an existing WAR distribution
- Setup and installation in an existing or new project

NOTE: If no security management provider is installed in the application, there will be no available user interface for managing the security realm. Once a security management provider is installed and setup, the user and group management user interfaces are automatically enabled and accessible from the main menu.

1.8.3.1. Enable the security management feature on an existing WAR distribution

Given an existing WAR distribution of either Drools and jBPM workbenches, follow these steps in order to install and enable the user management feature:

- Ensure the following libraries are present on *WEB-INF/lib*:
  - WEB-INF/lib/uberfire-security-management-api-0.9.0.Final.jar
  - WEB-INF/lib/uberfire-security-management-backend-0.9.0.Final.jar
- Add the concrete library for the security management provider to use in *WEB-INF/lib*:
  - Eg: WEB-INF/lib/uberfire-security-management-wildfly-0.9.0.Final.jar
  - If the concrete provider you're using requires more libraries, add those as well. Please read each provider's documentation [https://github.com/uberfire/uberfire-extensions/tree/master/uberfire-security/uberfire-security-management] for more information
- Replace the whole content for file *WEB-INF/classes/security-management.properties*, or if not present, create it. The settings present on this file depend on the concrete implementation you're using. Please read each provider's documentation [https://github.com/uberfire/uberfire-extensions/tree/master/uberfire-security/uberfire-security-management] for more information.
- If you're deploying on Wildfly or EAP, please check if the *WEB-INF/jboss-deployment-structure.xml* requires any update. Please read each provider's documentation [https://github.com/uberfire/uberfire-extensions/tree/master/uberfire-security/uberfire-security-management] for more information.

1.8.3.2. Setup and installation in an existing or new project

If you're building an Uberfire [http://uberfireframework.org/] based web application and you want to include the user and group management feature, please read this instructions [https://github.com/uberfire/uberfire-extensions/blob/master/uberfire-security/uberfire-security-management/uberfire-security-management-client-wb/README.md].

1.8.3.3. Disabling the security management feature

The security management feature can be disabled, and thus no services or user interface will be available, by any of:

- Uninstalling the security management provider from the application

  When no concrete security management provider installed on the application, the user and group management feature will be disabled and no services or user interface will be presented to the user.

- Removing or commenting the security management configuration file

  Removing or commenting all the lines in the configuration file located at *WEB-INF/classes/security-management.properties* will disable the user and group management feature and no services or user interface will be presented to the user.

1.8.4. Usage

The user and group management feature is presented using two different perspectives that are available from the main *Home* menu (considering that the feature is enabled) as:

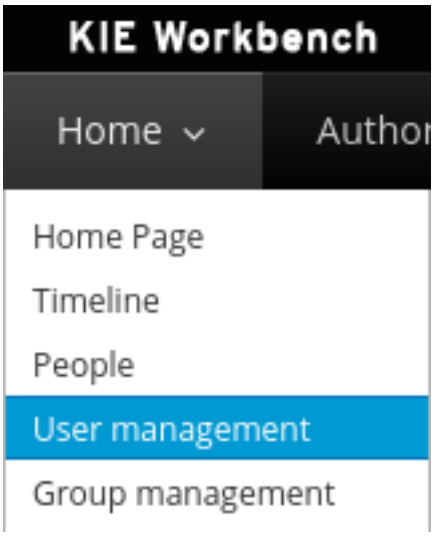


Figure 1.117.

Read the following sections for using both user and group management perspectives.

1.8.4.1. User management

The user management interface is available from the *User management* menu entry in the *Home* menu.

The interface is presented using two main panels: the users explorer on the west panel and the user editor on the center one:

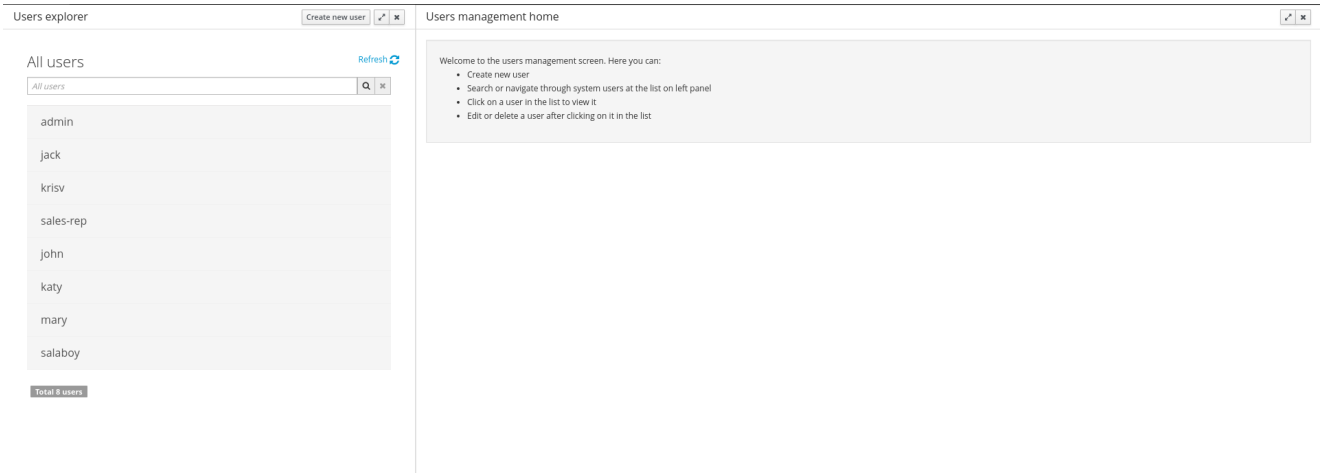


Figure 1.118.

The **users explorer**, on west panel, lists by default all the users present on the application's security realm:

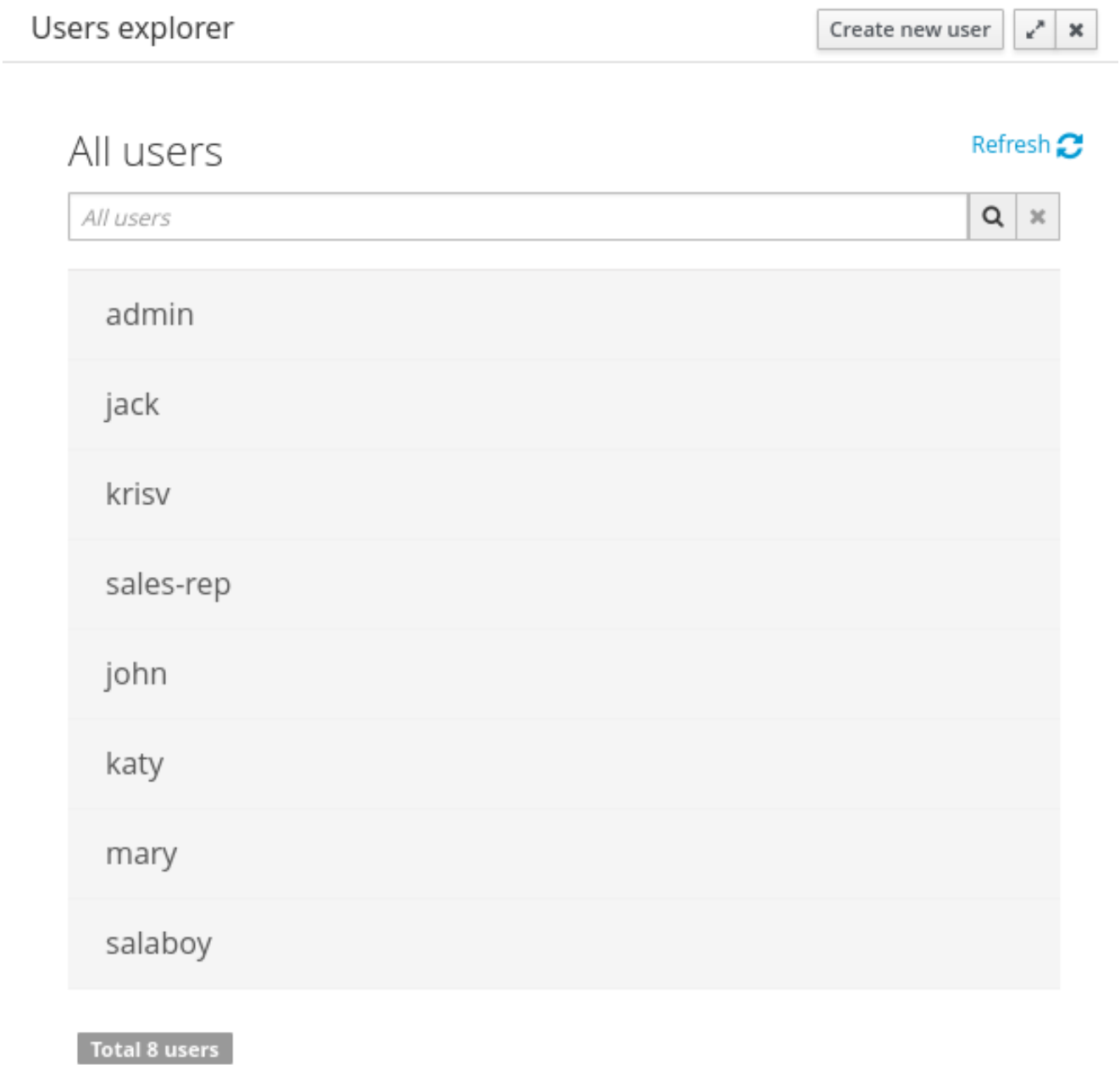


Figure 1.119.

In addition to listing all users, the users explorer allows:

- **Searching for users**

  When specifying the search pattern in the search box the users list will be reduced and will display only the users that match the search pattern.

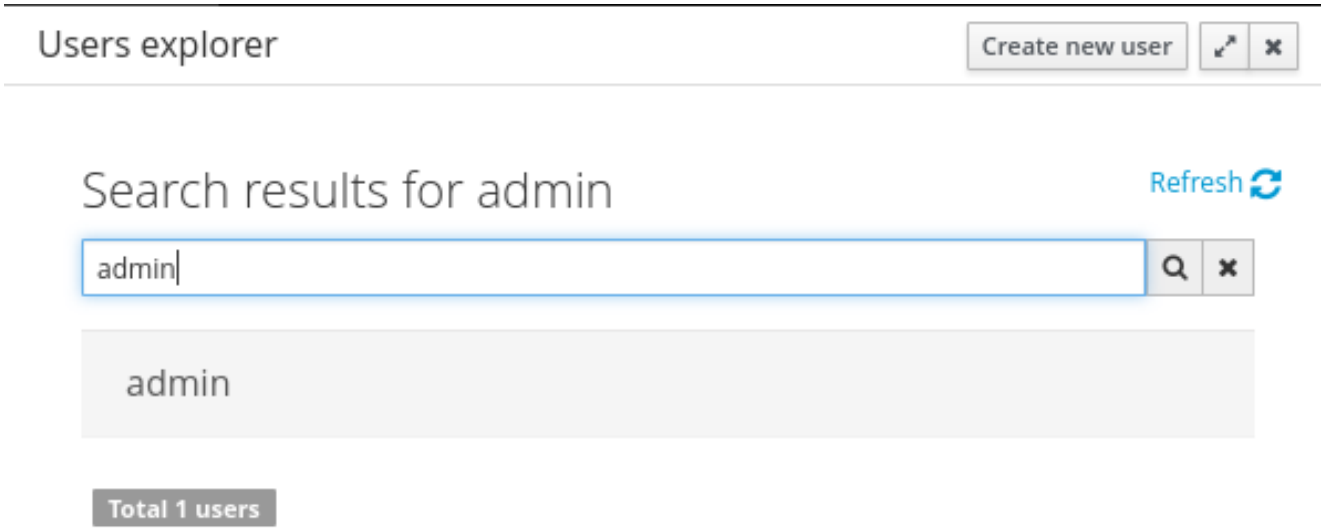


Figure 1.120.

Search patterns depend on the concrete security management provider being used by the application's. Please read each provider's documentation [https://github.com/uberfire/uberfire-extensions/tree/master/uberfire-security/uberfire-security-management] for more information.

- **Creating new users**

  By clicking on the *Create new user* button, a new screen will be presented on the center panel to perform a new user creation.

Figure 1.121.

The **user editor**, on the center panel, is used to create, view, update or delete users. Once creating a new user o clicking an existing user on the users explorer, the user editor screen is opened.

To **view an existing user**, click on an existing user in the Users Explorer to open the User Editor screen. For example, viewing the *admin* user when using the Wildfly security management provider results in this screen:

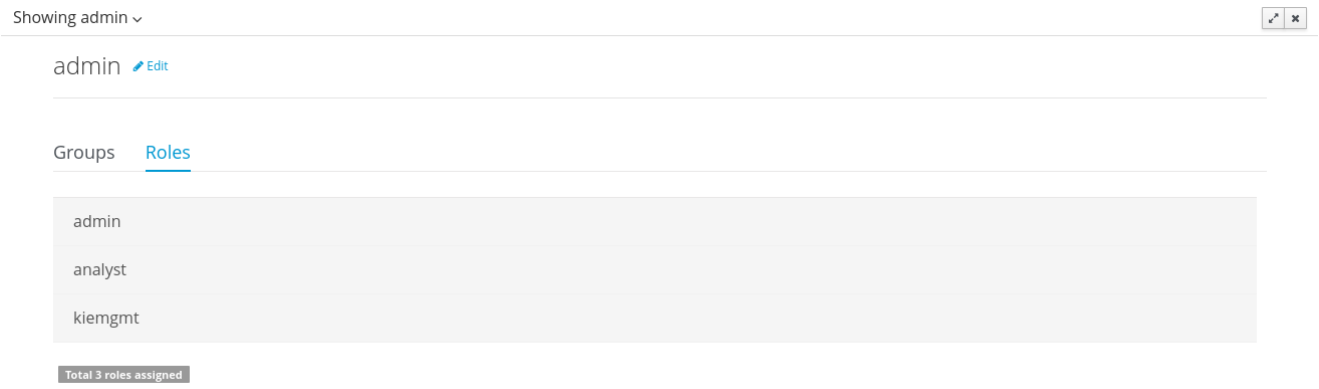


Figure 1.122.

Same admin user view operation but when using the Keycloak security management provider, instead of the Wildfly's one, results in this screen:

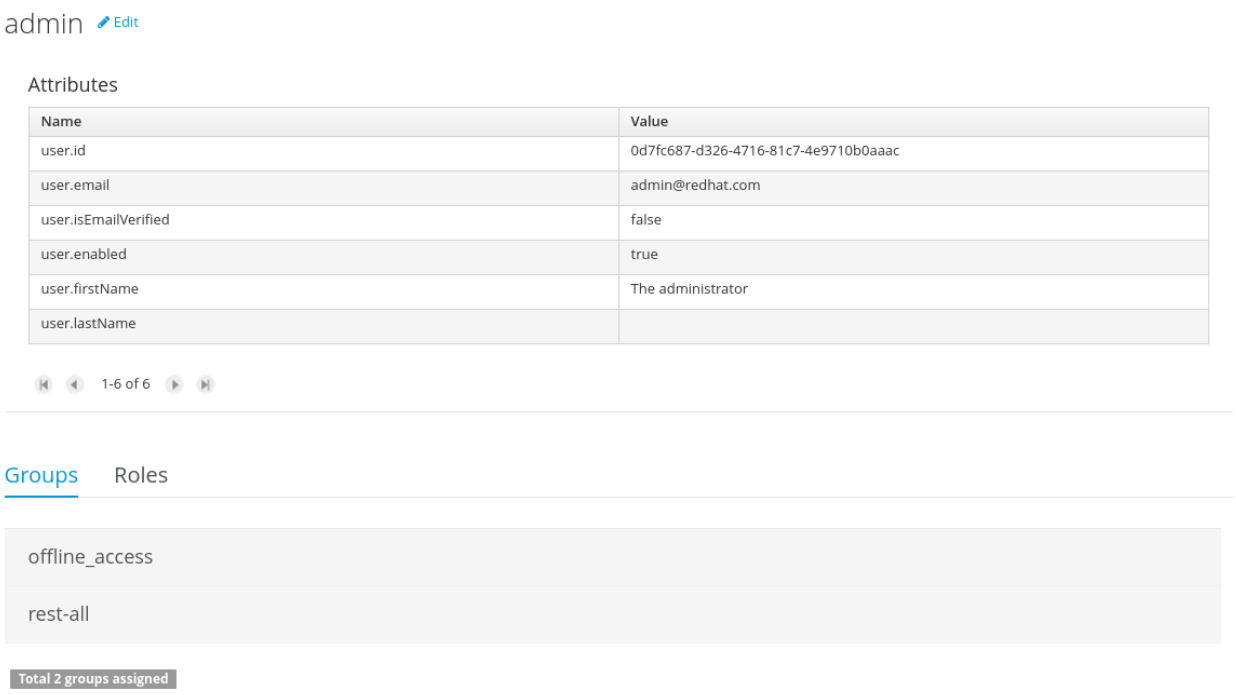


Figure 1.123.

Note that the user editor, when using the Keycloak sec. management provider, includes the user attributes management section, but it's not present when using the Wildfly's one. So remember that the information and actions available on the user interface depends on each provider's capabilities (as explained in previous sections).

Viewing a user in the user editor provides the following information (if provider supports it):

- The user name

- The user's attributes
- The assigned groups
- The assigned roles

In order to **update or delete an existing user**, click on the *Edit* button present near to the user-name in the user editor screen:

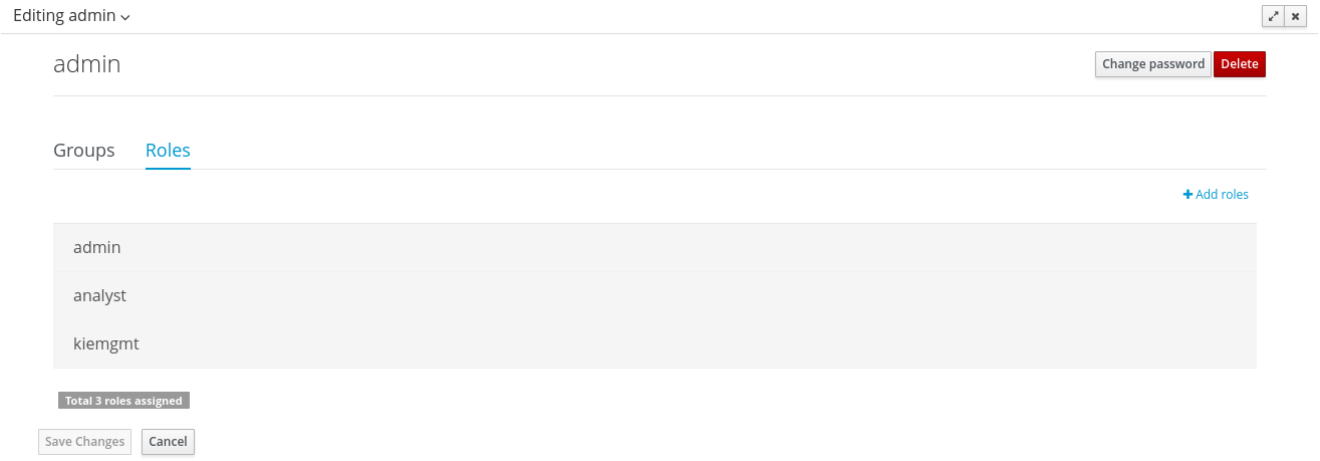


Figure 1.124.

Once the user editor presented in edit mode, different operations can be done (if the security management provider in use supports it):

- **Update the user's attributes**

  A group selection popup is presented when clicking on *Add to groups* button:

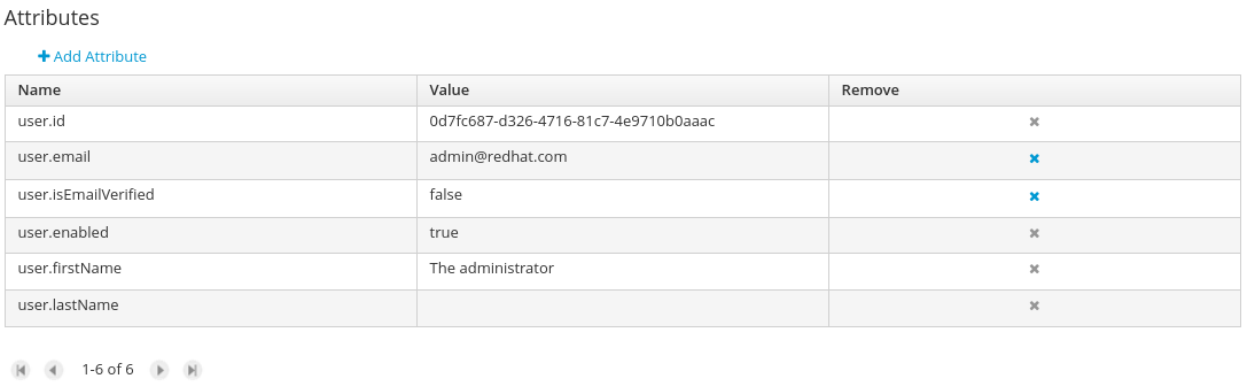


Figure 1.125.

This popup screen allows the user to search and select or deselect the groups assigned for the user currently being edited.

- **Update assigned groups**

  A group selection popup is presented when clicking on *Add to groups* button:

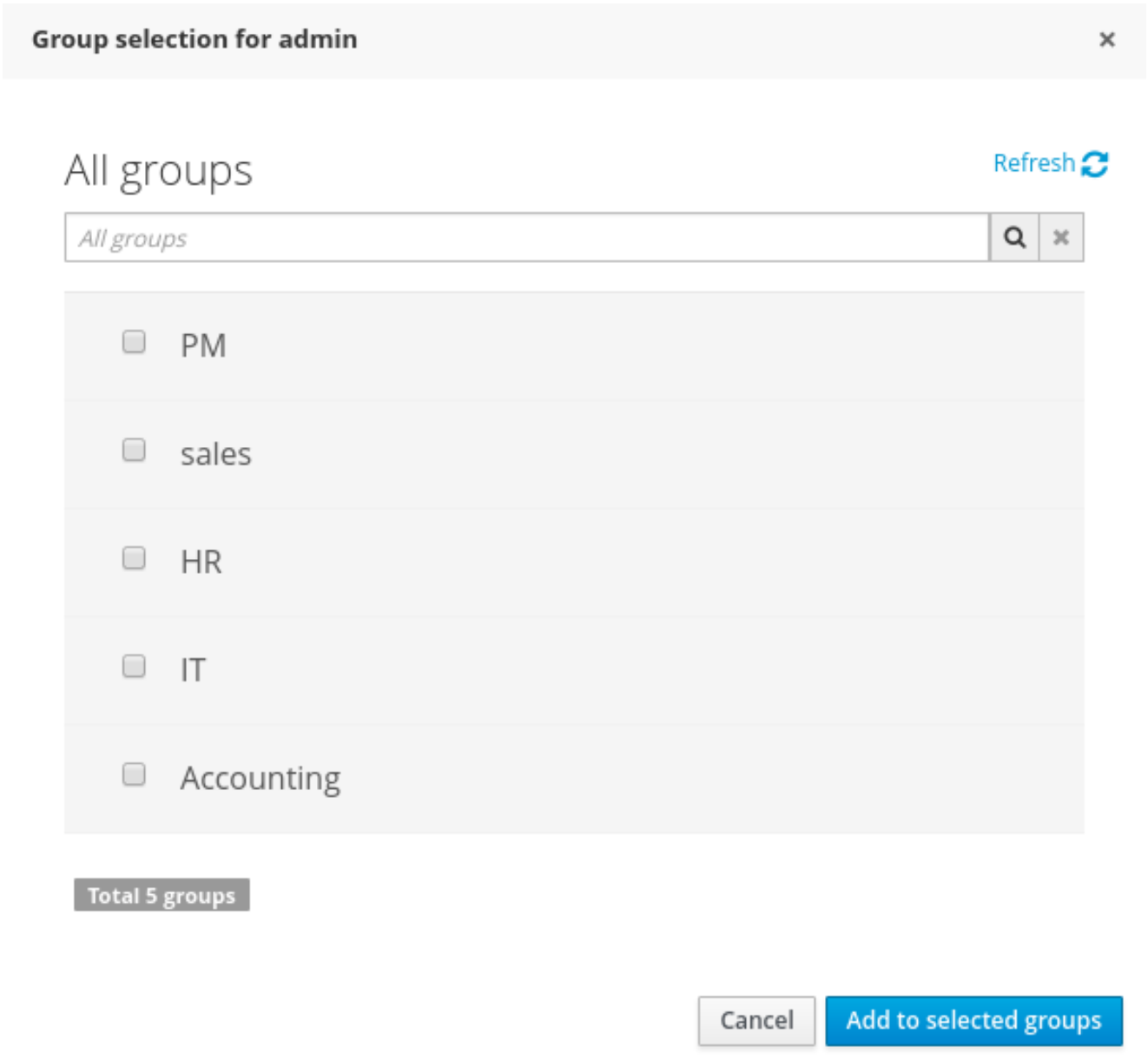


Figure 1.126.

This popup screen allows the user to search and select or deselect the groups assigned for the user currently being edited.

- **Update assigned roles**

  A role selection popup is presented when clicking on *Add to roles* button:

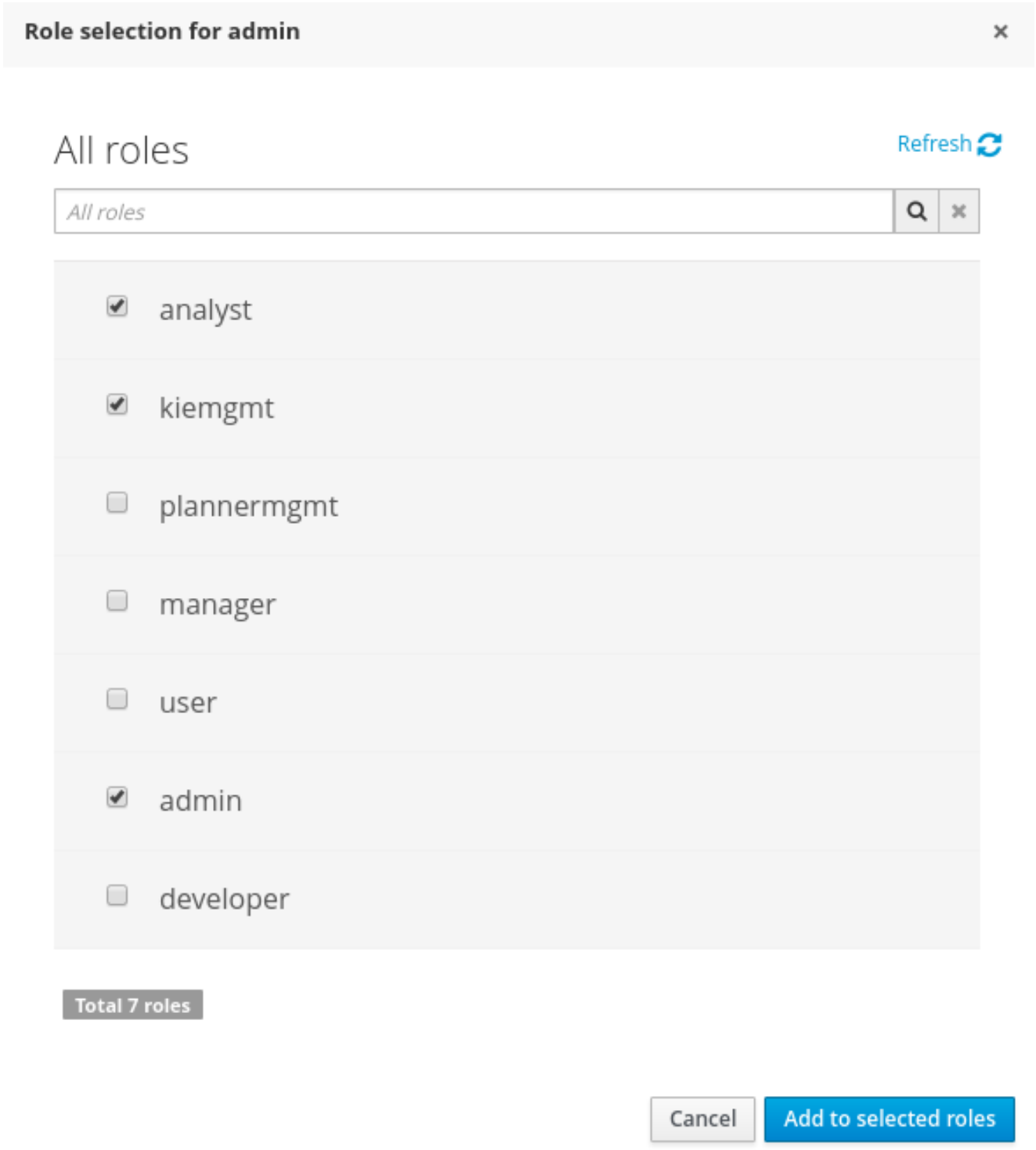


Figure 1.127.

This popup screen allows the user to search and select or deselect the roles assigned for the user currently being edited.

- **Change user's password**

A change password popup screen is presented when clicking on the *Change password* button:

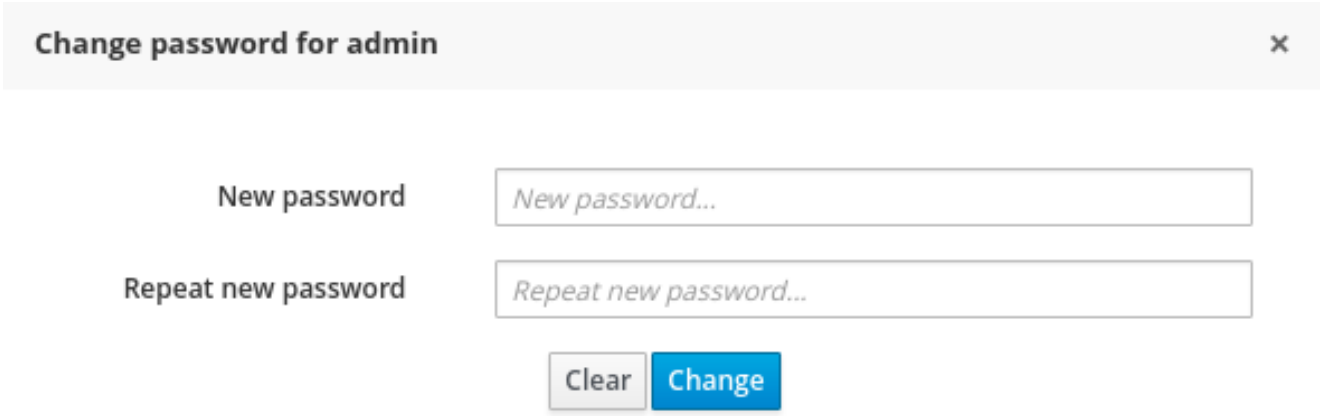


Figure 1.128.

- **Delete user**

  The user currently being edited can be deleted from the realm by clicking on the *Delete* button.

1.8.4.2. Group management

The group management interface is available from the *Group management* menu entry in the *Home* menu.

The interface is presented using two main panels: the groups explorer on the west panel and the group editor on the center one:

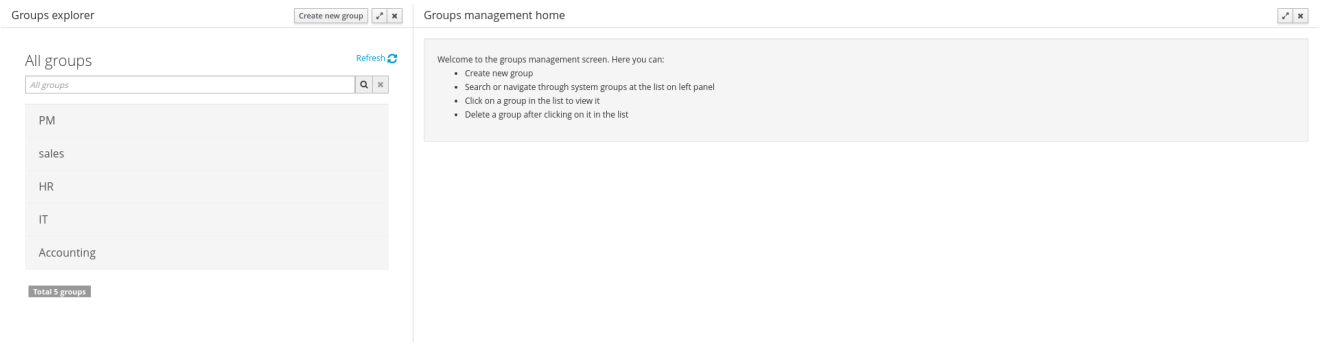


Figure 1.129.

The **groups explorer**, on west panel, lists by default all the groups present on the application's security realm:

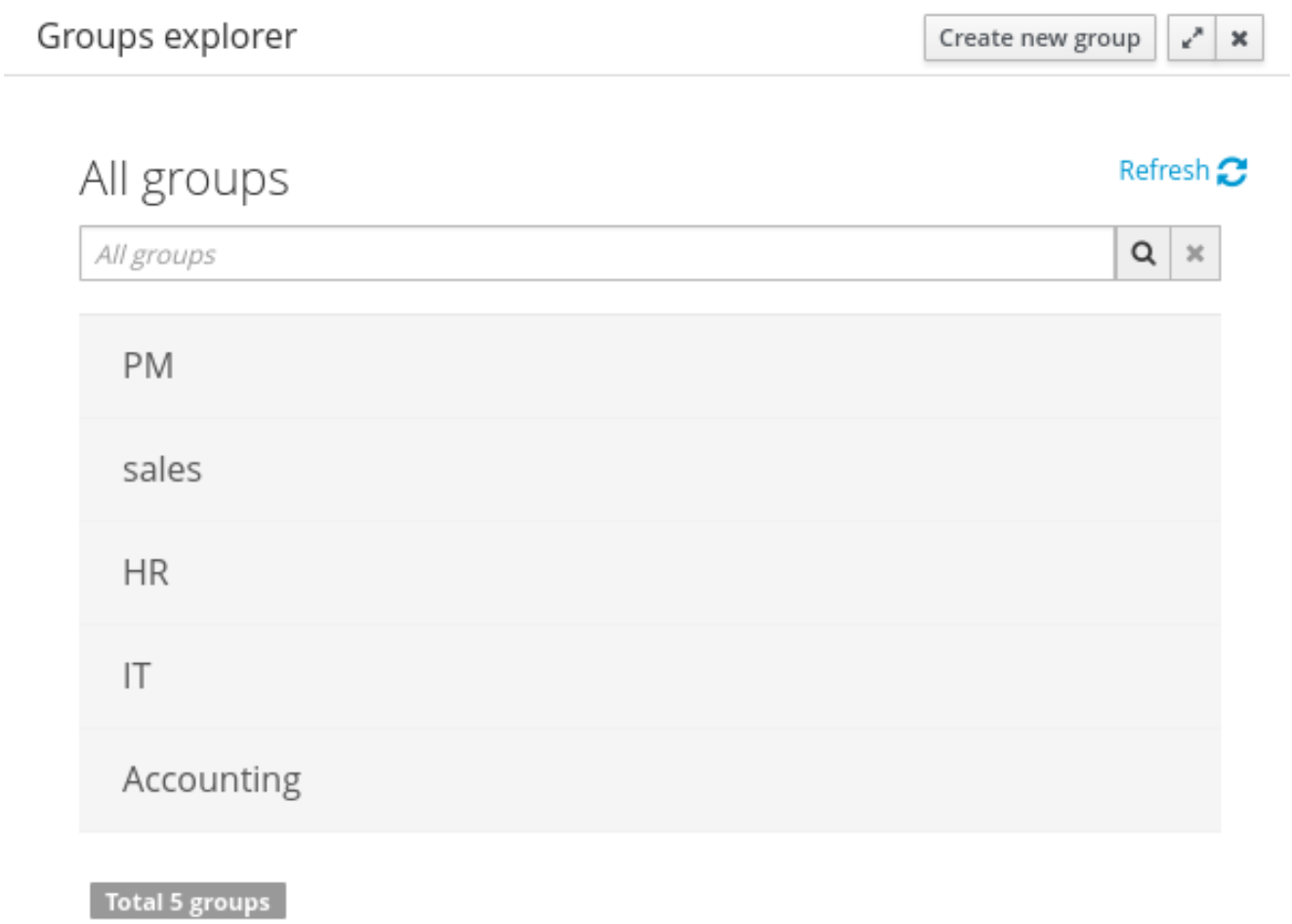


Figure 1.130.

In addition to listing all groups, the groups explorer allows:

- **Searching for groups**

  When specifying the search pattern in the search box the users list will be reduced and will display only the users that match the search pattern.

Figure 1.131.

Search patterns depend on the concrete security management provider being used by the application's. Please read each provider's documentation [https://github.com/uberfire/uberfire-extensions/tree/master/uberfire-security/uberfire-security-management] for more information.

- **Create new groups**

  By clicking on the *Create new group* button, a new screen will be presented on the center panel to perform a new group creation. Once the new group has been created, it allows to assign users to it:

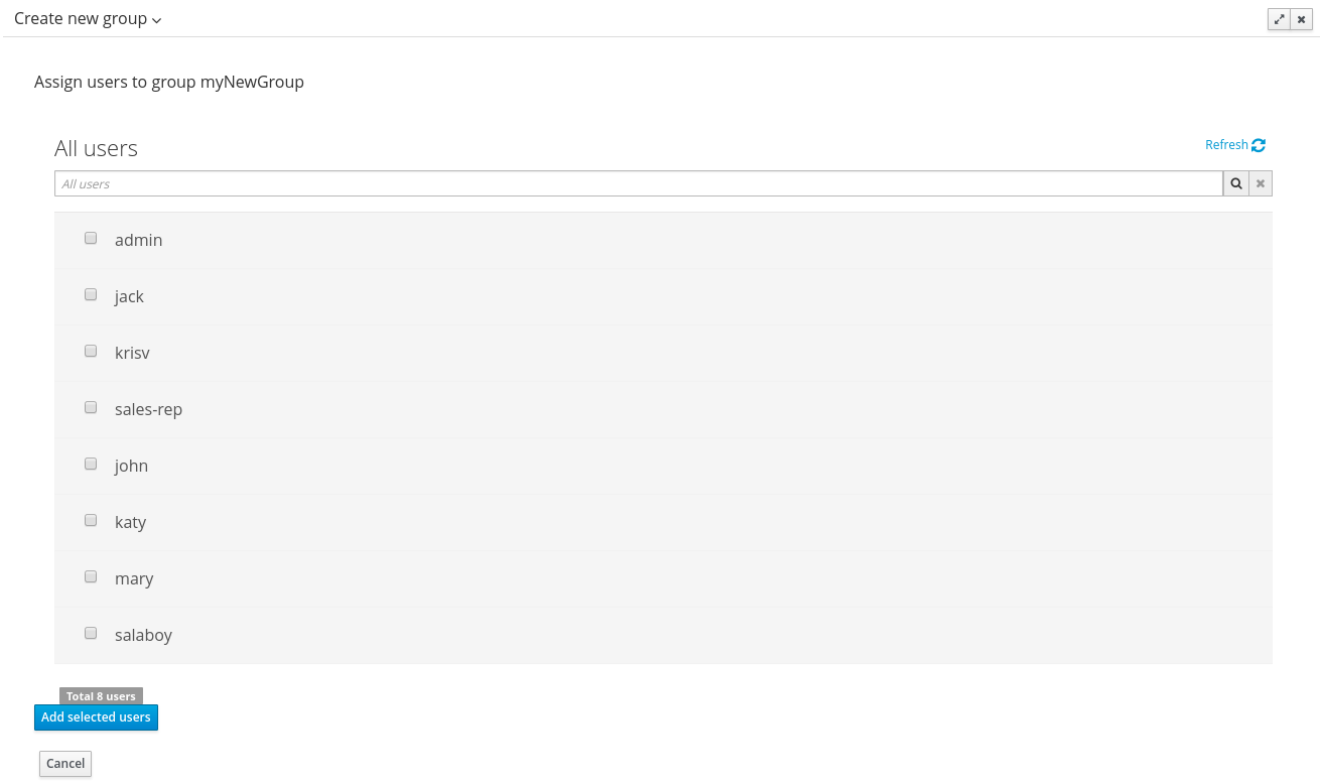


Figure 1.132.

The **group editor**, on the center panel, is used to create, view or delete groups. Once creating a new group o clicking an existing group on the groups explorer, the group editor screen is opened.

To **view an existing group**, click on an existing user in the Groups Explorer to open the Group Editor screen. For example, viewing the *sales* group results in this screen:

Figure 1.133.

To **delete an existing group** just click on the *Delete* button.

1.9. Embedding Workbench In Your Application

As we already know, Workbench provides a set of editors to author assets in different formats. According to asset's format a specialized editor is used.

One additional feature provided by Workbench is the ability to embed it in your own (Web) Applications thru it's **standalone** mode. So, if you want to edit rules, processes, decision tables, etc... in your own applications without switch to Workbench, you can.

In order to embed Workbench in your application all you'll need is the Workbench application deployed and running in a web/application server and, from within your own web applications, an iframe with proper HTTP query parameters as described in the following table.

Table 1.2. HTTP query parameters for standalone mode

Parameter Name	Explanation	Allow multiple values	Example
standalone	With just the presence of this parameter workbench will switch to standalone mode.	no	(none)
path	Path to the asset to be edited. Note that asset should already exists.	no	git://master@uf-playground/todo.md
perspective	Reference to an existing perspective name.	no	org.guvnor.m2repo.client.perspectives.Guv
header	Defines the name of the header that should be displayed (useful for context menu headers).	yes	ComplementNavArea

Note

Path and Perspective parameters are mutually exclusive, so can't be used together.

1.10. Asset Management

1.10.1. Asset Management Overview

This section of the documentation describes the main features included that contribute to the Asset Management functionality provided in the KIE Workbench and KIE Drools Workbench. All the features described here are entirely optional, but the usage is recommended if you are planning to have multiple projects. All the Asset Management features try to impose good practices on the repository structure that will make the maintainace, versioning and distribution of the projects simple and based on standards. All the Asset Management features are implemented using jBPM Business Processes, which means that the logic can be reused for external applications as well as adapted for domain specific requirements when needed.

Note

You must set the "kiemgmt" role to your user to be able to use the Asset Management Features

1.10.2. Managed vs Unmanaged Repositories

Since the creation of the assets management features repositories can be classified into Managed or Unmanaged.

1.10.2.1. Managed Repositories

All new assets management features are available for this type of repositories. Additionally a managed repository can be "Single Project" or "Multi Project".

A "Single Project" managed repository will contain just one Project. And a "Multi Project" managed repository can contain multiple Projects. All of them related through the same parent, and they will share the same group and version information.

1.10.2.2. Unmanaged Repositories

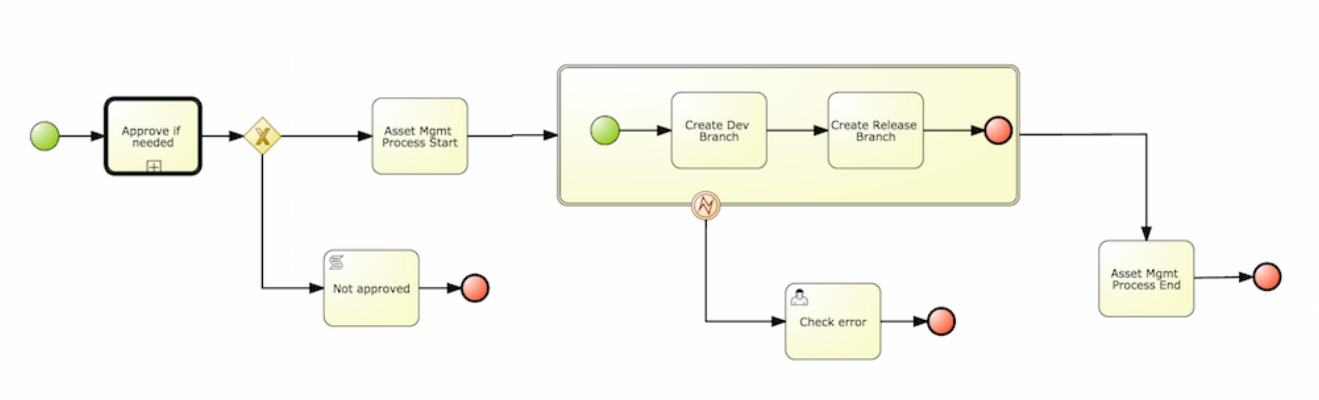
Assets management features are not available for this type or repositories and they basically behave the same as the repositories created with previous workbench versions.

1.10.3. Asset Management Processes

There are 4 main processes which represent the stages of the Asset Management feature: Configure Repository, Promote Changes, Build and Release.

1.10.3.1. Configure Repository

The Configure Repository process is in charge of the post initialization of the repository. This process will be automatically triggered if the user selects to create a Managed Repository on the New repository wizzard. If they decide to use the governance feature the process will kick in and as soon as the repository is created. A new development and release branches will be created. Notice that the first time that this process is called, the master branch is picked and both branches (dev and release) will be based on it.

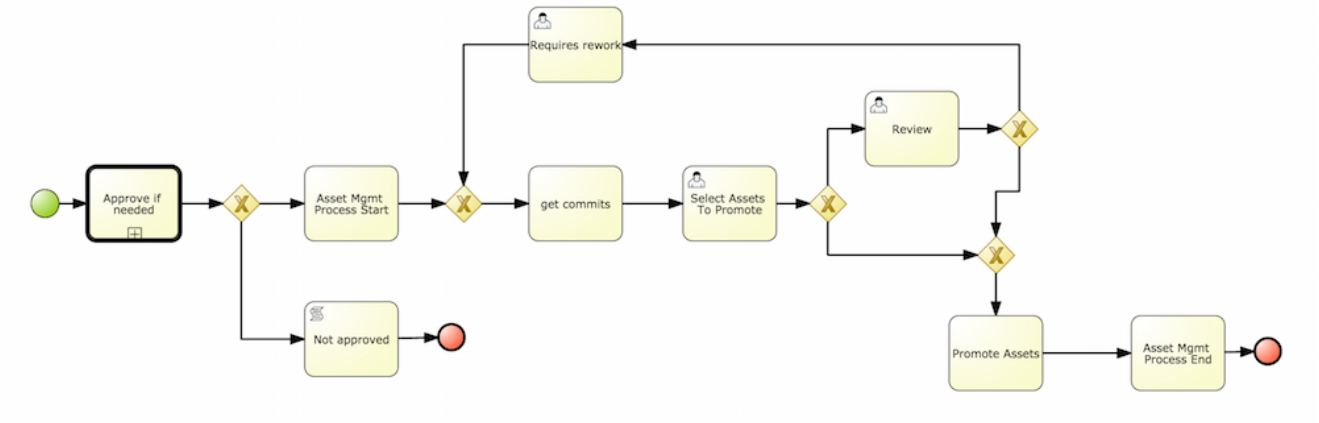


By default the asset management feature is not enabled so make sure to select Managed Repository on the New Repository Wizzard. When we work inside a managed repository, the development branch is selected for the users to work on. If multiple dev branches are created, the user will need to pick one.

1.10.3.2. Promote Changes Process

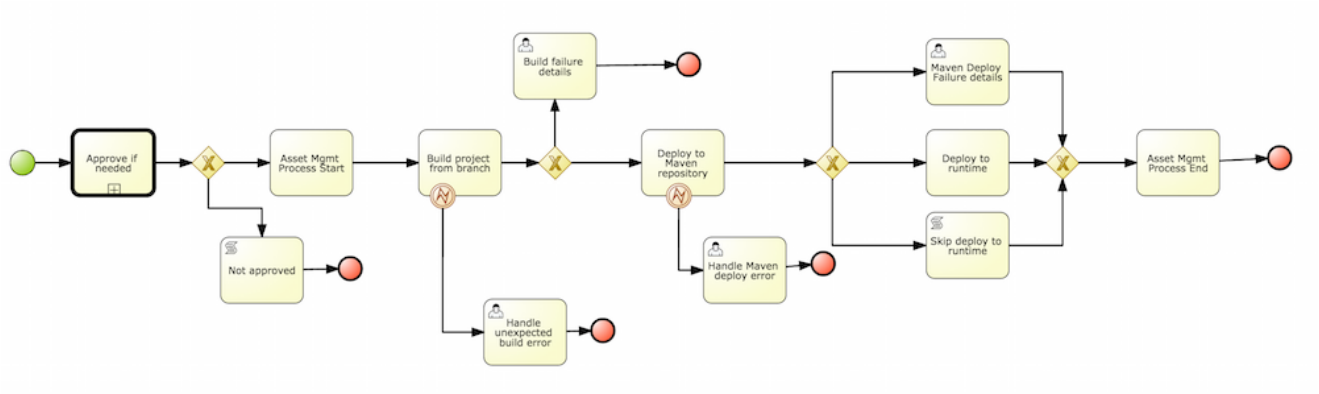
When some work is done in the developments branch and the users reach a point where the changes needs to be tested before going into production, they will start a new Promote Changes process so a more technical user can decide and review what needs to be promoted. The users belonging to the "kiemgmt" group will see a new Task in their Group Task List which will contain all the files that had been changed. The user needs to select the assets that will be promoting via the UI. The underlying process will be cherry-picking the commits selected by the user to the release branch. The user can specify that a review is needed by a more technical user.

This process can be repeated multiple times if needed before creating the artifacts for the release.



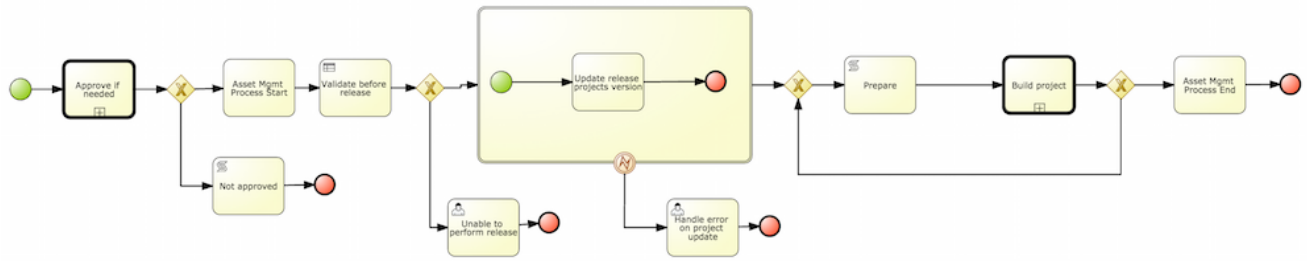
1.10.3.3. Build Process

The Build process can be triggered to build our projects from different branches. This allows us to have a more flexible way to build and deploy our projects to different runtimes.



1.10.3.4. Release Process

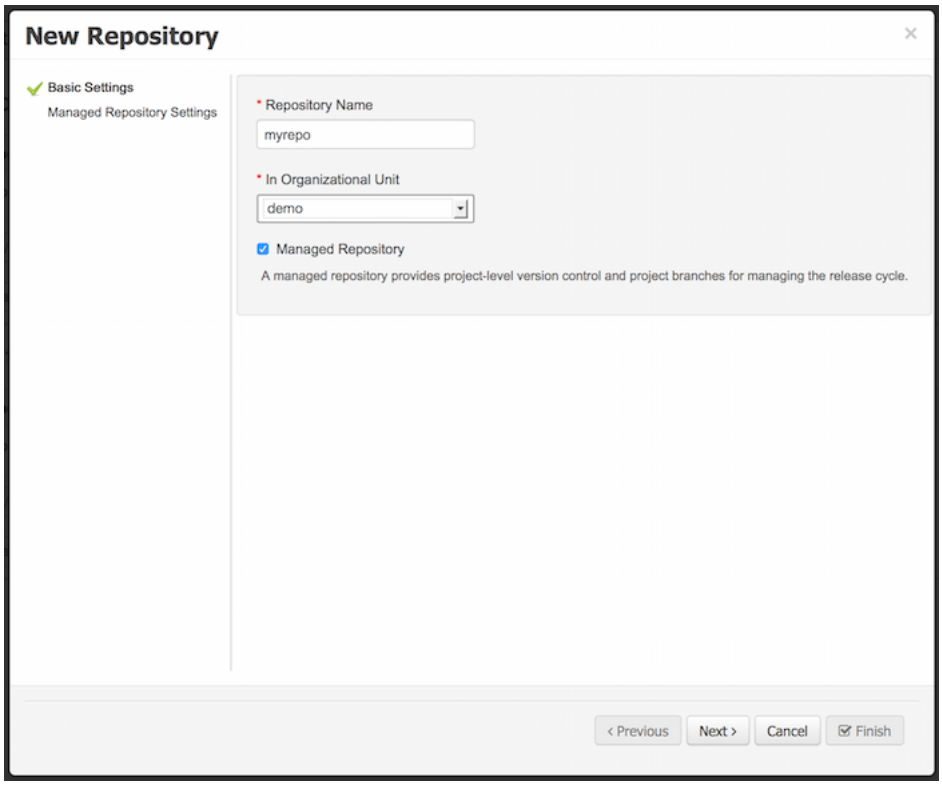
The release process is triggered at any time when the user decided that it is time to generate a release of the project that he/she is working on. This process will build the project (calling the Build Process) and it will update all the maven artifacts to the next version.



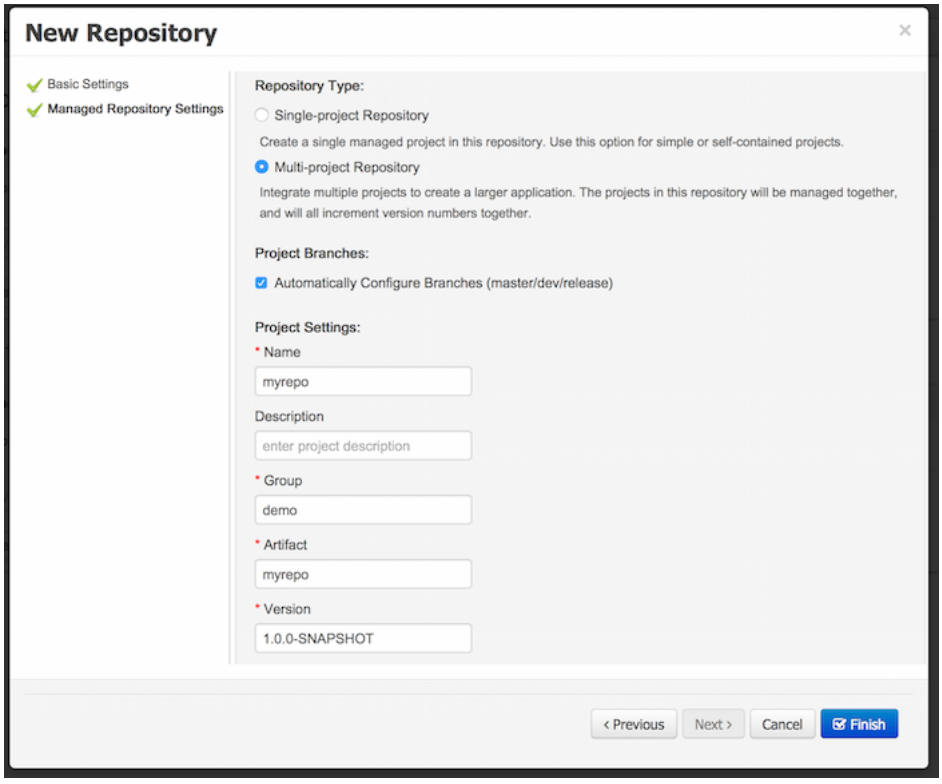
1.10.4. Usage Flow

This section describes the common usage flow for the asset management features showing all the screens involved.

The first contact with the Asset Management features starts on the Repository creation.



If the user chooses to create a Managed Respository a new page in the wizzard is enabled:



When a managed repository is created the assets management configuration process is automatically launched in order to create the repository branches, and the corresponding project structure is also created.

1.10.5. Repository Structure

Once a repository has been created it can be managed through the Repository Structure Screen.

To open the Repository Structure Screen for a given repository open the Project Authoring Perspective, browse to the given repository and select the "Repository -> Repository Structure" menu option.

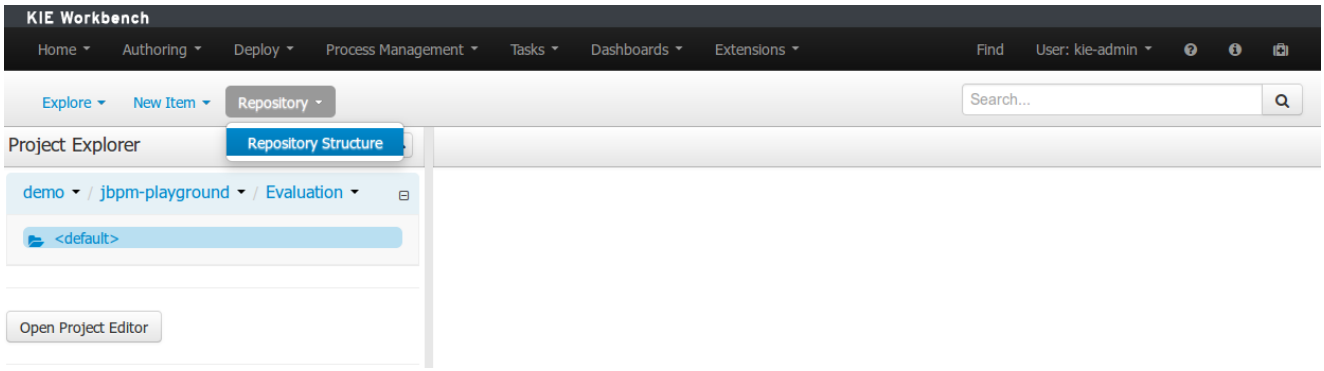


Figure 1.134. Repository Structure Menu

1.10.5.1. Single Project Managed Repository

The following picture shows an example of a single project managed repository structure.

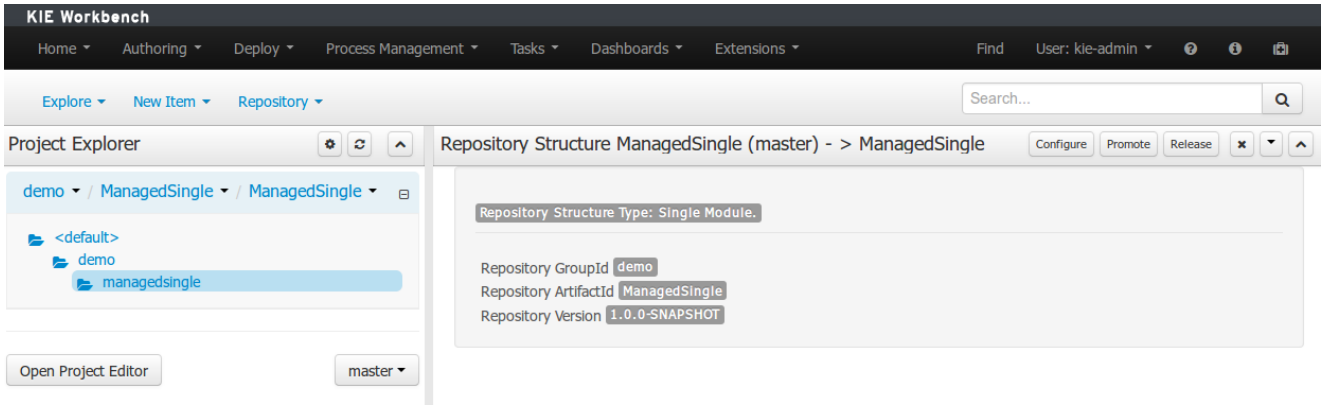


Figure 1.135. Single Project Managed Repository

1.10.5.2. Multi Project Managed Repository

The following picture shows an example of a multi project managed repository structure.

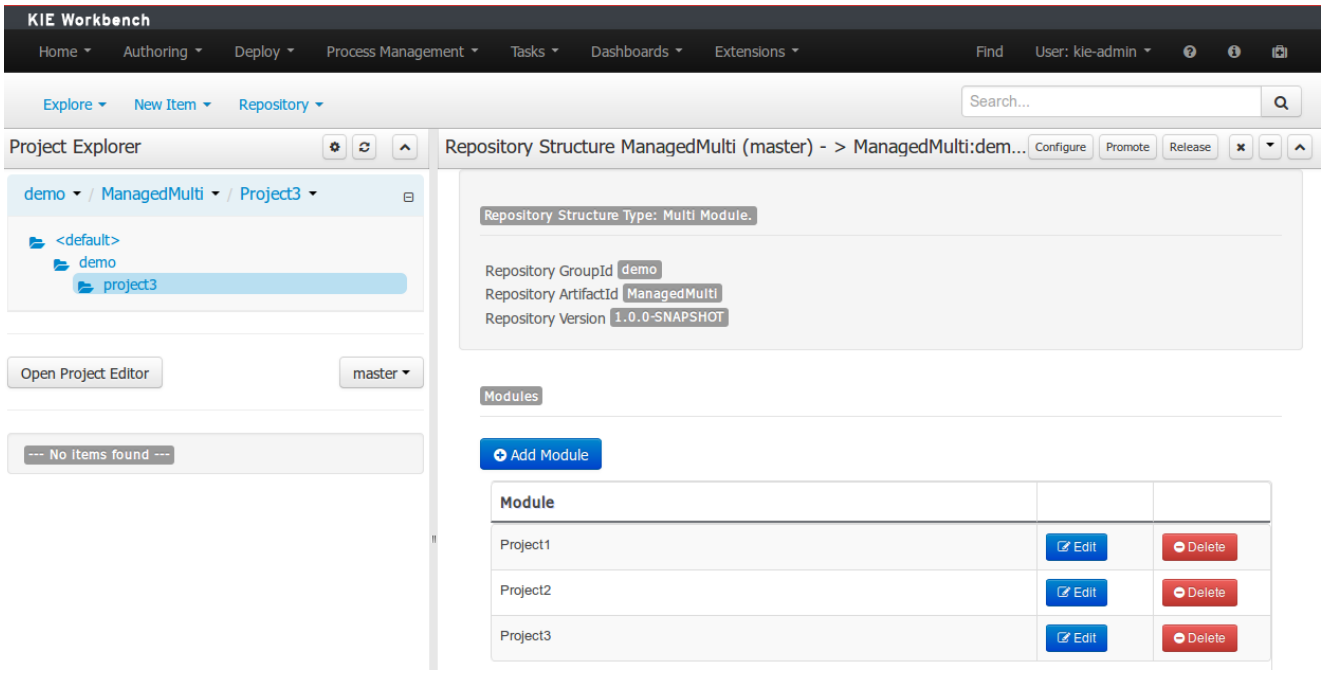


Figure 1.136. Multi Project Managed Repository

1.10.5.3. Unmanaged Repository

The following picture shows an example of an unmanaged repository structure.

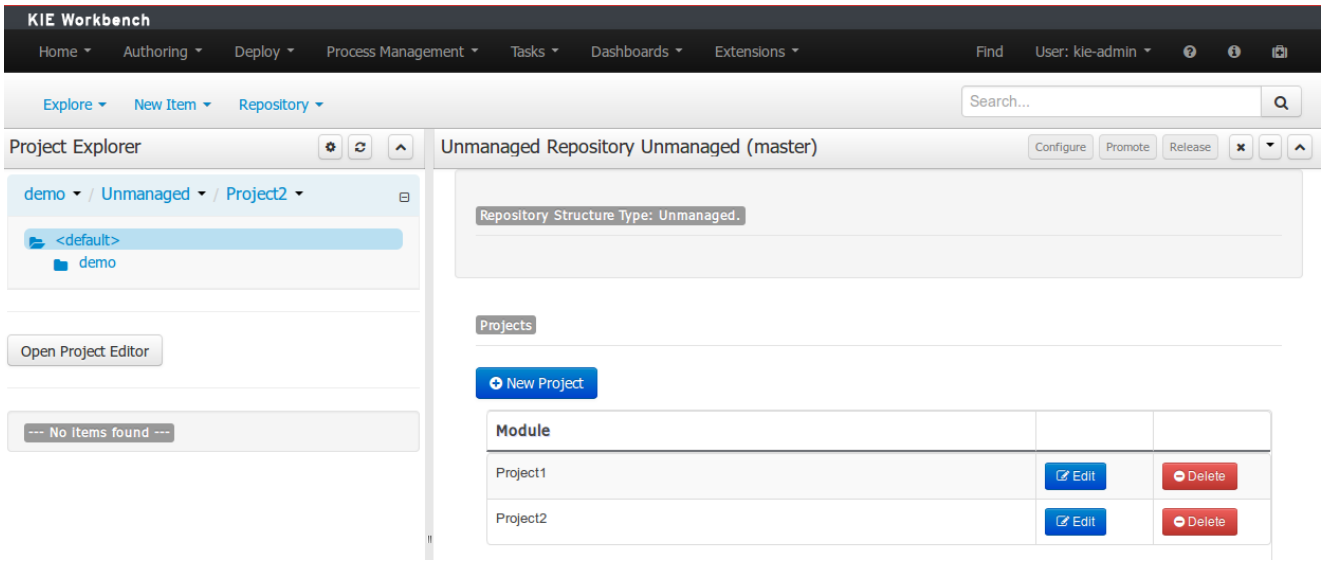


Figure 1.137. Unmanaged Repository

1.10.6. Managed Repositories Operations

The following picture shows the screen areas related to managed repositories operations.

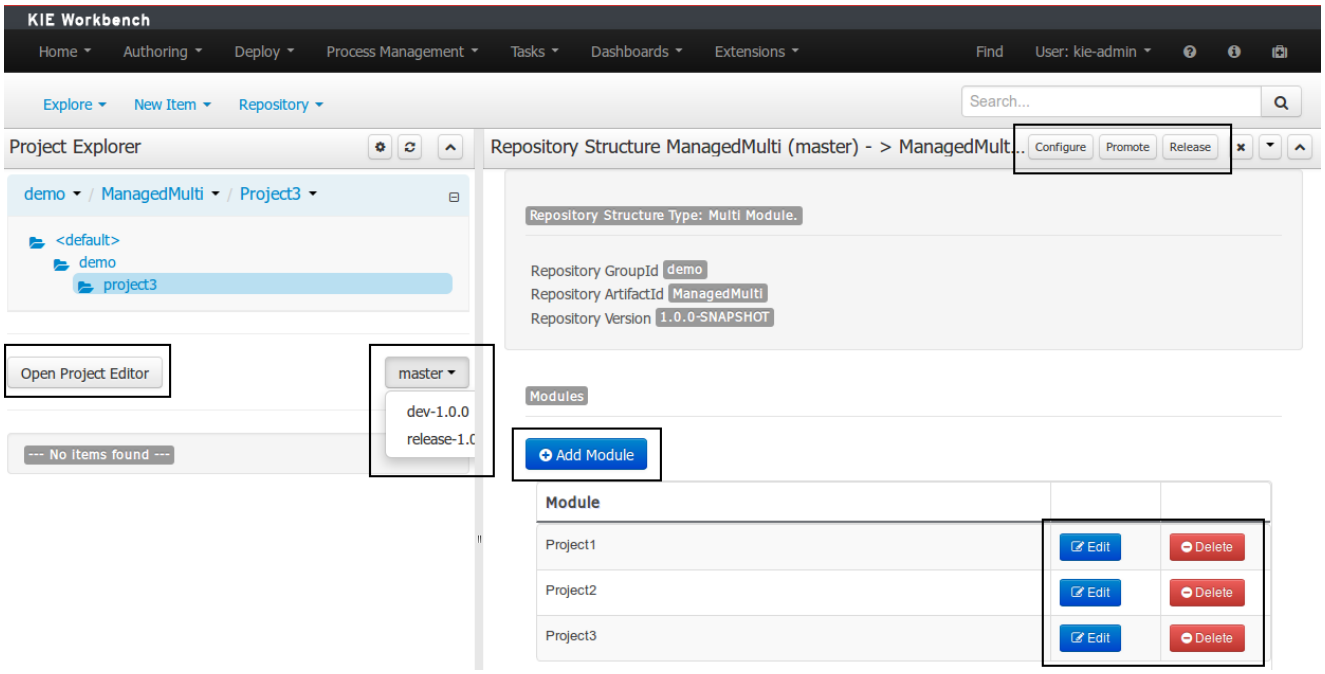


Figure 1.138. Managed Repositories Operations

1.10.6.1. Branch Selector

The branch selector lets to switch between the different branches created by the Configure Repository Process.

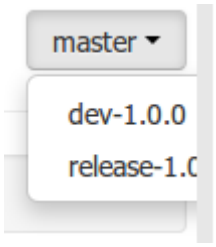


Figure 1.139. Branch Selector

1.10.6.2. Project Operations

From the repository structure screen it's also possible to create, edit or delete projects from current repository.

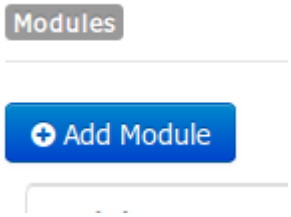


Figure 1.140. Add Project to current structure

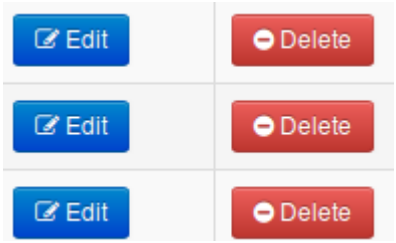


Figure 1.141. Edit/Delete projects from current structure

1.10.6.3. Launch Assets Management Processes

The assets management processes can also be launched from the Project Structure Screen.

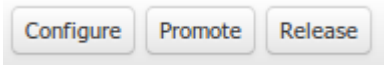


Figure 1.142. Launch Assets Management Processes

1.10.6.3.1. Launch the Configure Repository Process

Filling the parameters bellow a new instance of the Configure Repository can be started. (see Configure Repository Process)

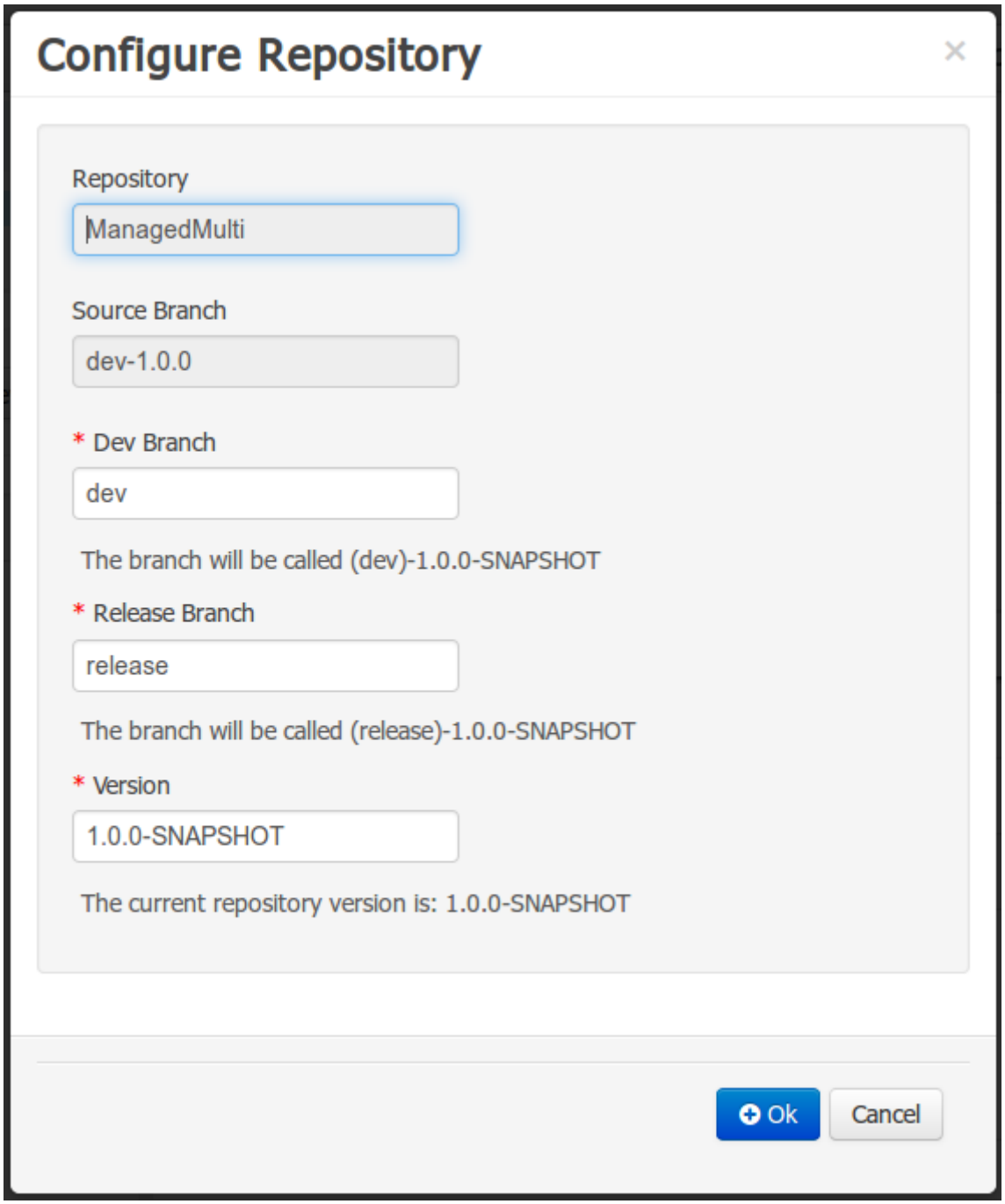


Figure 1.143. Configure Repository Process Parameters

1.10.6.3.2. Launch the Promote Changes Process

Filling the parameters bellow a new instance of the Promote Changes Process can be started. (see Promote Changes Process)

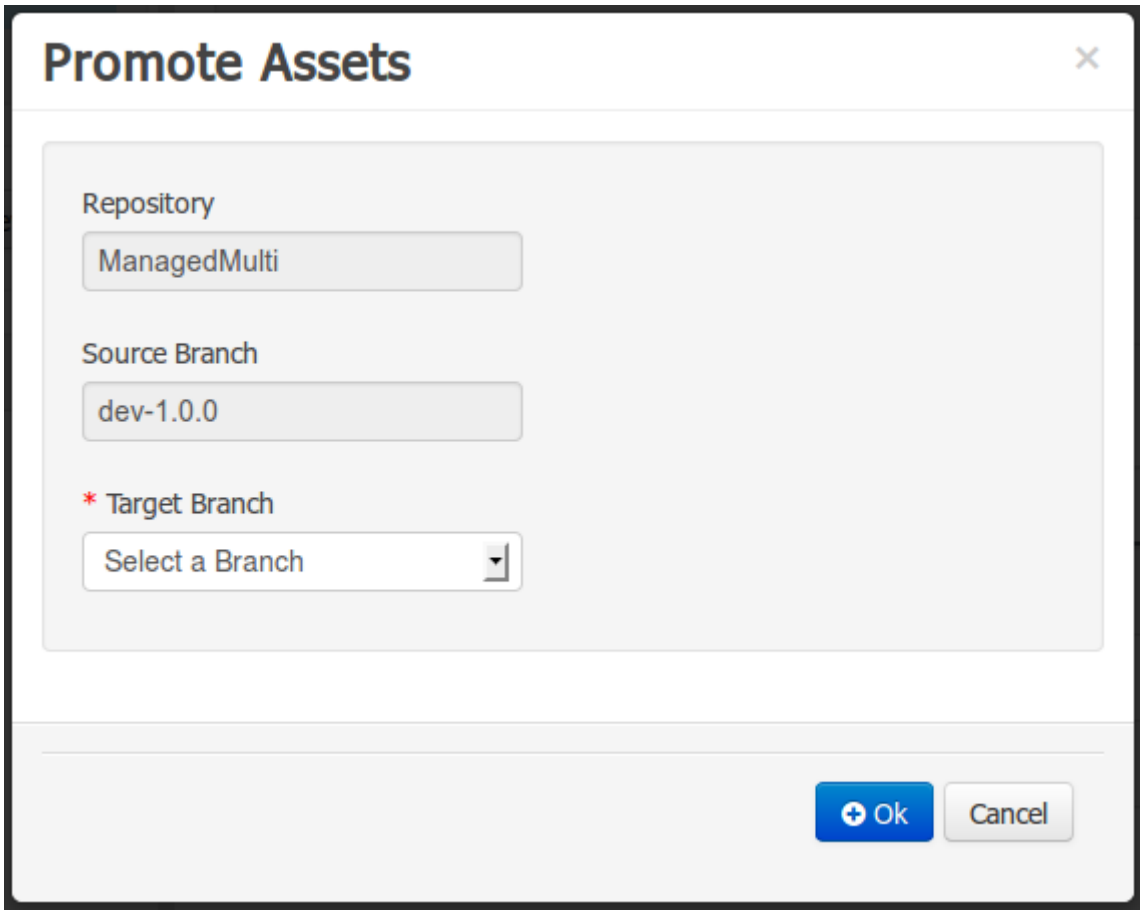


Figure 1.144. Promote Changes Process Parameters

1.10.6.3.3. Launch the Release Process

Filling the parameters bellow a new instance of the Release Process can be started. (see Release Process)

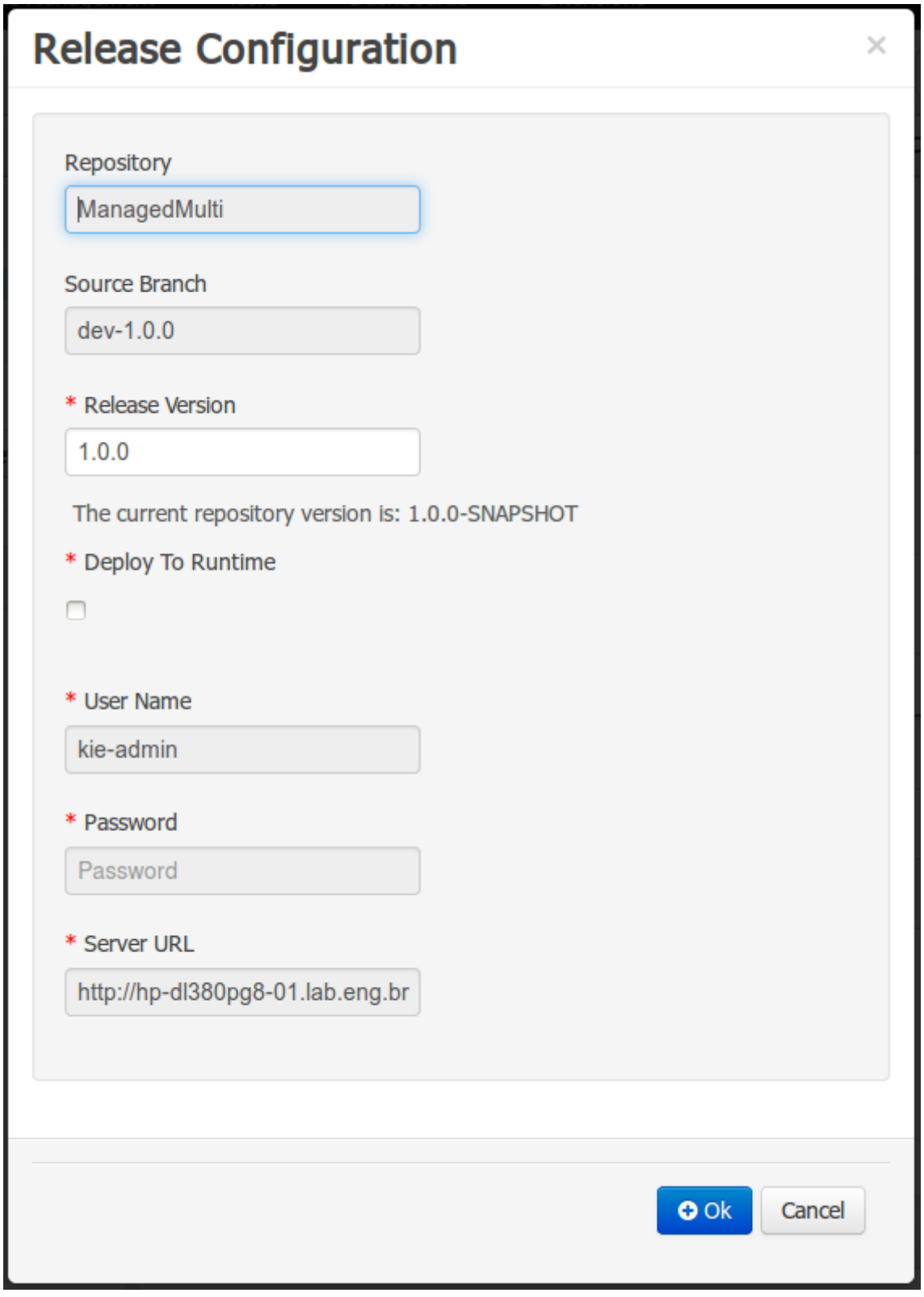


Figure 1.145. Release Process Parameters

1.11. Execution Server Management UI

The Execution Server Management UI allows users create and modify Server Templates and Containers, it also allows users manage Remote Servers. This screen is available via Deploy -> Rule Deployments menu.

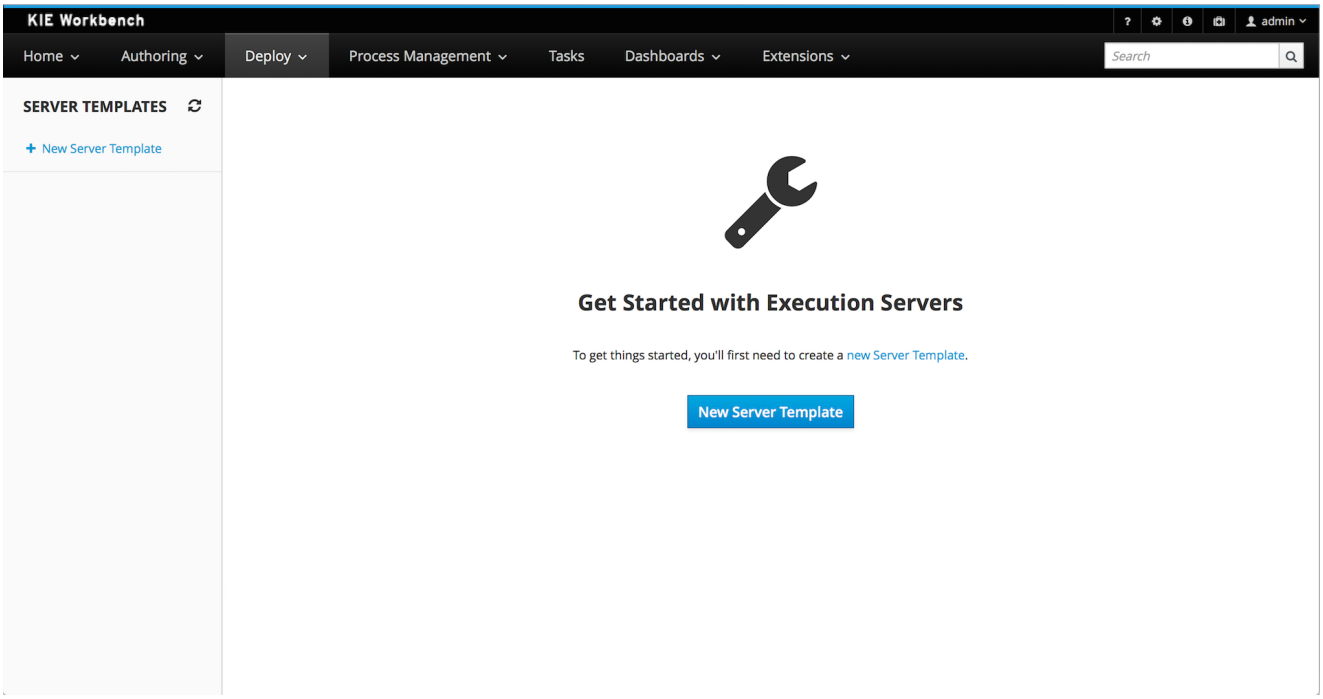


Figure 1.146. Execution Server Management

Note

The management UI is only available for KIE Managed Servers.

1.11.1. Server Templates

Server templates are used to define a common configuration that can be used for multiple servers, thus the name: Template.

Server Templates can be created directly from the management UI or it's automatically created when a server connects to controller and there isn't a template definition for that remote server. Server templates may have one or more capabilities, such capabilities can't be modified, if you need modify the capabilities you'll have to create a new template. Here is the list of current capabilities:

- Rule (Drools)
- Process (jBPM)

- Planning (Optaplanner)

Note

For Planner capability it's mandatory to enable Rule's capability too.

In order to create a new Server Template you have to click at New Server Template button and follow the wizard. It's also possible to create a container during Wizard, but for now let's limit to just the template.

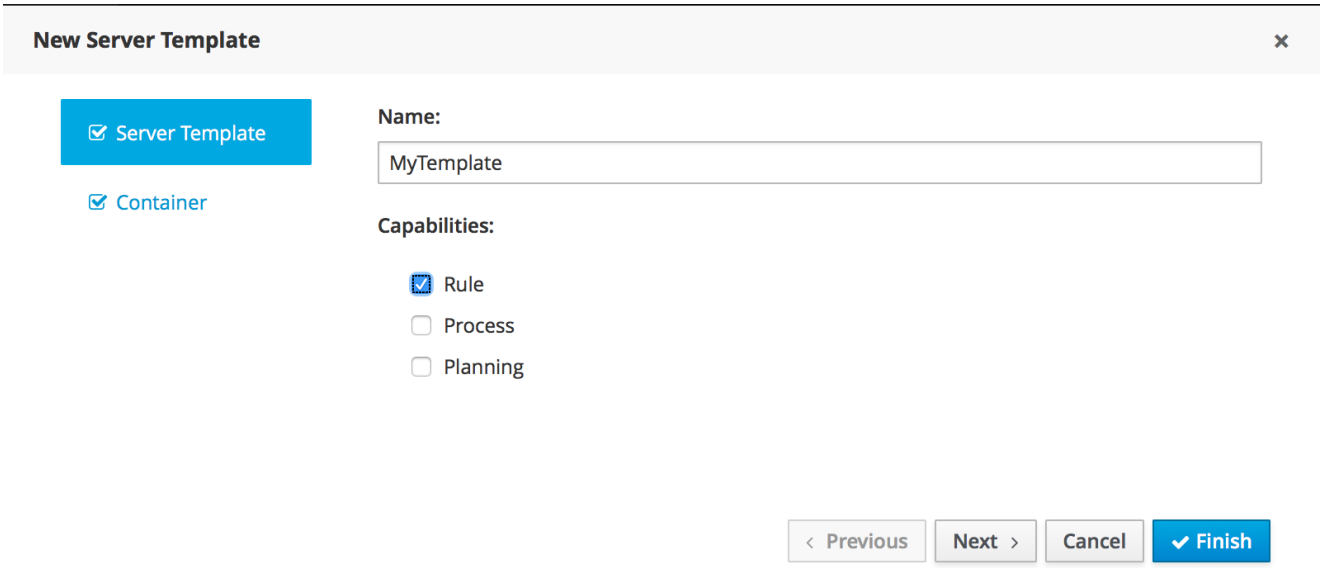


Figure 1.147. New Server Template Wizard

Once created you'll get the new Template listed on the left hand side, with the new Server Template highlighted. On the right hand side you get the 2nd level navigation that lists Containers and Remote Servers that are related to selected Server Template.

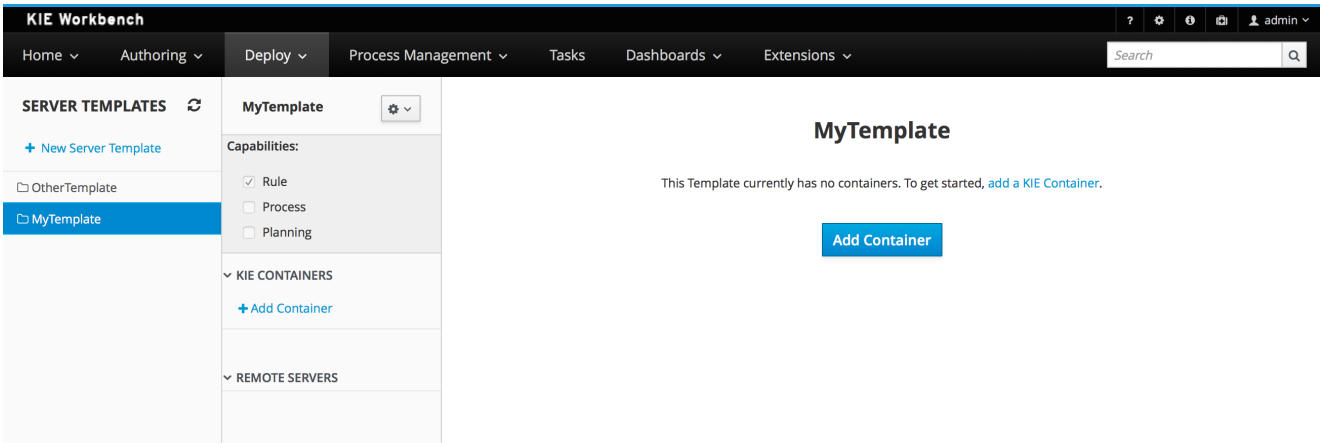


Figure 1.148. Server Templates

On top of the navigation is also possible to delete the current Server Template or create a copy of it.

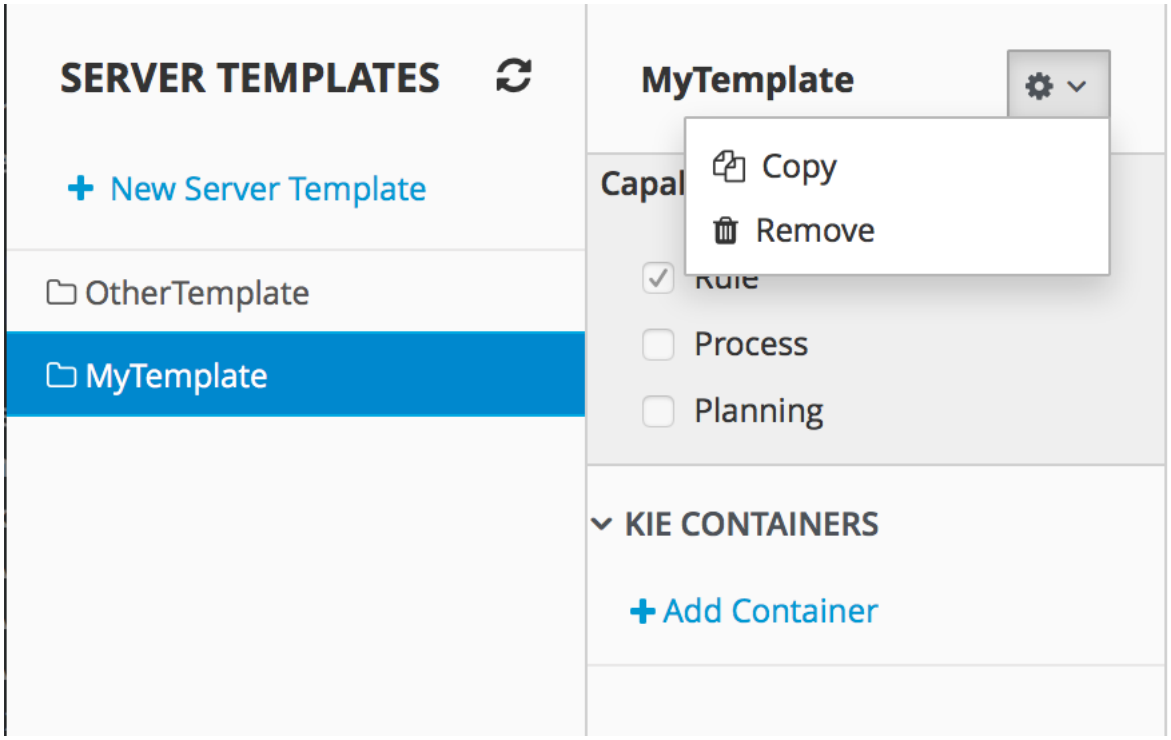


Figure 1.149. Server Template Actions

1.11.2. Container

A Container is a KIE Container configuration of the Server Template. Click the Add Container button to create a new container for the current Server Template.

The search area can help users find an specific KJARs that they are looking for.

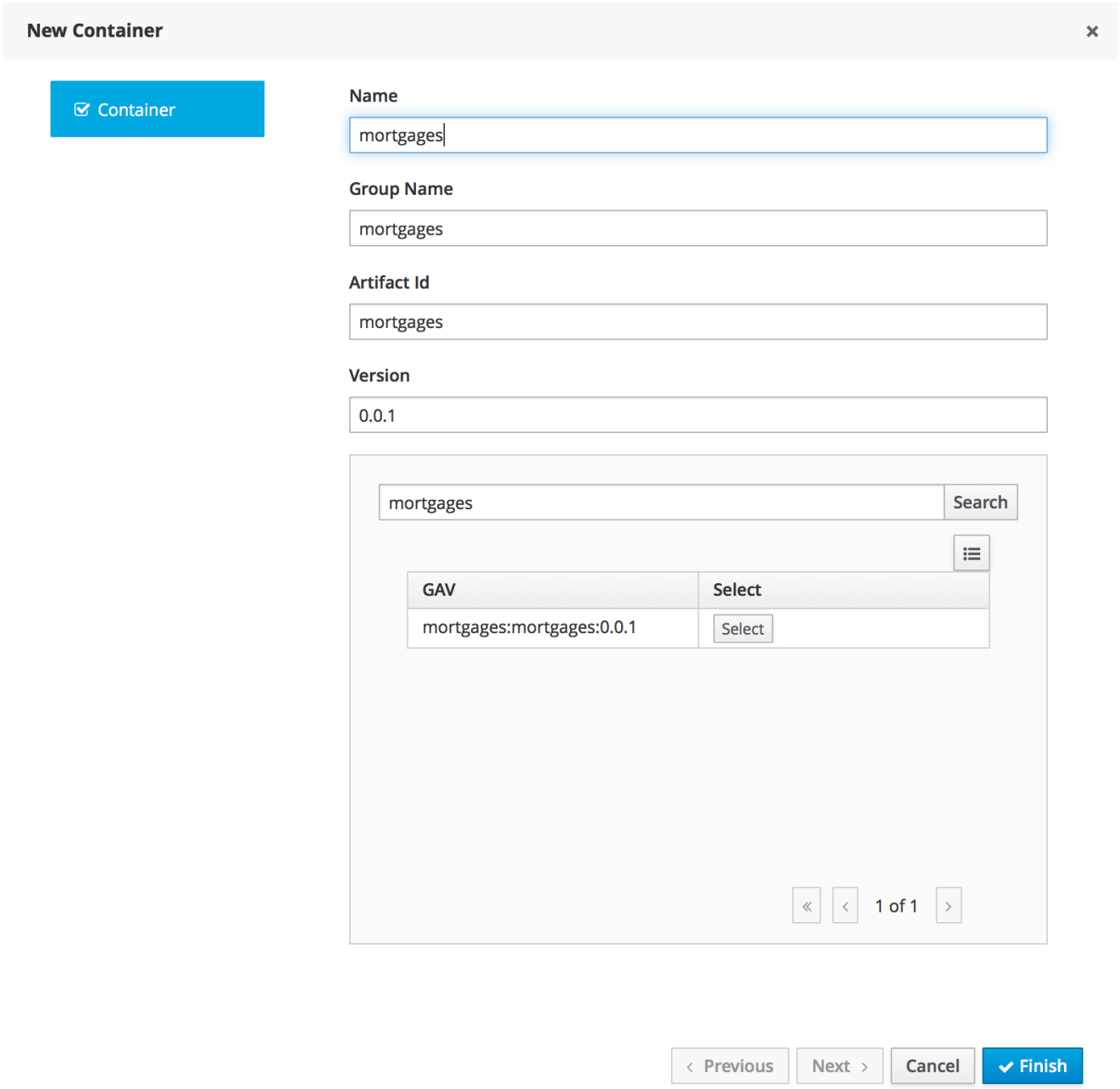


Figure 1.150. New Container Wizard

For Server Templates that have Process capabilities enabled, the Wizard has a 2nd optional step where users can configure some process related behaviors.

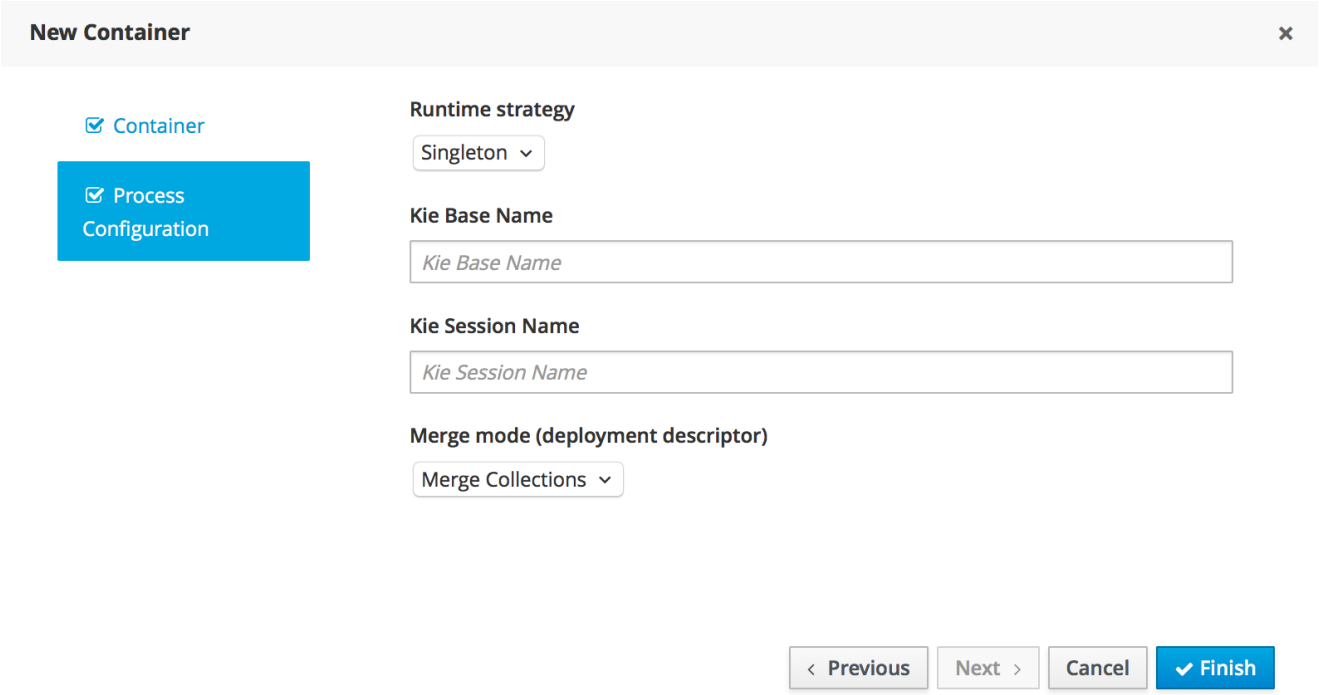


Figure 1.151. Process Configuration

Once created the new Container will be displayed on the containers list just above the list of remote servers. Just after created a container is by default Stopped which is the only state that allows users to remove it.

Figure 1.152. Container

A Container has the following tabs available for management and/or configuration:

- Status
- Version Configuration
- Process Configuration

Status tab lists all the Remote Servers that are running the active Container. Each Remote Server is rendered as a Card, which displays to users status and endpoint.

Note

Only started Containers are deployed to remote servers.

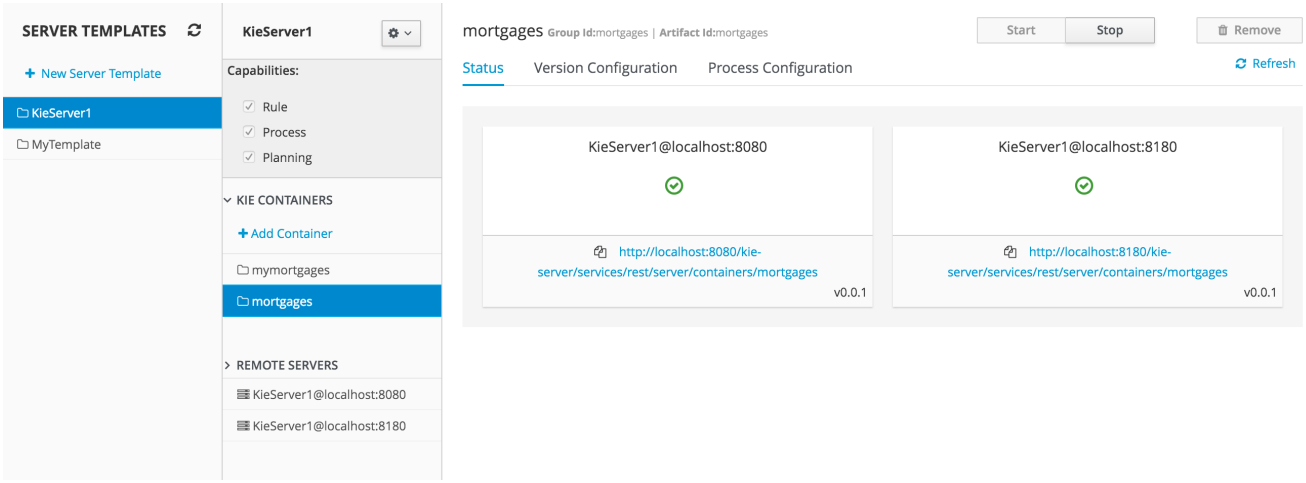


Figure 1.153. Status Container

Version Configuration tab allow users change the current version of the Container. User's can upgrade manually to a specific version using the "Upgrade" button, or enable/disable the Scanner. It's also possible to execute a ScanNow operation, that will scan for new versions only once.

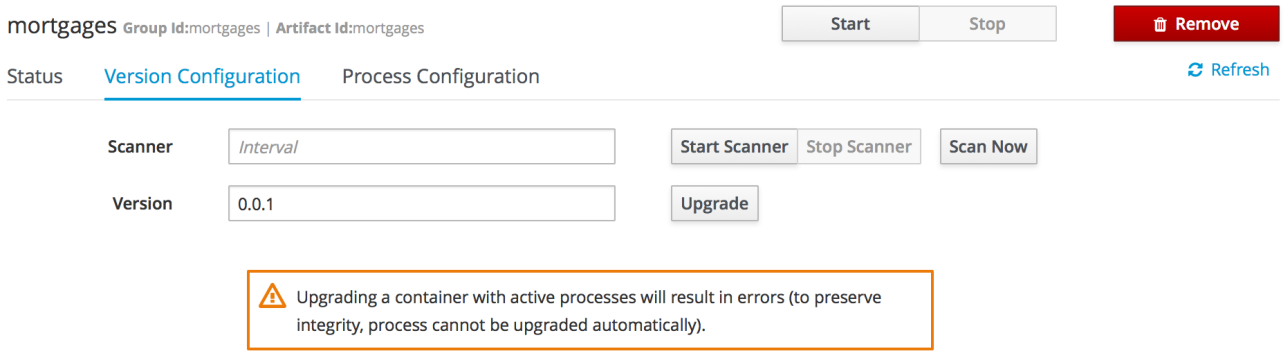


Figure 1.154. Version Configuration

Process Configuration is the same form that is displayed during New Container Wizard for Template Servers that have Process Capability. If Template Server doesn't have such capability, the action buttons will be disabled.

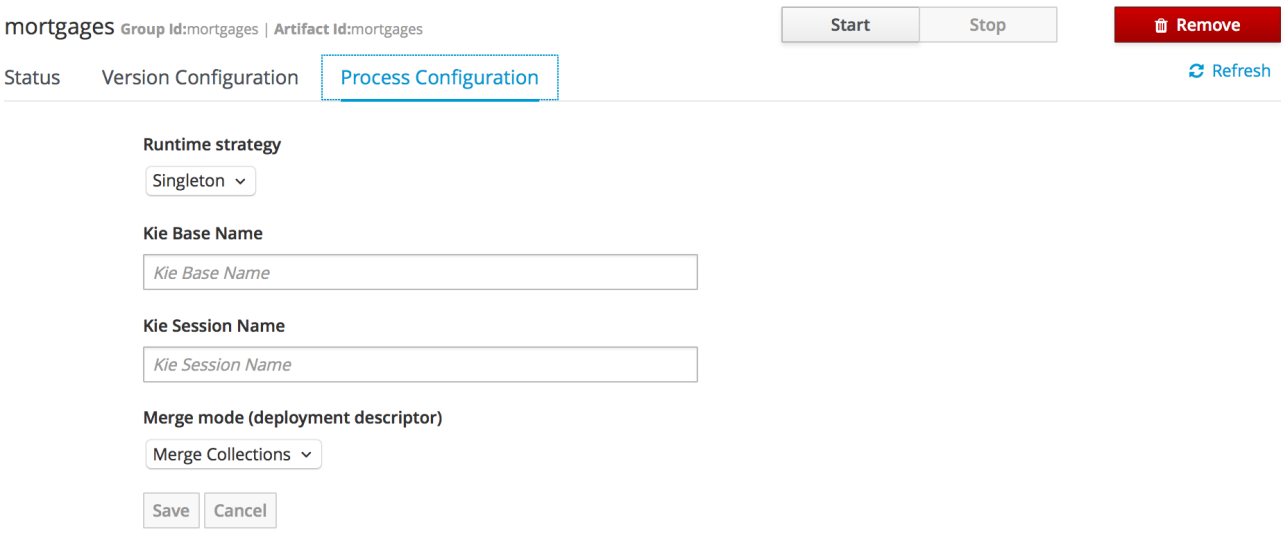


Figure 1.155. Process Configuration

1.11.3. Remote Server

Remote Server is a Managed KIE Server instance running that has a controller configured.

Note

By default Workbench comes with a Controller embedded.

The list of Remote Servers are displayed just under the list of Containers. Once selected the screens reveals the Remote Server details and a list of cards, each card represents a running Container.

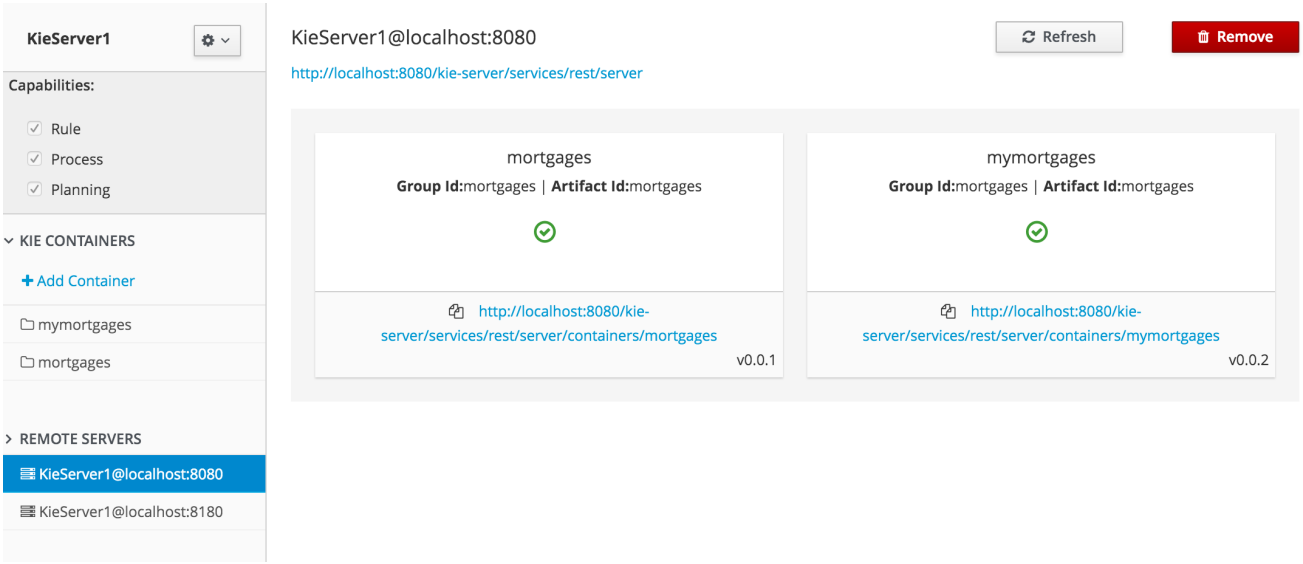


Figure 1.156. Remote Servers

Chapter 2. Authoring Planning Assets

2.1. Solver Editor

The solver editor creates a solver configuration that can be run in the Execution Solver or plain Java code after the kjar is deployed

Note

To see and use this editor, the user needs to have the role `plannermgmt`.

Use the `Validate` button to validate the solver configuration. This will actually build a Solver, so most issues in your project will present itself then, without the need to deploy and run it.

By default, the solver configuration will automatically scan for all planning entities and a planning solution classes. If none are found (or too many), validation will fail.

Chapter 3. Workbench Integration

3.1. REST

REST API calls to Knowledge Store allow you to manage the Knowledge Store content and manipulate the static data in the repositories of the Knowledge Store. The calls are asynchronous, that is, they continue their execution after the call was performed as a job. The job ID is returned by every calls to allow after the REST API call was performed to request the job status and verify whether the job finished successfully. Parameters of these calls are provided in the form of JSON entities.

When using Java code to interface with the REST API, the classes used in POST operations or otherwise returned by various operations can be found in the `(org.kie.workbench.services:)kie-wb-common-services` JAR. All of the classes mentioned below can be found in the `org.kie.workbench.common.services.shared.rest` package in that JAR.

3.1.1. Job calls

Every Knowledge Store REST call returns its job ID after it was sent. This is necessary as the calls are asynchronous and you need to be able to reference the job to check its status as it goes through its lifecycle. During its lifecycle, a job can have the following statuses:

- `ACCEPTED`: the job was accepted and is being processed
- `BAD_REQUEST`: the request was not accepted as it contained incorrect content
- `RESOURCE_NOT_EXIST`: the requested resource (path) does not exist
- `DUPLICATE_RESOURCE`: the resource already exists
- `SERVER_ERROR`: an error on the server occurred
- `SUCCESS`: the job finished successfully
- `FAIL`: the job failed
- `DENIED`: the job was denied
- `GONE`: the job ID could not be found

  A job can be GONE in the following cases:

  - The job was explicitly removed
  - The job finished and has been deleted from the status cache (the job is removed from status cache after the cache has reached its maximum capacity)
  - The job never existed

The following `job` calls are provided:

[GET] ***/jobs/{jobID}***
: Returns the job status

  Returns a `JobResult` instance

Example 3.1. An example (formatted) response body to the get job call on a repository clone request

```
"{
  "status":"SUCCESS",
  "jodId":"1377770574783-27",
       "result":"Alias:    testInstallAndDeployProject,    Scheme:    git,    Uri:    git://
testInstallAndDeployProject",
  "lastModified":1377770578194,"detailedResult":null
}"
```

[DELETE] ***/jobs/{jobID}***
: Removes the job: If the job is not yet being processed, this will remove the job from the job queue. However, this will not cancel or stop an ongoing job

  Returns a `JobResult` instance

3.1.2. Repository calls

Repository calls are calls to the Knowledge Store that allow you to manage its Git repositories and their projects.

The following `repositories` calls are provided:

[GET] **/repositories**
: Gets information about the repositories in the Knowledge Store

  Returns a `Collection<Map<String, String>>` or `Collection<RepositoryRequest>` instance, depending on the JSON serialization library being used. The keys used in the `Map<String, String>` instance match the fields in the `RepositoryRequest` class

Example 3.2. An example (formatted) response body to the get repositories call

```
[
  {
    "name":"wb-assets",
    "description":"generic assets",
    "userName":null,
    "password":null,
```

```
    "requestType":null,
    "gitURL":"git://bpms-assets"
 },
 {
   "name":"loanProject",
   "description":"Loan processes and rules",
   "userName":null,
   "password":null,
   "requestType":null,
   "gitURL":"git://loansProject"
 }
]
```

[GET] **/repositories/{repositoryName}**

Gets information about a repository

Returns a `Map<String, String>` or `RepositoryRequest` instance, depending on the JSON serialization library being used. The keys used in the `Map<String, String>` instance match the fields in the `RepositoryRequest` class

Example 3.3. An example (formatted) response body to the get repository call

```
{
  "name":"wb-assets",
  "description":"generic assets",
  "userName":null,
  "password":null,
  "requestType":null,
  "gitURL":"git://bpms-assets"
}
```

[POST] **/repositories**

Creates a new empty repository or a new repository cloned from an existing (git) repository

Consumes a `RepositoryRequest` instance

Returns a `CreateOrCloneRepositoryRequest` instance

Example 3.4. An example (formatted) response body to the create repositories call

```
{
  "name":"new-project-repo",
  "description":"repo for my new project",
  "userName":null,"password":null,
  "requestType":"new",
  "gitURL":null
}
```

[DELETE] **/repositories/*{repositoryName}***

Removes the repository from the Knowledge Store

Returns a `RemoveRepositoryRequest` instance

[POST] **/repositories/*{repositoryName}*/projects/**

Creates a project in the repository

Consumes an `Entity` instance

Returns a `CreateProjectRequest` instance

Example 3.5. An example (formatted) request body that defines the project to be created

```
{
  "name":"myProject",
  "description": "my project"
}
```

[DELETE] **/repositories/*{repositoryName}*/projects/**

Deletes the project in the repository

Returns a `DeleteProjectRequest` instance

[GET] **/repositories/*{repositoryName}*/projects/**

Gets information about the projects

Returns a `Collection<Map<String, String>>` or `Collection<ProjectResponse>` instance, depending on the JSON serialization library being used. The keys used in the `Map<String, String>` instance match the fields in the `ProjectResponse` class

Example 3.6. An example (formatted) response body to the get projects call

```
[
  {
    "name":"wb-assets",
    "description":"generic assets",
    "groupId":"org.test",
    "version":"1.0"
 },
 {
   "name":"loanProject",
   "description":"Loan processes and rules",
    "groupId":"com.bank",
    "version":"3.7"
 }
]
```

3.1.3. Organizational unit calls

Organizational unit calls are calls to the Knowledge Store that allow you to manage its organizational units, so as to organize the connected Git repositories.

The following `organizationalUnits` calls are provided:

[POST] **/organizationalunits**
Creates an organizational unit in the Knowledge Store

Consumes an `OrganizationalUnit` instance

Returns a `CreateOrganizationalUnitRequest` instance

Example 3.7. An example (formatted) request body defining a new organizational unit to be created

```
{
  "name":"testgroup",
  "description":"",
  "owner":"tester",
  "repositories":["testGroupRepository"]
}
```

[GET] **/organizationalunits/{orgUnitName}**
Creates an organizational unit

Consumes an `OrganizationalUnit` instance

Returns a `CreateOrganizationalUnitRequest` instance

Example 3.8. An example (formatted) request body defining a new organizational unit to be created

```
{
  "name":"testgroup",
  "description":"",
  "owner":"tester",
  "repositories":["testGroupRepository"]
}
```

[POST] **/organizationalunits/{orgUnitName}**
Creates an organizational unit in the Knowledge Store

Consumes an `UpdateOrganizationalUnit` instance

Returns a `UpdateOrganizationalUnitRequest` instance

Example 3.9. An example (formatted) request body defining a new organizational unit to be created

```
{
  "name":"testgroup",
  "description":"",
  "owner":"tester",
  "repositories":["testGroupRepository"]
}
```

[DELETE] **/organizationalunits/*{organizationalUnitName}***
Deletes a organizational unit

Returns a `RemoveOrganizationalUnitRequest` instance

[POST] **/organizationalunits/*{organizationalUnitName}*/repositories/*{repositoryName}***
Adds the repository to the organizational unit

Returns a `AddRepositoryToOrganizationalUnitRequest` instance

[DELETE] **/organizationalunits/*{organizationalUnitName}*/repositories/*{repositoryName}***
Removes the repository from the organizational unit

Returns a `RemoveRepositoryFromOrganizationalUnitRequest` instance

3.1.4. Maven calls

Maven calls are calls to a Project in the Knowledge Store that allow you compile and deploy the Project resources.

The following `maven` calls are provided:

[POST] **/repositories/*{repositoryName}*/projects/*{projectName}*/maven/compile**
Compiles the project (equivalent to `mvn compile`)

Consumes a `BuildConfig` instance. While this must be supplied, it's not needed for the operation and may be left blank.

Returns a `CompileProjectRequest` instance

[POST] **/repositories/*{repositoryName}*/projects/*{projectName}*/maven/install**
Installs the project (equivalent to `mvn install`)

Consumes a `BuildConfig` instance. While this must be supplied, it's not needed for the operation and may be left blank.

Returns a `InstallProjectRequest` instance

[POST] **/repositories/*{repositoryName}*/projects/*{projectName}*/maven/test**
Compiles the project runs a test as part of compilation

Consumes a `BuildConfig` instance

Returns a `TestProjectRequest` instance

[POST] **/repositories/*{repositoryName}*/projects/*{projectName}*/maven/deploy**

Deploys the project (equivalent to `mvn deploy`)

Consumes a `BuildConfig` instance. While this must be supplied, it's not needed for the operation and may be left blank.

Returns a `DeployProjectRequest` instance

3.1.5. REST summary

The URL templates in the table below are relative the following URL:

- `http://server:port/business-central/rest`

Table 3.1. Knowledge Store REST calls

URL Template	Type	Description
/jobs/{jobID}	GET	return the job status
/jobs/{jobID}	DELETE	remove the job
/organizationalunits	GET	return a list of organizational units
/organizationalunits	POST	create an organizational unit in the Knowledge Store described by the JSON `OrganizationalUnit` entity
/organizationalunits/{organizationalUnitName}/repositories/{repositoryName}	POST	add a repository to an organizational unit
/organizationalunits/{organizationalUnitName}/repositories/{repositoryName}	DELETE	remove a repository from an organizational unit
/repositories/	POST	add the repository to the organizational unit described by the JSON `RepositoryReqest` entity
/repositories	GET	return the repositories in the Knowledge Store
/repositories/{repositoryName}	DELETE	remove the repository from the Knowledge Store
/repositories/	POST	create or clone the repository defined by the JSON `RepositoryRequest` entity

URL Template	Type	Description
/repositories/{repositoryName}/projects/	POST	create the project defined by the JSON entity in the repository
/repositories/{repositoryName}/projects/{projectName}/maven/compile/	POST	compile the project
/repositories/{repositoryName}/projects/{projectName}/maven/install	POST	install the project
/repositories/{repositoryName}/projects/{projectName}/maven/test/	POST	compile the project and run tests as part of compilation
/repositories/{repositoryName}/projects/{projectName}/maven/deploy/	POST	deploy the project

3.2. Keycloak SSO integration

Single Sign On (SSO) and related token exchange mechanisms are becoming the most common scenario for the authentication and authorization in different environments on the web, specially when moving into the cloud.

This section talks about the integration of Keycloak with jBPM or Drools applications in order to use all the features provided on Keycloak. Keycloak is an integrated SSO and IDM for browser applications and RESTful web services. Lean more about it in the Keycloak's home page [http://keycloak.jboss.org/].

The result of the integration with Keycloak has lots of advantages such as:

- Provide an integrated SSO and IDM environment for different clients, including jBPM and Drools workbenches
- Social logins - use your Facebook, Google, Linkedin, etc accounts
- User session management
- And much more...

Next sections cover the following integration points with Keycloak:

- **Workbench authentication through a Keycloak server**

  It basically consists of securing both web client and remote service clients through the Keycloak SSO. So either web interface or remote service consumers (whether a user or a service) will authenticate into trough KC.

- **Execution server authentication through a Keycloak server**

Consists of securing the remote services provided by the execution server (as it does not provides web interface). Any remote service consumer (whether a user or a service) will authenticate trough KC.

- **Consuming remote services**

  This section describes how a third party clients can consume the remote service endpoints provided by both Workbench and Execution Server, such as the REST API or remote file system services.

3.2.1. Scenario

Consider the following diagram as the environment for this document's example:

Keycloak is a standalone process that provides remote authentication, authorization and administration services that can be potentially consumed by one or more jBPM applications over the network.

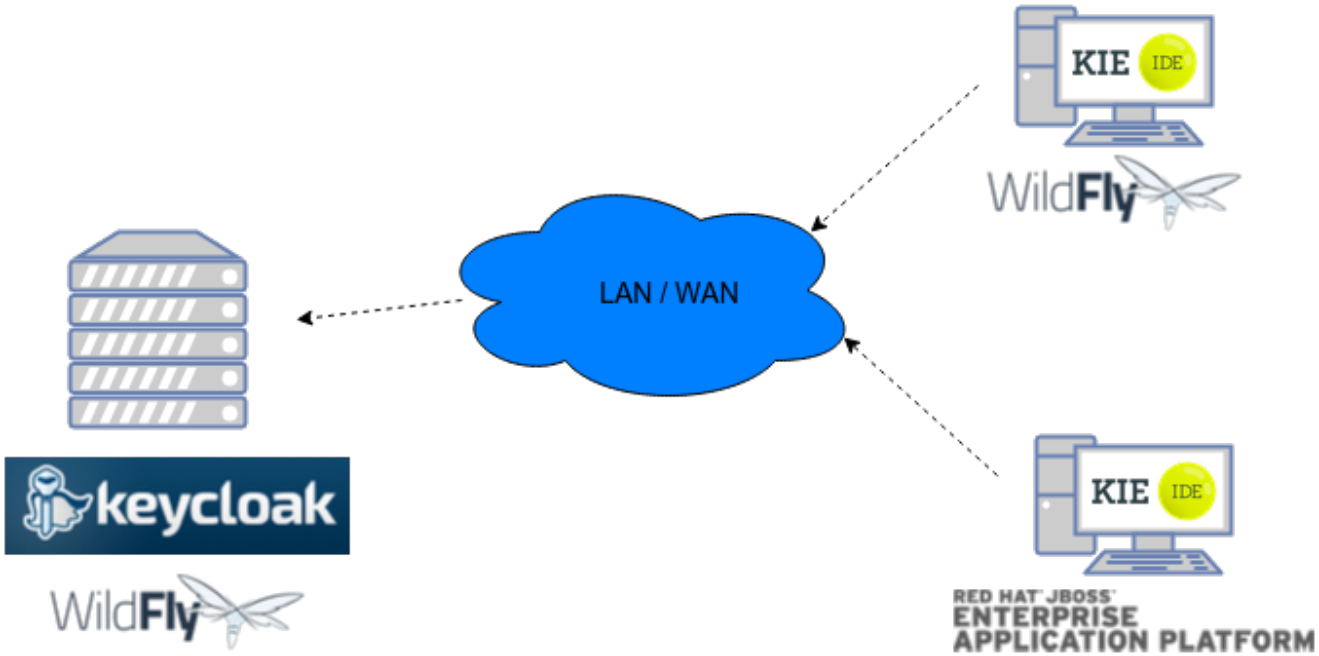


Figure 3.1.

Consider these main steps for building this environment:

- Install and setup a Keycloak server
- Create and setup a Realm for this example - Configure realm's clients, users and roles
- Install and setup the SSO client adapter & jBPM application

Note: The resulting environment and the different configurations for this document are based on the jBPM (KIE) Workbench, but same ones can also be applied for the KIE Drools Workbench as well.

3.2.2. Install and setup a Keycloak server

Keycloak provides an extensive documentation and several articles about the installation on different environments. This section describes the minimal setup for being able to build the integrated environment for the example. Please refer to the Keycloak documentation [http://keycloak.jboss.org/docs] if you need more information.

Here are the steps for a minimal Keycloak installation and setup:

- Download latest version of Keycloak from the Downloads [http://keycloak.jboss.org/downloads] section. This example is based on Keycloak 1.9.0.Final
- Unzip the downloaded distribution of Keycloak into a folder, let's refer it as

```
$KC_HOME
```

- Run the KC server - This example is based on running both Keycloak and jBPM on same host. In order to avoid port conflicts you can use a port offset for the Keycloak's server as:

```
$KC_HOME/bin/standalone.sh -Djboss.socket.binding.port-offset=100
```

- Create a Keycloak's administration user - Execute the following command to create an admin user for this example:

```
$KC_HOME/bin/add-user.sh -r master -u 'admin' -p 'admin'
```

The Keycloak administration console will be available at http://localhost:8180/auth/admin (use the admin/admin for login credentials).

3.2.3. Create and setup the demo realm

Security realms are used to restrict the access for the different application's resources.

Once the Keycloak server is running next step is about creating a realm. This realm will provide the different users, roles, sessions, etc for the jBPM application/s.

Keycloak provides several examples for the realm creation and management, from the official examples [https://github.com/keycloak/keycloak/tree/master/examples] to different articles with more examples.

Follow these steps in order to create the *demo* realm used later in this document:

- Go to the Keycloak administration console [http://localhost:8180/auth/admin] and click on *Add realm* button. Give it the name *demo*.

- Go to the Clients section (from the main admin console menu) and create a new client for the *demo* realm:
  - Client ID: *kie*
  - Client protocol: *openid-connect*
  - Acces type: *confidential*
  - Root URL: *http://localhost:8080*
  - Base URL: */kie-wb-6.5.0.Final*
  - Redirect URIs: */kie-wb-6.5.0.Final/**

The resulting *kie* client settings screen:

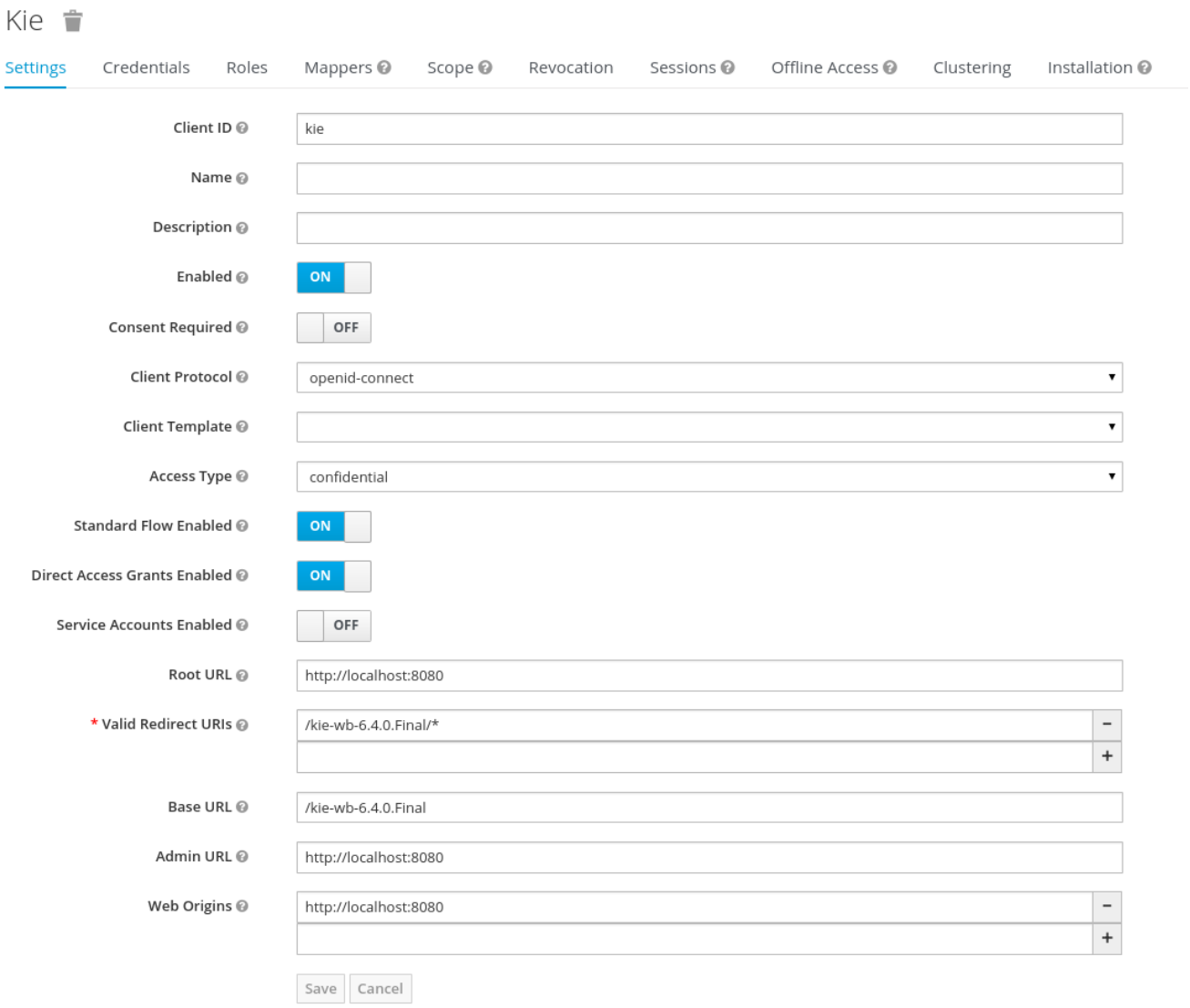


Figure 3.2.

Note: As you can see in the above settings it's being considered the value *kie-wb-6.5.0.Final* for the application's context path. If your jbpm application will be deployed on a different context path, host or port, just use your concrete settings here.

Last step for being able to use the *demo* realm from the jBPM workbench is create the application's user and roles:

- Go to the Roles section and create the roles *admin, kiemgmt* and *rest-all*
- Go to the Users section and create the *admin* user. Set the password with value "password" in the credentials tab, unset the temporary switch.
- In the Users section navigate to the *Role Mappings* tab and assign the *admin, kiemgmt* and *rest-all* roles to the *admin* user

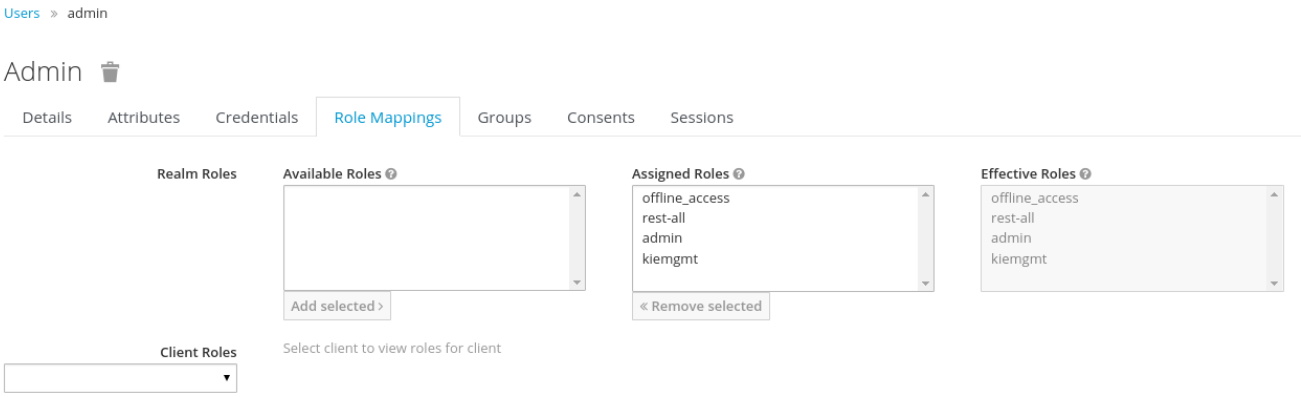


Figure 3.3.

At this point a Keycloak server is running on the host, setup with a minimal configuration set. Let's move to the jBPM workbench setup.

3.2.4. Install and setup jBPM Workbench

For this tutorial let's use a Wildfly as the application server for the jBPM workbench, as the jBPM installer does by default.

Let's assume, after running the jBPM installer, the *$JBPM_HOME* as the root path for the Wildfly server where the application has been deployed.

3.2.4.1. Install the KC adapter

In order to use the Keycloak's authentication and authorization modules from the jBPM application, the Keycloak adapter [https://keycloak.github.io/docs/userguide/keycloak-server/html/ch08.html] for Wildfly must be installed on our server at *$JBPM_HOME*. Keycloak provides multiple adapters for different containers out of the box, if you are using another container or need to use another adapter, please take a look at the adapters configuration [https://keycloak.github.io/docs/user-

guide/keycloak-server/html/ch08.html]from Keycloak docs. Here are the steps to install and setup the adapter for Wildfly 8.2.x:

- Download the adapter from here [https://repository.jboss.org/nexus/service/local/repositories/central/content/org/keycloak/keycloak-wf8-adapter-dist/1.9.0.Final/keycloak-wf8-adapter-dist-1.9.0.Final.zip]
- Execute the following commands on your shell:

```
cd $JBPM_HOME/unzip keycloak-wf8-adapter-dist.zip // Install the KC client adaptercd
 $JBPM_HOME/bin./standalone.sh -c standalone-full.xml // Setup the KC client adapter.// **
 Once server is up, open a new command line terminal and run:cd $JBPM_HOME/bin./jboss-cli.sh
 -c --file=adapter-install.cli

client adaptercd
 $JBPM_HOME/bin./standalone.sh -c standalone-full.xml // Setup the KC

client adapter.// ** Once server is up, open a new command line terminal
and run:cd
 $JBPM_HOME/bin./jboss-cli.sh -c
```

3.2.4.2. Configure the KC adapter

Once installed the KC adapter into Wildfly, next step is to configure the adapter in order to specify different settings such as the location for the authentication server, the realm to use and so on.

Keycloak provides two ways of configuring the adapter:

- Per WAR configuration
- Via Keycloak subsystem

In this example let's use the second option, use the Keycloak subsystem, so our WAR is free from this kind of settings. If you want to use the per WAR approach, please take a look here [https://keycloak.github.io/docs/userguide/keycloak-server/html/ch08.html#d4e932].

Edit the configuration file *$JBPM_HOME/standalone/configuration/standalone-full.xml* and locate the subsystem configuration section. Add the following content:

```
<subsystem     xmlns="urn:jboss:domain:keycloak:1.1">         <secure-deployment     name="kie-
wb-6.5.0.Final.war">                     <realm>demo</realm>                     <realm-public-
key>MIIBIjANBgkqhkiG9w0BAQEFAAOCA...</realm-public-key>               <auth-server-url>http://
localhost:8180/auth</auth-server-url>   <ssl-required>external</ssl-required>   <resource>kie</
resource>    <enable-basic-auth>true</enable-basic-auth>    <credential name="secret">925f9190-
a7c1-4cfd-8a3c-004f9c73dae6</credential>    <principal-attribute>preferred_username</principal-
attribute>  </secure-deployment></subsystem>
 xmlns="urn:jboss:domain:keycloak:1.1">  <secure-deployment
name="kie-wb-6.5.0.Final.war">
<realm>demo</realm>    <realm-public-key>MIIBIjANBgkqhkiG9w0BAQEFAAOCA...</realm-
public-key>    <auth-server-url>http://localhost:8180/auth</auth-
```

```
server-url>    <ssl-required>external</
ssl-required>
<resource>kie</resource>    <enable-basic-auth>true</enable-
basic-auth>    <credential name="secret">925f9190-
a7c1-4cfd-8a3c-004f9c73dae6</credential>    <principal-attribute>preferred_username</
principal-attribute>  </
secure-deployment>
```

If you have imported the example json files from this document in *step 2*, you can just use same configuration as above by using your concrete deployment name . Otherwise please use your values for these configurations:

- Name for the secure deployment - Use your concrete application's WAR file name
- Realm - Is the realm that the applications will use, in our example, the *demo* realm created the previous step.
- Realm Public Key - Provide here the public key for the *demo* realm. It's not mandatory, if it's not specified, it will be retrieved from the server. Otherwise, you can find it in the Keycloak admin console -> Realm settings (for *demo* realm) -> Keys
- Authentication server URL - The URL for the Keycloak's authentication server
- Resource - The name for the client created on step 2. In our example, use the value *kie*.
- Enable basic auth - For this example let's enable Basic authentication mechanism as well, so clients can use both Token (Baerer) and Basic approaches to perform the requests.
- Credential - Use the password value for the *kie* client. You can find it in the Keycloak admin console -> Clients -> kie -> Credentials tab -> Copy the value for the *secret*.

For this example you have to take care about using your concrete values for *secure-deployment name*, *realm-public-key* and *credential* password. You can find detailed information about the KC adapter configurations here [https://keycloak.github.io/docs/userguide/keycloak-server/html/ch08.html#adapter-config].

3.2.4.3. Run the environment

At this point a Keycloak server is up and running on the host, and the KC adapter is installed and configured for the jBPM application server. You can run the application using:

```
$JBPM_HOME/bin/standalone.sh -c standalone-full.xml
```

You can navigate into the application once the server is up at:

```
http://localhost:8080/kie-wb-6.5.0.Final
```

Figure 3.4.

Use your Keycloak's admin user credentials to login: *admin/password*.

3.2.5. Securing workbench remote services via Keycloak

Both jBPM and Drools workbenches provides different remote service endpoints that can be consumed by third party clients using the remote API [http://docs.jboss.org/jbpm/v6.3/user-guide/ch17.html].

In order to authenticate those services thorough Keycloak the *BasicAuthSecurityFilter* must be disabled, apply those modifications for the the *WEB-INF/web.xml* file (app deployment descriptor) from jBPM's WAR file:

- Remove the following filter from the deployment descriptor:

```
<filter>             <filter-name>HTTP    Basic    Auth    Filter</filter-name>       <filter-
class>org.uberfire.ext.security.server.BasicAuthSecurityFilter</filter-class>  <init-param>
   <param-name>realmName</param-name>     <param-value>KIE Workbench Realm</param-value>  </
init-param></filter><filter-mapping>  <filter-name>HTTP Basic Auth Filter</filter-name>  <url-
pattern>/rest/*</url-pattern>  <url-pattern>/maven2/*</url-pattern>  <url-pattern>/ws/*</url-
pattern></filter-mapping>
   <filter-name>HTTP Basic Auth Filter</filter-
name>  <filter-class>org.uberfire.ext.security.server.BasicAuthSecurityFilter</filter-
class>  <init-
param>    <param-name>realmName</param-
name>    <param-value>KIE Workbench Realm</param-
value>  </init-
param></

filter><filter-
mapping>  <filter-name>HTTP Basic Auth Filter</filter-
name>  <url-pattern>/rest/*</url-
pattern>  <url-pattern>/maven2/*</url-
pattern>  <url-pattern>/ws/*</url-
pattern></filter-
```

- Constraint the remote services URL patterns as:

```
<security-constraint>  <web-resource-collection>    <web-resource-name>remote-services</web-
resource-name>    <url-pattern>/rest/*</url-pattern>    <url-pattern>/maven2/*</url-pattern>
    <url-pattern>/ws/*</url-pattern>  </web-resource-collection>  <auth-constraint>    <role-
name>rest-all</role-name>  </auth-constraint></security-constraint>
rity-constraint>
 <web-resource-collection>    <web-resource-name>remote-
services</web-resource-name>    <url-pattern>/
rest/*</url-pattern>    <url-pattern>/
maven2/*</url-pattern>    <url-pattern>/
ws/*</url-pattern>
</web-resource-collection>
  <auth-constraint>    <role-
name>rest-all</role-name>
 </auth-
```

Important note: The user that consumes the remote services must be member of role *rest-all*. As on described previous steps, the *admin* user in this example it's already a member of the *rest-all* role.

3.2.6. Securing workbench's file system services via Keycloak

In order to consume other remote services such as the file system ones (e.g. remote GIT), a specific **Keycloak login module must be used** for the application's security domain in the *$JBPM_HOME/standalone/configuration/standalone-full.xml* file. By default the workbench uses the *other* security domain, so the resulting configuration on the *$JBPM_HOME/standalone/configuration/standalone-full.xml* should be such as:

```
     <security-domain name="other" cache-type="default">
       <authentication>
                <login-module  code="org.keycloak.adapters.jaas.DirectAccessGrantsLoginModule"
flag="required">
              <!-- Parameter value can be a file system absolute path or a classpath (e.g.
"classpath:/some-path/kie-git.json")-->
           <module-option name="keycloak-config-file" value="$JBPM_HOME/kie-git.json"/>
         </login-module>
       </authentication>
     </security-domain>
```

Note that:

- The login modules on the *other* security domain in the *$JBPM_HOME/standalone/configuration/standalone-full.xml* file must be REPLACED by the above given one.
- Replace *$JBPM_HOME/kie-git.json* by the path (on file system) or the classpath (e.g. *classpath:/some-path/kie-git.json*) for the json configuration file used for the remote services client. Please continue reading in order to create this Keycloak client and how to obtain this json file.

At this point, remote services that use JAAS for the authentication process, such as the file system ones (e.g. GIT), are secured by Keycloak using the client specified in the above json configuration file. So let's create this client on Keycloak and generate the required JSON file:

- Navigate to the KC administration console [http://localhost:8180/auth/admin] and create a new client for the *demo* realm using *kie-git* as name.
- Enable *Direct Access Grants Enabled* option, disable *Standard Flow Enabled* and use a *confidential* access type for this client. See below image as example:

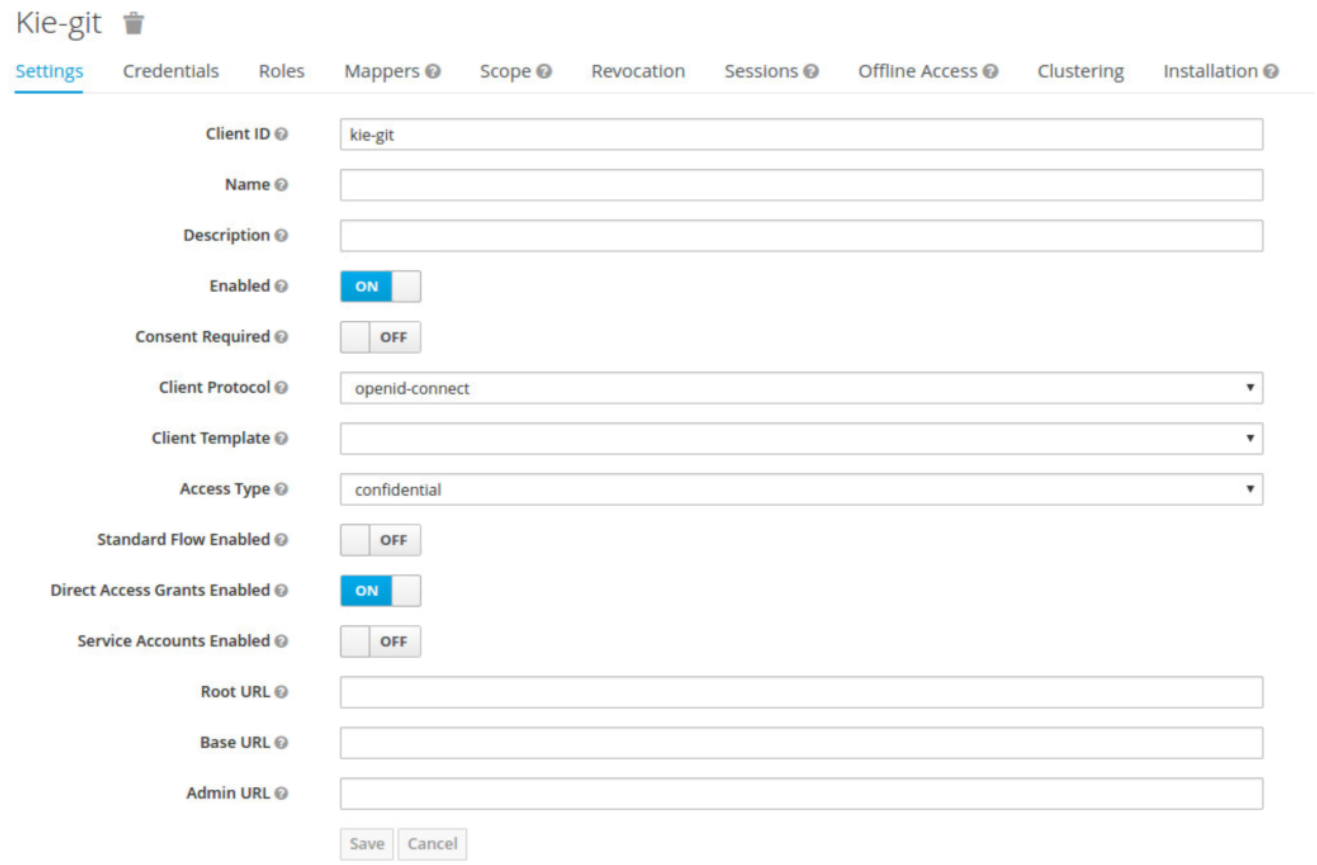


Figure 3.5.

- Go to the *Installation* tab in same *kie-git* client configuration screen and export using the *Keycloak OIDC JSON* type.
- Finally copy this generated JSON file into an accessible directory on the server's file system or add it in the application's classpath. Use this path value as the *keycloak-config-file* argument for the above configuration of the *org.keycloak.adapters.jaas.DirectAccessGrantsLoginModule* login module.
- More information about Keycloak JAAS Login modules can be found here [https://keycloak.gitbooks.io/securing-client-applications-guide/content/v/2.2/topics/oidc/java/jaas.html].

At this point, the internal Git repositories can be cloned by all users authenticated via the Keycloak server. Command example:

```
git clone ssh://admin@localhost:8001/system
```

3.2.7. Execution server

The KIE Execution Server provides a REST API [https://docs.jboss.org/drools/release/latest/drools-docs/html/ch22.html] than can be consumed for any third party clients,. This this section is about how to integration the KIE Execution Server with the Keycloak SSO in order to delegate the third party clients identity management to the SSO server.

Consider the above environment running, so consider having:

- A Keycloak server running and listening on http://localhost:8180/auth
- A realm named *demo* with a client named *kie* for the jBPM Workbench
- A jBPM Workbench running at http://localhost:8080/kie-wb-6.5.0.Final

Follow these steps in order to add an execution server into this environment:

- Create the client for the execution server on Keycloak
- Install setup and the Execution server (with the KC client adapter)

3.2.7.1. Create the execution server's client on Keycloak

As per each execution server is going to be deployed, you have to create a new client on the *demo* realm in Keycloak.:

- Go to the KC admin console [https://mojo.redhat.com/external-link.jspa?url=http%3A%2F%2Flocalhost%3A8180%2Fauth%2Fadmin] -> Clients -> New client
- Name: *kie-execution-server*
- Root URL: *http://localhost:8280/*
- Client protocol: *openid-connect*
- Access type: *confidential* (or *public* if you want so, but not recommended for production environments)
- Valid redirect URIs: */kie-server-6.5.0.Final/**
- Base URL: */kie-server-6.5.0.Final*

In this example the *admin* user already created on previous steps is the one used for the client requests. So ensure that the *admin* user is member of the role *kie-server* in order to use the execution server's remote services. If the role does not exist, create it.

Note: This example considers that the execution server will be configured to run using a port offset of 200, so the HTTP port will be available at localhost:8280.

3.2.7.2. Install and setup the KC adapter on the execution server

At this point, a client named *kie-execution-server* is ready on the KC server to use from the execution server.

Let's install, setup and deploy the execution server:

- Install another Wildfly server to use for the execution server and the KC client adapter as well. You can follow above instructions for the Workbench or follow the official adapters documentation [https://keycloak.github.io/docs/userguide/keycloak-server/html/ch08.html]
- Edit the *standalone-full.xml* file from the Wildfly server's configuration path and configure the KC subsystem adapter as:

```
<secure-deployment   name="kie-server-6.5.0.Final.war">            <realm>demo</realm>
     <realm-public-key>MIGfMA0GCSqGSIb...</realm-public-key>          <auth-server-url>http://
localhost:8180/auth</auth-server-url>          <ssl-required>external</ssl-required>
 <resource>kie-execution-server</resource>     <enable-basic-auth>true</enable-basic-auth>
  <credential name="secret">e92ec68d-6177-4239-be05-28ef2f3460ff</credential>    <principal-
attribute>preferred_username</principal-attribute></secure-deployment>
 name="kie-server-6.5.0.Final.war">
 <realm>demo</realm>    <realm-public-key>MIGfMA0GCSqGSIb...</
realm-public-key>    <auth-server-url>http://localhost:8180/auth</
auth-server-url>    <ssl-
required>external</ssl-required>    <resource>kie-
execution-server</resource>    <enable-basic-auth>true</
enable-basic-auth>    <credential
name="secret">e92ec68d-6177-4239-be05-28ef2f3460ff</credential>    <principal-
attribute>preferred_username</principal-attribute>
```

Consider your concrete environment settings if different from this example:

- Secure deployment name -> use the name of the execution server war file being deployed
- Public key -> Use the demo realm public key or leave it blank, the server will provide one if so
- Resource -> This time, instead of the kie client used in the WB configuration, use the *kie-execution-server* client
- Enable basic auth -> Up to you. You can enable Basic auth for third party service consumers
- Credential -> Use the secret key for the *kie-execution-server* client. You can find it in the *Credentials*tab of the KC admin console

3.2.7.3. Deploy and run the execution server

Just deploy the execution server in Wildfly using any of the available mechanisms. Run the execution server using this command:

```
$EXEC_SERVER_HOME/bin/standalone.sh    -c    standalone-full.xml    -Djboss.socket.binding.port-
offset=200           -Dorg.kie.server.id=<ID>           -Dorg.kie.server.user=<USER>           -
Dorg.kie.server.pwd=<PWD>          -Dorg.kie.server.location=<LOCATION_URL>                   -
Dorg.kie.server.controller=<CONTROLLER_URL>  -Dorg.kie.server.controller.user=<CONTROLLER_USER>
 -Dorg.kie.server.controller.pwd=<CONTOLLER_PASSWORD>
```

Example:

```
$EXEC_SERVER_HOME/bin/standalone.sh    -c    standalone-full.xml    -Djboss.socket.binding.port-
offset=200         -Dorg.kie.server.id=kieserver1         -Dorg.kie.server.user=admin         -
Dorg.kie.server.pwd=password               -Dorg.kie.server.location=http://localhost:8280/kie-
server-6.5.0.Final/services/rest/server  -Dorg.kie.server.controller=http://localhost:8080/kie-
wb-6.5.0.Final/rest/controller             -Dorg.kie.server.controller.user=admin             -
Dorg.kie.server.controller.pwd=password
```

mportant note: The users that will consume the execution server remote service endpoints must have the role kie-server assigned. So create and assign this role in the KC admin console for the users that will consume the execution server remote services.

Once up, you can check the server status as (considered using Basic authentication for this request, see next*Consuming remote services* for more information):

```
curl http://admin:password@localhost:8280/kie-server-6.5.0.Final/services/rest/server/
```

3.2.8. Consuming remote services

In order to use the different remote services provided by the Workbench or by an Execution Server, your client must be authenticated on the KC server and have a valid token to perform the requests.

Remember that in order to use the remote services, the authenticated user must have assigned:

- The role *rest-all* for using the WB remote services
- The role *kie-server* for using the Execution Server remote services

Please ensure necessary roles are created and assigned to the users that will consume the remote services on the Keycloak admin console.

You have two options to consume the different remove service endpoints:

- Using basic authentication, if the application's client supports it

- Using Bearer (token) based authentication

3.2.8.1. Using basic authentication

If the KC client adapter configuration has the Basic authentication enabled, as proposed in this guide for both WB (*step 3.2*) and Execution Server, you can avoid the token grant/refresh calls and just call the services as the following examples.

Example for a WB remote repositories endpoint:

```
curl http://admin:password@localhost:8080/kie-wb-6.5.0.Final/rest/repositories
```

Example to check the status for the Execution Server:

```
curl http://admin:password@localhost:8280/kie-server-6.5.0.Final/services/rest/server/
```

3.2.8.2. Using token based authentication

First step is to create a new client on Keycloak that allows the third party remote service clients to obtain a token. It can be done as:

- Go to the KC admin console and create a new client using this configuration:
  - Client id: *kie-remote*
  - Client protocol: *openid-connect*
  - Access type: *public*
  - Valid redirect URIs: *http://localhost/*
- As we are going to manually obtain a token and invoke the service let's increase the lifespan of tokens slightly. In production access tokens should have a relatively low timeout, ideally less than 5 minutes:
  - Go to the KC admin console
  - Click on your Realm Settings
  - Click on Tokens tab
  - Change the value for Access Token Lifespan to 15 minutes (That should give us plenty of time to obtain a token and invoke the service before it expires)

Once a public client for our remote clients has been created, you can now obtain the token by performing an HTTP request to the KC server's tokens endpoint. Here is an example for command line:

```
RESULT=`curl                    --data                    "grant_type=password&client_id=kie-
remote&username=admin&passwordpassword=<the_client_secret>"  http://localhost:8180/auth/realms/
demo/protocol/openid-connect/token`
```

```
TOKEN=`echo $RESULT | sed 's/.*access_token":"//g' | sed 's/".*//g'`
```

At this point, if you echo the *$TOKEN* it will output the token string obtained from the KC server, that can be now used to authorize further calls to the remote endpoints. For exmple, if you want to check the internal jBPM repositories:

```
curl -H "Authorization: bearer $TOKEN" http://localhost:8080/kie-wb-6.5.0.Final/rest/reposito
ries
```

Chapter 4. Workbench High Availability

4.1.1. VFS clustering

The VFS repositories (usually git repositories) stores all the assets (such as rules, decision tables, process definitions, forms, etc). If that VFS resides on each local server, then it must be kept in sync between all servers of a cluster.

Use Apache Zookeeper [http://zookeeper.apache.org/] and Apache Helix [http://helix.incubator.apache.org/] to accomplish this. Zookeeper glues all the parts together. Helix is the cluster management component that registers all cluster details (nodes, resources and the cluster itself). Uberfire (on top of which Workbench is build) uses those 2 components to provide VFS clustering.

To create a VFS cluster:

1. Download Apache Zookeeper [http://zookeeper.apache.org/] and Apache Helix [http://helix.incubator.apache.org/].
2. Install both:
   a. Unzip Zookeeper into a directory (`$ZOOKEEPER_HOME`).
   b. In `$ZOOKEEPER_HOME`, copy `zoo_sample.conf` to `zoo.conf`
   c. Edit `zoo.conf`. Adjust the settings if needed. Usually only these 2 properties are relevant:

```
# the directory where the snapshot is stored.dataDir=/tmp/zookeeper# the port at which the
 clients will connectclientPort=2181
 is
stored.dataDir=/tmp/zookeeper# the port at which the clients
```

   d. Unzip Helix into a directory (`$HELIX_HOME`).
3. Configure the cluster in Zookeeper:
   a. Go to its `bin` directory:

```
$ cd $ZOOKEEPER_HOME/bin
```

   b. Start the Zookeeper server:

```
$ sudo ./zkServer.sh start
```

If the server fails to start, verify that the `dataDir` (as specified in `zoo.conf`) is accessible.

c. To review Zookeeper's activities, open `zookeeper.out`:

```
$ cat $ZOOKEEPER_HOME/bin/zookeeper.out
```

4. Configure the cluster in Helix:

a. Go to its `bin` directory:

```
$ cd $HELIX_HOME/bin
```

b. Create the cluster:

```
$ ./helix-admin.sh --zkSvr localhost:2181 --addCluster kie-cluster
```

The `zkSvr` value must match the used Zookeeper server. The cluster name (`kie-cluster`) can be changed as needed.

c. Add nodes to the cluster:

```
# Node 1
$ ./helix-admin.sh --zkSvr localhost:2181 --addNode kie-cluster nodeOne:12345
# Node 2
$ ./helix-admin.sh --zkSvr localhost:2181 --addNode kie-cluster nodeTwo:12346
...
```

Usually the number of nodes a in cluster equal the number of application servers in the cluster. The node names (`nodeOne:12345` , ...) can be changed as needed.

Note

`nodeOne:12345` is the unique identifier of the node, which will be referenced later on when configuring application servers. It is not a host and port number, but instead it is used to uniquely identify the logical node.

d. Add resources to the cluster:

```
$ ./helix-admin.sh --zkSvr localhost:2181 --addResource kie-cluster vfs-repo 1 LeaderS
tandby AUTO_REBALANCE
```

The resource name (`vfs-repo`) can be changed as needed.

e. Rebalance the cluster to initialize it:

```
$ ./helix-admin.sh --zkSvr localhost:2181 --rebalance kie-cluster vfs-repo 2
```

f. Start the Helix controller to manage the cluster:

```
$   ./run-helix-controller.sh --zkSvr localhost:2181 --cluster kie-cluster 2>&1 > /tmp/
controller.log &
```

5. Configure the security domain correctly on the application server. For example on WildFly and JBoss EAP:

a. Edit the file `$JBOSS_HOME/domain/configuration/domain.xml`.

For simplicity sake, presume we use the default domain configuration which uses the profile `full` that defines two server nodes as part of `main-server-group`.

b. Locate the profile `full` and add a new security domain by copying the other security domain already defined there by default:

```
<security-domain name="kie-ide" cache-type="default">    <authentication>         <login-
module code="Remoting" flag="optional">           <module-option name="password-stacking"
 value="useFirstPass"/>         </login-module>         <login-module code="RealmDirect"
 flag="required">           <module-option name="password-stacking" value="useFirstPass"/
>         </login-module>    </authentication></security-domain>
ide" cache-type="default">
   <authentication>         <login-module
 code="Remoting" flag="optional">            <module-option name="password-
stacking" value="useFirstPass"/>
 </login-module>         <login-module
 code="RealmDirect" flag="required">            <module-option name="password-
stacking" value="useFirstPass"/>
 </login-module>
  </
```

Important

The security-domain name is a magic value.

6. Configure the system properties for the cluster on the application server. For example on WildFly and JBoss EAP:

   a. Edit the file `$JBOSS_HOME/domain/configuration/host.xml`.

   b. Locate the XML elements `server` that belong to the `main-server-group` and add the necessary system property.

      For example for nodeOne:

```
<system-properties>
  <property name="jboss.node.name" value="nodeOne" boot-time="false"/>
  <property name="org.uberfire.nio.git.dir" value="/tmp/kie/nodeone" boot-time="false"/>
     <property   name="org.uberfire.metadata.index.dir"   value="/tmp/kie/nodeone"   boot-
time="false"/>
  <property name="org.uberfire.cluster.id" value="kie-cluster" boot-time="false"/>
  <property name="org.uberfire.cluster.zk" value="localhost:2181" boot-time="false"/>
  <property name="org.uberfire.cluster.local.id" value="nodeOne_12345" boot-time="false"/>
  <property name="org.uberfire.cluster.vfs.lock" value="vfs-repo" boot-time="false"/>
  <!-- If you're running both nodes on the same machine: -->
  <property name="org.uberfire.nio.git.daemon.port" value="9418" boot-time="false"/>
</system-properties>
```

      And for nodeTwo:

```
<system-properties>
  <property name="jboss.node.name" value="nodeTwo" boot-time="false"/>
  <property name="org.uberfire.nio.git.dir" value="/tmp/kie/nodetwo" boot-time="false"/>
     <property   name="org.uberfire.metadata.index.dir"   value="/tmp/kie/nodetwo"   boot-
time="false"/>
  <property name="org.uberfire.cluster.id" value="kie-cluster" boot-time="false"/>
  <property name="org.uberfire.cluster.zk" value="localhost:2181" boot-time="false"/>
  <property name="org.uberfire.cluster.local.id" value="nodeTwo_12346" boot-time="false"/>
  <property name="org.uberfire.cluster.vfs.lock" value="vfs-repo" boot-time="false"/>
  <!-- If you're running both nodes on the same machine: -->
  <property name="org.uberfire.nio.git.daemon.port" value="9419" boot-time="false"/>
</system-properties>
```

      Make sure the cluster, node and resource names match those configured in Helix.

4.1.2. jBPM clustering

In addition to the information above, jBPM clustering requires additional configuration. See this blog post [http://mswiderski.blogspot.com.br/2013/06/clustering-in-jbpm-v6.html] to configure the database etc correctly.

Part III. OptaPlanner Execution Server

The KIE Server is a standalone execution server for rules, planning and workflows.

Chapter 5. KIE Execution Server

5.1. Overview

The *Kie Server* is a modular, standalone server component that can be used to instantiate and execute rules and processes. It exposes this functionality via REST, JMS and Java interfaces to client application. It also provides seamless integration with the *Kie Workbench*.

At its core, the *Kie Server* is a configurable web application packaged as a WAR file. Distributions are availables for pure web containers (like Tomcat) and for JEE 6 and JEE 7 containers.

Most capabilities on the Kie Server are configurable, and based on the concepts of extensions. Each extension can be enabled/disabled independently, allowing the user to configure the server to its need.

The current version of the Kie Server ships with two default extensions:

- BRM: provides support for the execution of Business Rules using the Drools rules engine.
- BPM: provides support for the execution of Business Processes using the jBPM process engine. It supports:
  - process execution
  - task execution
  - assynchronous job execution

Both extensions enabled by default, but can be disabled by setting the corresponding property (see configuration chapter for details).

This server was designed to have a low footprint, with minimal memory consumption, and therefore, to be easily deployable on a cloud environment. Each instance of this server can open and instantiate multiple *Kie Containers* which allows you to execute multiple services in parallel.

5.1.1. Glossary

- **Kie Server**: execution server purely focusing on providing runtime environment for both rules and processes. These capabilities are provided by *Kie Server Extensions*. More capabilities can be added by further extensions (e.g. customer could add his own extensions in case of missing functionality that will then use infrastructure of the KIE Server). A Kie Server instance is a standalone Kie Server executing on a given application server/web container. A Kie Server instantiates and provides support for multiple Kie Containers.
- **Kie Server Extension**: a "plugin" for the Kie Server that adds capabilities to the server. The Kie Server ships with two default kie server extensions: BRM and BPM.

- **Kie Container**: an in-memory instantiation of a kjar, allowing for the instantiation and usage of its assets (domain models, processes, rules, etc). A Kie Server exposes Kie Containers through a standard API over transport protocols like REST and JMS.
- **Controller**: a server-backed REST endpoint that will be responsible for managing KIE Server instances. Such end point must provide following capabilities:
  - respond to connect requests
  - sync all registered containers on the corresponding *Kie Server ID*
  - respond to disconnect requests
- **Kie Server state**: currently known state of given Kie Server instance. This is a local storage (by default in file) that maintains the following information:
  - list of registered controllers
  - list of known containers
  - kie server configuration

  The server state is persisted upon receival of events like: *Kie Container* created, *Kie Container* is disposed, controller accepts registration of *Kie Server* instance, etc.
- **Kie Server ID**: an arbitrary assigned identifier to which configurations are assigned. At boot, each Kie Server Instance is assigned an ID, and that ID is matched to a configuration on the controller. The Kie Server Instance fetches and uses that configuration to setup itself.

5.2. Installing the KIE Server

The KIE Server is distributed as a web application archive (WAR) file. The WAR file comes in three different packagings:

- *webc* - WAR for ordinary Web (Servlet) containers like Tomcat
- *ee6* - WAR for JavaEE 6 containers like JBoss EAP 6.x
- *ee7* - WAR for JavaEE 7 containers like WildFly 8.x

To install the KIE Execution Server and verify it is running, complete the following steps:

1. Deploy the WAR file into your web container.
2. Create a user with the role of `kie-server` on the container.
3. Test that you can access the execution engine by navigating to the endpoint in a browser window: `http://SERVER:PORT/CONTEXT/services/rest/server/`.
4. When prompted for username/password, type in the username and password that you created in step 2.
5. Once authenticated, you will see an XML response in the form of engine status, similar to this:

Example 5.1. Sample handshaking server response

```
<response type="SUCCESS" msg="KIE Server info">
  <kie-server-info>
    <version>6.5.1-SNAPSHOT</version>
  </kie-server-info>
</response>
```

5.2.1. Bootstrap switches

The Kie Server accepts a number of bootstrap switches (system properties) to configure the behaviour of the server. The following is a table of all the supported switches.

Table 5.1. Kie Server bootstrap switches

Property	Value	Description	Required
org.drools.server.ext.disabled	boolean (default is "false")	If true, disables the BRM support (i.e. rules support).	No
org.jbpm.server.ext.disabled	boolean (default is "false")	If true, disables the BPM support (i.e. processes support)	No
org.kie.server.id	string	An arbitrary ID to be assigned to this server. If a remote controller is configured, this is the ID under which the server will connect to the controller to fetch the kie container configurations.	No. If not provided, an ID is automatically generated.
org.kie.server.user	string (default is "kieserver")	User name used to connect with the kieserver from the controller, required when running in managed mode	No
org.kie.server.pwd	string (default is "kieserver1!")	Password used to connect with the kieserver from the controller, required when running in managed mode	No
org.kie.server.controller	comma separated list of urls	List of urls to controller REST endpoint. E.g.: `http://localhost:8080/kie-wb/rest/controller`	Yes when using a controller
org.kie.server.controller.user	string (default is "kieserver")	Username used to connect to the controller REST api	Yes when using a controller

Property	Value	Description	Required
org.kie.server.controller.pwd	string (default is "kieserver1!")	Password used to connect to the controller REST api	Yes when using a controller
org.kie.server.location	URL location of kie server instance	The URL used by the controller to call back on this server. E.g.: `http://localhost:8230/kie-server/services/rest/server`	Yes when using a controller
org.kie.server.domain	string	JAAS LoginContext domain that shall be used to authenticate users when using JMS	No
org.kie.server.bypass.auth.user	boolean (default is "false")	Allows to bypass the authenticated user for task related operations e.g. queries	No
org.kie.server.repo	valid file system path (default is ".")	Location on local file system where kie server state files will be stored	No
org.kie.server.persistence.ds	string	Datasource JNDI name	Yes when BPM support enabled
org.kie.server.persistence.tm	string	Transaction manager platform for Hibernate properties set	Yes when BPM support enabled
org.kie.server.persistence.dialect	string	Hibernate dialect to be used	Yes when BPM support enabled
org.jbpm.ht.callback	string	One of supported callbacks for Task Service (default jaas)	No
org.jbpm.ht.custom.callback	string	Custom implementation of UserGroupCallback in case org.jbpm.ht.callback was set to ‘custom’	No
kie.maven.settings.custom	valid file system path	Location of custom settings.xml for maven configuration	No
org.kie.executor.interval	integer (default is 3)	Number of time units between polls by executor	No

Property	Value	Description	Required
org.kie.executor.poolsize	Integer (default is 1)	Number of threads in the pool for async work	No
org.kie.executor.retry.count	Integer (default is 3)	Number of retries to handle errors	No
org.kie.executor.timeunit	TimeUnit (default is "SECONDS")	TimeUnit representing interval	No
org.kie.executor.disabled	Boolean (default is "false")	Disables executor completely	No
kie.server.jms.queues.response	String (default is "queue/KIE.SERVER.RESPONSE")	JNDI name of response queue for JMS	No
org.kie.server.controller.connect	Integer (default is 10000)	Waiting time in milliseconds between repeated attempts to connect kie server to controller when kie server starts up	No
org.drools.server.filter.classes	Boolean (default is "false")	If true, accept only classes which are annotated with @org.kie.api.remote.Remotable or @javax.xml.bind.annotation.XmlRootElement as extra JAXB classes	No

Important

If you are running both KIE Server and KIE Workbench you must configure KIE Server to use a different Data Source to KIE Workbench using the **org.kie.server.persistence.ds** property. KIE Workbench uses a jBPM Executor Service that can conflict with KIE Server if they share the same Data Source.

5.2.2. Installation details for different containers

5.2.2.1. Tomcat 7.x/8.x

1. Download and unzip the Tomcat distribution. Let's call the root of the distribution `TOMCAT_HOME`. This directory is named after the Tomcat version, so for example `apache-tomcat-7.0.55`.
2. Download *kie-server-6.5.1-SNAPSHOT-webc.war* and place it into `TOMCAT_HOME/webapps`.
3. Configure user(s) and role(s). Make sure that file `TOMCAT_HOME/conf/tomcat-users.xml` contains the following username and role definition. You can of course choose different username and password, just make sure that the user has role `kie-server`:

Example 5.2. Username and role definition for Tomcat

```
<role rolename="kie-server"/>
<user username="serveruser" password="my.s3cr3t.pass" roles="kie-server"/>
```

4. Start the server by running `TOMCAT_HOME/bin/startup.[sh|bat]`. You can check out the Tomcat logs in `TOMCAT_HOME/logs` to see if the application deployed successfully. Please read the table above for the bootstrap switches that can be used to properly configure the instance. For instance:

```
./startup.sh -Dorg.kie.server.id=first-kie-server          -Dorg.kie.server.location=http://
localhost:8080/kie-server/services/rest/server
er             -Dorg.kie.server.location=http://localhost:8080/kie-server/services/rest/
```

5. Verify the server is running. Go to `http://SERVER:PORT/CONTEXT/services/rest/server/` and type the specified username and password. You should see simple XML message with basic information about the server.

Important

You can not leverage the JMS interface when running on Tomcat, or any other Web container. The Web container version of the WAR contains only the REST interface.

5.2.2.2. WildFly 8.x

1. Download and unzip the WildFly distribution. Let's call the root of the distribution `WILDFLY_HOME`. This directory is named after the WildFly version, so for example `wildfly-8.2.0.Final`.

2. Download *kie-server-6.5.1-SNAPSHOT-ee7.war* and place it into `WILDFLY_HOME/standalone/deployments`.

3. Configure user(s) and role(s). Execute the following command `WILDFLY_HOME/bin/add-user.[sh|bat] -a -u 'kieserver' -p 'kieserver1!' -ro 'kie-server'`. You can of course choose different username and password, just make sure that the user has role `kie-server`.

4. Start the server by running `WILDFLY_HOME/bin/standalone.[sh|bat] -c standalone-full.xml <bootstrap_switches>`. You can check out the standard output or WildFly logs in `WILDFLY_HOME/standalone/logs` to see if the application deployed successfully. Please read the table above for the bootstrap switches that can be used to properly configure the instance. For instance:

```
./standalone.sh  --server-config=standalone-full.xml            -Djboss.socket.binding.port-
offset=150                       -Dorg.kie.server.id=first-kie-server                        -
Dorg.kie.server.location=http://localhost:8230/kie-server/services/rest/server
full.xml                 -Djboss.socket.binding.port-
offset=150                 -Dorg.kie.server.id=first-kie-
server             -Dorg.kie.server.location=http://localhost:8230/kie-server/services/rest/
```

5. Verify the server is running. Go to `http://SERVER:PORT/CONTEXT/services/rest/server/` and type the specified username and password. You should see simple XML message with basic information about the server.

5.3. Kie Server setup

Important

Server setup and registration changed significantly from versions 6.2 and before. The following applies only to version 6.3 and forward.

5.3.1. Managed Kie Server

A managed instance is one that requires a controller to be available to properly startup the Kie Server instance.

A Controller is a component responsible for keeping and managing a Kie Server Configuration in centralized way. Each controller can manager multiple configurations at once and there can be multiple controllers in the environment. Managed KIE Servers can be configured with a list of controllers but will connect to only one at a time.

Note

It's important to mention that even though there can be multiple controllers they should be kept in sync to make sure that regardless which one of them is contacted by KIE Server instance it will provide same set of configuration.

At startup, if a Kie Server is configured with a list of controllers, it will try succesivelly to connect to each of them until a connection is successfully stablished with one of them. If for any reason a connection can't be stablished, the server will not start, even if there is local storage available with configuration. This happens by design in order to ensure consistency. For instance, if the Kie Server was down and the configuration has changed, this restriction guarantees that it will run with up to date configuration or not at all.

Note

In order to run the Kie Server in standalone mode, without connecting to any controllers, please see "Unmanaged Kie Server".

The configuration sets, among other things:

- kie containers to be deployed and started
- configuration items - currently this is a place holder for further enhancements that will allow remotely configure KIE Execution Server components - timers, persistence, etc

The Controller, besides providing configuration management, is also responsible for overall management of Kie Servers. It provides a REST api that is divided into two parts:

- the controller itself that is exposed to interact with KIE Execution Server instances
- an administration API that allows to remotely manage Kie Server instances:
  - add/remove servers
  - add/remove containers to/from the servers
  - start/stop containers on servers

The controller deals only with the Kie Server configuration or definition to put it differently. It does not handle any runtime components of KIE Execution Server instances. They are always considered remote to controller. The controller is responsible for persisting the configuration to preserve restarts of the controller itself. It should manage the synchronization as well in case multiple controllers are configured to keep all definitions up to date on all instances of the controller.

By default controller is shipped with Kie Workbench and provides a fully featured management interface (both REST api and UI). It uses underlying git repository as persistent store and thus when GIT repositories are clustered (using Apache Zookeeper and Apache Helix) it will cover the controllers synchronization as well.

The diagram above illustrates the single controller (workbench) setup with multiple Kie Server instances managed by it.

The diagram below illustrates the clustered setup where there are multiple instances of controller synchronized over Zookeeper.

In the above diagram we can see that the Kie Server instances are capable of connecting to any controllers, but they will connect to only one. Each instance will attempt to connect to controller

as long as it can reach one. Once connection is established with one of the controllers it will skip the others.

5.3.1.1. Working with managed servers

There are two approaches that users can take when working with managed KIE Server instances:

- *Configuration first:* with this approach, a user will start working with the controller (either UI or REST api) and create and configure Kie Server definitions. That consists basically of an identification for the server definition (id and name + optionally version for improved readability) and the configuration for the Kie Containers to run on the server.
- *Registration first:* with this approach, the Kie Server instances are started first and auto register themselves on controller. The user then can configure the Kie Containers. This option simply skips the registration step done in the first approach and populates it with server id, name and version directly upon auto registration. There are no other differences between the two approaches.

5.3.2. Unmanaged KIE Execution Server

An unmanaged Kie Server is in turn just a standalone instance, and thus must be configured individually using REST/JMS api from the Kie Server itself. There is no controller involved. The configuration is automatically persisted by the server into a file and that is used as the internal server state, in case of restarts.

The configuration is updated during the following operations:

- deploy Kie Container
- undeploy Kie Container
- start Kie Container
- stop Kie Container

Note

if the Kie Server is restarted, it will try to restablish the same state that was persisted before shutdown. That means that Kie Containers that were running, will be started, but the ones that were stopped/disposed before, will not.

In most use cases, the Kie Server should be executed in managed mode as that provides some benefits, like a web user interface (if using the workbench as a controller) and some facilities for clustering.

5.4. Creating a Kie Container

Once your Execution Server is registered, you can start adding **Kie Containers** to it.

Kie Containers are self contained environments that have been provisioned to hold instances of your packaged and deployed rule instances.

1. Start by clicking the **+** icon next to the Execution Server where you want to deploy your Container. This will bring up the New Container screen.
2. If you know the **Group Name**, **Artifact Id** and **Version** (GAV) of your deployed package, then you can enter those details and click the Ok button to select that instance (and provide a name for the Container);
3. If you don't know these values, you can search KIE Workbench for all packages that can be deployed. Click the **Search** button without entering any value in the search field (you can narrow your search by entering any term that you know exists in the package that you want to deploy).

   Important

   INSERT SCREENSHOT HERE

   The figure above shows that there are three deployable packages available to be used as containers on the Execution Server. Select the one that you want by clicking the Select button. This will auto-populate the **GAV** and you can then click the **Ok** button to use this deployable as the new Container.
4. Enter a name for this Container at the top and then press the Ok button.

   Important

   The Container name must be unique inside each execution server and must not contain any spaces.

Note

Just below the **GAV** row, you will see an uneditable row that shows you the **URL** for your Container against which you will be able to execute REST commands.

5.5. Managing Containers

Containers within the Execution Server can be started, stopped and updated from within KIE Workbench.

5.5.1. Starting a Container

Once registered, a Container is in the 'Stopped' mode. It can be started by first selecting it and then clicking the Start button. You can also select multiple Containers and start them all at the same time.

Once the Container is in the 'Running' mode, a green arrow appears next to it. If there are any errors starting the Container(s), red icons appear next to Containers and the Execution Server that they are deployed on.

You should check the logs of both the Execution Server and the current Business Central to see what the errors are before redeploying the Containers (and possibly the Execution Server).

5.5.2. Stopping and Deleting a Container

Similar to starting a Container, select the Container(s) that you want to stop (or delete) and click the Stop button (which replaces the Start button for that Container once it has entered the 'Running' mode) or the Delete button.

5.5.3. Updating a Container

You can update deployed `KieContainers` without restarting the Execution Server. This is useful in cases where the Business Rules change, creating new versions of packages to be provisioned.

You can have multiple versions of the same package provisioned and deployed, each to a different `KieContainer`.

To update deployments in a `KieContainer` dynamically, click on the icon next to the Container. This will open up the Container Info screen. An example of this screen is shown here:

Important

INSERT SCREENSHOT HERE

The Container Info screen is a useful tool because it not only allows you to see the endpoint for this `KieContainer`, but it also allows you to either manually or automatically refresh the provision if an update is available. The update can be manual or automatic:

Manual Update: To manually update a `KieContainer`, enter the new Version number in the Version box and click on the **Update** button. You can of course, update the Group Id or the Artifact Id , if these have changed as well. Once updated, the Execution server updates the container and shows you the resolved GAV attributes at the bottom of the screen in the **Resolved Release Id** section.

Automatic Update: If you want a deployed Container to always have the latest version of your deployment without manually editing it, you will need to set the Version property to the value of `LATEST` and start a `Scanner`. This will ensure that the deployed provision always contains the latest

version. The Scanner can be started just once on demand by clicking the Scan Now button or you can start it in the background with scans happening at a specified interval (in milliseconds).You can also set this value to `LATEST` when you are first creating this deployment. The **Resolved Release Id** in this case will show you the actual, latest version number.

5.6. Kie Server REST API

The Execution Server supports the following commands via the REST API.

Please note the following before using these commands:

- The base URL for these will remain as the endpoint defined earlier (for example: `http://SERVER:PORT/CONTEXT/services/rest/server/`)
- All requests require basic HTTP Authentication for the role kie-server as indicated earlier.

5.6.1. [GET] /

Returns the Execution Server information

Example 5.3. Example Server Response

```
<response type="SUCCESS" msg="KIE Server info">
  <kie-server-info>
    <version>6.2.0.redhat-1</version>
  </kie-server-info>
</response>
```

5.6.2. [POST] /

Using POST HTTP method, you can execute various commands on the Execution Server. E.g: create-container, list-containers, dispose-container and call-container.
Following is the full list of commands:

- CreateContainerCommand
- GetServerInfoCommand
- ListContainersCommand
- CallContainerCommand
- DisposeContainerCommand
- GetContainerInfoCommand
- GetScannerInfoCommand
- UpdateScannerCommand

- UpdateReleaseIdCommand

The commands itself can be found in the `org.kie.server.api.commands` package.

5.6.3. [GET] /containers

Returns a list of containers that have been created on this Execution Server.

Example 5.4. Example Server Response

```
<response type="SUCCESS" msg="List of created containers">
  <kie-containers>
    <kie-container container-id="MyProjectContainer" status="STARTED">
      <release-id>
        <artifact-id>Project1</artifact-id>
        <group-id>com.redhat</group-id>
        <version>1.0</version>
      </release-id>
      <resolved-release-id>
        <artifact-id>Project1</artifact-id>
        <group-id>com.redhat</group-id>
        <version>1.0</version>
      </resolved-release-id>
    </kie-container>
  </kie-containers>
</response>
```

The endpoint supports also filtering based on `ReleaseId` and container status. Examples:

- `/containers?groupId=org.example` - returns only containers with the specified groupId
- `/containers?groupId=org.example&artifactId=project1&version=1.0.0.Final` - returns only containers with the specified `ReleaseId`
- `/containers?status=started,failed` - returns containers which are either started or failed

5.6.4. [GET] /containers/{id}

Returns the status and information about a particular container. For example, executing `http://SERVER:PORT/CONTEXT/services/rest/server/containers/MyProjectContainer` could return the following example container info.

Example 5.5. Example Server Response

```
`<response type="SUCCESS" msg="Info for container MyProjectContainer">
  <kie-container container-id="MyProjectContainer" status="STARTED">
    <release-id>
      <artifact-id>Project1</artifact-id>
      <group-id>com.redhat</group-id>
      <version>1.0</version>
    </release-id>
```

```
    <resolved-release-id>
      <artifact-id>Project1</artifact-id>
      <group-id>com.redhat</group-id>
      <version>1.0</version>
    </resolved-release-id>
  </kie-container>
</response>
```

5.6.5. [PUT] /containers/{id}

Allows you to create a new Container in the Execution Server. For example, to create a Container with the id of **MyRESTContainer** the complete endpoint will be: `http://SERVER:PORT/CONTEXT/services/rest/server/containers/MyRESTContainer`. An example of request is:

Example 5.6. Example Request to create a container

```
<kie-container container-id="MyRESTContainer">
  <release-id>
    <artifact-id>Project1</artifact-id>
    <group-id>com.redhat</group-id>
    <version>1.0</version>
  </release-id>
</kie-container>
```

And the response from the server, if successful, would be be:

Example 5.7. Example Server Response when creating a container

```
<response type="SUCCESS" msg="Container MyRESTContainer successfully deployed with module
 com.redhat:Project1:1.0">
  <kie-container container-id="MyProjectContainer" status="STARTED">
    <release-id>
      <artifact-id>Project1</artifact-id>
      <group-id>com.redhat</group-id>
      <version>1.0</version>
    </release-id>
    <resolved-release-id>
      <artifact-id>Project1</artifact-id>
      <group-id>com.redhat</group-id>
      <version>1.0</version>
    </resolved-release-id>
  </kie-container>
</response>
```

5.6.6. [DELETE] /containers/{id}

Disposes the Container specified by the id. For example, executing `http://SERVER:PORT/CONTEXT/services/rest/server/containers/MyProjectContainer` using the DELETE HTTP method will return the following server response:

Example 5.8. Example Server Response disposing a container

```
<response type="SUCCESS" msg="Container MyProjectContainer successfully disposed."/>
```

5.6.7. [POST] /containers/instances/{id}

Executes operations and commands against the specified Container. You can send commands to this Container in the body of the POST request. For example, to fire all rules for Container with id MyRESTContainer (`http://SERVER:PORT/CONTEXT/services/rest/server/containers/instances/MyRESTContainer`), you would send the fire-all-rules command to it as shown below (in the body of the POST request):

Example 5.9. Example Server Request to fire all rules

```
<fire-all-rules/>
```

Following is the list of supported commands:

- AgendaGroupSetFocusCommand
- ClearActivationGroupCommand
- ClearAgendaCommand
- ClearAgendaGroupCommand
- ClearRuleFlowGroupCommand
- DeleteCommand
- InsertObjectCommand
- ModifyCommand
- GetObjectCommand
- InsertElementsCommand
- FireAllRulesCommand
- QueryCommand
- SetGlobalCommand
- GetGlobalCommand
- GetObjectsCommand
- BatchExecutionCommand

These commands can be found in the `org.drools.core.command.runtime` package.

5.6.8. [GET] /containers/{id}/release-id

Returns the full release id for the Container specified by the id.

Example 5.10. Example Server Response

```
`<response type="SUCCESS" msg="ReleaseId for container MyProjectContainer">
  <release-id>
    <artifact-id>Project1</artifact-id>
    <group-id>com.redhat</group-id>
    <version>1.0</version>
  </release-id>
</response>
```

5.6.9. [POST] /containers/{id}/release-id

Allows you to update the release id of the container deployment. Send the new complete release id to the Server.

Example 5.11. Example Server Request

```
<release-id>
  <artifact-id>Project1</artifact-id>
  <group-id>com.redhat</group-id>
  <version>1.1</version>
</release-id>
```

The Server will respond with a success or error message, similar to the one below:

Example 5.12. Example Server Response

```
<response type="SUCCESS" msg="Release id successfully updated.">  <release-id>     <artifact-
id>Project1</artifact-id>      <group-id>com.redhat</group-id>     <version>1.0</version>    </
release-id> </response>
fully up
dated.">  <release-id>
 <artifact-id>Project1</artifact-id>
  <group-id>com.redhat</group-id>
   <version>1.0</version>
```

5.6.10. [GET] /containers/{id}/scanner

Returns information about the scanner for this Container's automatic updates.

Example 5.13. Example Server Response

```
<response type="SUCCESS" msg="Scanner info successfully retrieved">
  <kie-scanner status="DISPOSED"/>
</response>
```

5.6.11. [POST] /containers/{id}/scanner

Allows you to start or stop a scanner that controls polling for updated Container deployments. To start the scanner, send a request similar to: `http://SERVER:PORT/CONTEXT/services/rest/server/containers/{container-id}/scanner` with the following POST data.

Example 5.14. Example Server Request to start the scanner

```
<kie-scanner status="STARTED" poll-interval="20"/>
```

The poll-interval attribute is in seconds. The response from the server will be similar to:

Example 5.15. Example Server Response

```
<response type="SUCCESS" msg="Kie scanner successfully created.">
  <kie-scanner status="STARTED"/>
</response>
```

To stop the Scanner, replace the status with `DISPOSED` and remove the poll-interval attribute.

5.6.12. Native REST client for Execution Server

Commands outlined in this section can be sent with any REST client, whether it is curl, RESTEasy or .NET based application. However, when sending requests from Java based application, users can utilize out of the box native client for remote communication with Execution Server. This client is part of the **org.kie:kie-server-client** project. It doesn't allow creating XML request, therefore it is necessary generate them before, for example, using Drools API.

Example 5.16. Generate XML request

```
import java.util.ArrayList;
import java.util.List;

import org.drools.core.command.impl.GenericCommand;
import org.drools.core.command.runtime.BatchExecutionCommandImpl;
import org.drools.core.command.runtime.rule.FireAllRulesCommand;
import org.drools.core.command.runtime.rule.InsertObjectCommand;
import org.kie.api.command.BatchExecutionCommand;
```

```
import org.kie.internal.runtime.helper.BatchExecutionHelper;

public class DecisionClient {

public static void main(String args[]) {
        Bean1 bean1 = new Bean1();
        bean1.setName("Robert");

        InsertObjectCommand insertObjectCommand = new InsertObjectCommand(bean1, "f1");
        FireAllRulesCommand fireAllRulesCommand = new FireAllRulesCommand("myFireCommand");

        List<GenericCommand<?>> commands = new ArrayList<GenericCommand<?>>();
        commands.add(insertObjectCommand);
        commands.add(fireAllRulesCommand);
        BatchExecutionCommand command = new BatchExecutionCommandImpl(commands);

           String xStreamXml = BatchExecutionHelper.newXStreamMarshaller().toXML(command); //
 actual XML request
    }
}
```

Once the request is generated it can be sent using **kie-server-client** as follows:

Example 5.17. Sending XML request with kie-server-client

```
import org.kie.server.api.model.ServiceResponse;
import org.kie.server.client.KieServicesClient;
import org.kie.server.client.KieServicesConfiguration;
import org.kie.server.client.KieServicesFactory;

//user "anton" must have role "kie-server" assigned
KieServicesConfiguration config =  KieServicesFactory.
        newRestConfiguration("http://localhost:8080/kie-server/services/rest/server",
        "anton",
        "password1!");
 KieServicesClient client = KieServicesFactory.newKieServicesClient(config);
// the request "xStreamXml" we generated in previous step
// "ListenerReproducer" is the name of the Container
ServiceResponse<String> response = client.executeCommands("ListenerReproducer", xStreamXml);
System.out.println(response.getResult());
```

5.7. OptaPlanner REST API

When the Planner capability is enabled, the Kie Server supports the following additional REST APIs. As usual, all these APIs are also available through JMS and the Java client API. Please also note:

- The base URL for these will remain as the endpoint defined earlier (for example `http://SERVER:PORT/CONTEXT/services/rest/server/`).

- All requests require basic HTTP Authentication for the role kie-server as indicated earlier.
- To get a specific marshalling format, add the HTTP headers `Content-Type` and optional `X-KIE-ContentType` in the HTTP request. For example:

```
Content-Type: application/xmlX-KIE-ContentType: xstream
plication/xmlX-
```

The example requests and responses used below presume that a kie container is build using the optacloud example of OptaPlanner Workbench, by calling a `PUT` on `/services/rest/server/containers/optacloud-kiecontainer-1` with this content:

```
<kie-container container-id="optacloud-kiecontainer-1">
  <release-id>
    <group-id>opta</group-id>
    <artifact-id>optacloud</artifact-id>
    <version>1.0.0</version>
  </release-id>
</kie-container>
```

5.7.1. [GET] /containers/{containerId}/solvers

Returns the list of solvers created in the container.

Example 5.18. Example Server Response (XStream)

```
<org.kie.server.api.model.ServiceResponse>
  <type>SUCCESS</type>
  <msg>Solvers list successfully retrieved from container 'optacloud-kiecontainer-1'</msg>
  <result class="org.kie.server.api.model.instance.SolverInstanceList">
    <solvers>
      <solver-instance>
        <container-id>optacloud-kiecontainer-1</container-id>
        <solver-id>solver1</solver-id>
        <solver-config-file>opta/optacloud/cloudSolverConfig.solver.xml</solver-config-file>
        <status>NOT_SOLVING</status>
      </solver-instance>
      <solver-instance>
        <container-id>optacloud-kiecontainer-1</container-id>
        <solver-id>solver2</solver-id>
        <solver-config-file>opta/optacloud/cloudSolverConfig.solver.xml</solver-config-file>
        <status>NOT_SOLVING</status>
      </solver-instance>
    </solvers>
  </result>
</org.kie.server.api.model.ServiceResponse>
```

Example 5.19. Example Server Response (JSON)

```
{
  "type" : "SUCCESS",
  "msg" : "Solvers list successfully retrieved from container 'optacloud-kiecontainer-1'",
  "result" : {
    "solver-instance-list" : {
      "solver" : [ {
        "status" : "NOT_SOLVING",
        "container-id" : "optacloud-kiecontainer-1",
        "solver-id" : "solver1",
        "solver-config-file" : "opta/optacloud/cloudSolverConfig.solver.xml"
      }, {
        "status" : "NOT_SOLVING",
        "container-id" : "optacloud-kiecontainer-1",
        "solver-id" : "solver2",
        "solver-config-file" : "opta/optacloud/cloudSolverConfig.solver.xml"
      } ]
    }
  }
}
```

5.7.2. [PUT] /containers/{containerId}/solvers/{solverId}

Creates a new solver with the given `{solverId}` in the container `{containerId}`. The request's body is a marshalled SolverInstance entity that must specify the solver configuration file.

The following is an example of the request and the corresponding response.

Example 5.20. Example Server Request (XStream)

```
<solver-instance>
  <solver-config-file>opta/optacloud/cloudSolverConfig.solver.xml</solver-config-file>
</solver-instance>
```

Example 5.21. Example Server Response (XStream)

```
<org.kie.server.api.model.ServiceResponse>
  <type>SUCCESS</type>
  <msg>Solver 'solver1' successfully created in container 'optacloud-kiecontainer-1'</msg>
  <result class="solver-instance">
    <container-id>optacloud-kiecontainer-1</container-id>
    <solver-id>solver1</solver-id>
    <solver-config-file>opta/optacloud/cloudSolverConfig.solver.xml</solver-config-file>
    <status>NOT_SOLVING</status>
  </result>
</org.kie.server.api.model.ServiceResponse>
```

Example 5.22. Example Server Request (JSON)

```
{
  "solver-config-file" : "opta/optacloud/cloudSolverConfig.solver.xml"
}
```

Example 5.23. Example Server Response (JSON)

```
{
  "type" : "SUCCESS",
  "msg" : "Solver 'solver1' successfully created in container 'optacloud-kiecontainer-1'",
  "result" : {
    "solver-instance" : {
      "container-id" : "optacloud-kiecontainer-1",
      "solver-id" : "solver1",
      "solver-config-file" : "opta/optacloud/cloudSolverConfig.solver.xml",
      "status" : "NOT_SOLVING"
    }
  }
}
```

5.7.3. [GET] /containers/{containerId}/solvers/{solverId}

Returns the current state of the solver `{solverId}` in container `{containerId}`.

Example 5.24. Example Server Response (XStream)

```
<org.kie.server.api.model.ServiceResponse>
  <type>SUCCESS</type>
   <msg>Solver 'solver1' state successfully retrieved from container 'optacloud-kiecontainer-
1'</msg>
  <result class="solver-instance">
    <container-id>optacloud-kiecontainer-1</container-id>
    <solver-id>solver1</solver-id>
    <solver-config-file>opta/optacloud/cloudSolverConfig.solver.xml</solver-config-file>
    <status>NOT_SOLVING</status>
  </result>
</org.kie.server.api.model.ServiceResponse>
```

Example 5.25. Example Server Response (JSON)

```
{
  "type" : "SUCCESS",
    "msg" : "Solver 'solver1' state successfully retrieved from container 'optacloud-
kiecontainer-1'",
  "result" : {
    "solver-instance" : {
      "container-id" : "optacloud-kiecontainer-1",
```

```
      "solver-id" : "solver1",
      "solver-config-file" : "opta/optacloud/cloudSolverConfig.solver.xml",
      "status" : "NOT_SOLVING"
    }
  }
}
```

5.7.4. [POST] /containers/{containerId}/solvers/{solverId}

Updates the state of the {solverId} in container {containerId}, most notably to start solving. The request's body is a marshalled `SolverInstance` and can either request the solver to solve a planning problem or to stop solving one. The SolverInstance state determines which operation should be executed and can be set one of two possible values:

- SOLVING: starts the solver if it is not executing yet. The request's body must also contain the problem's data to be solved.
- NOT_SOLVING: requests the solver to terminate early, if it is running. All other attributes are ignored.

5.7.4.1. Start solving

For example, to solve an optacloud problem with 2 computers and 1 process:

Example 5.26. Example Server Request (XStream)

```
<solver-instance>
  <status>SOLVING</status>
  <planning-problem class="opta.optacloud.CloudSolution">
    <computerList>
      <opta.optacloud.Computer>
        <cpuPower>10</cpuPower>
        <memory>4</memory>
        <networkBandwidth>100</networkBandwidth>
        <cost>1000</cost>
      </opta.optacloud.Computer>
      <opta.optacloud.Computer>
        <cpuPower>20</cpuPower>
        <memory>8</memory>
        <networkBandwidth>100</networkBandwidth>
        <cost>3000</cost>
      </opta.optacloud.Computer>
    </computerList>
    <processList>
      <opta.optacloud.Process>
        <requiredCpuPower>1</requiredCpuPower>
        <requiredMemory>7</requiredMemory>
        <requiredNetworkBandwidth>1</requiredNetworkBandwidth>
      </opta.optacloud.Process>
    </processList>
  </planning-problem>
```

```
</solver-instance>
```

Notice that the response does not contain the best solution yet, because solving can take seconds, minutes, hours or days and this would time out the HTTP request:

Example 5.27. Example Server Response (XStream)

```
<org.kie.server.api.model.ServiceResponse>
  <type>SUCCESS</type>
  <msg>Solver 'solver1' from container 'optacloud-kiecontainer-1' successfully updated.</msg>
  <result class="solver-instance">
    <container-id>optacloud-kiecontainer-1</container-id>
    <solver-id>solver1</solver-id>
    <solver-config-file>opta/optacloud/cloudSolverConfig.solver.xml</solver-config-file>
    <status>SOLVING</status>
  </result>
</org.kie.server.api.model.ServiceResponse>
```

Instead, it's solving asynchronously and you need to call the bestsolution URL to get the best solution.

5.7.4.2. Terminate solving

For example, to terminate solving:

Example 5.28. Example Server Request (XStream)

```
<solver-instance>
  <status>NOT_SOLVING</status>
</solver-instance>
```

Example 5.29. Example Server Response (XStream)

```
<org.kie.server.api.model.ServiceResponse>
  <type>SUCCESS</type>
  <msg>Solver 'solver1' from container 'optacloud-kiecontainer-1' successfully updated.</msg>
  <result class="solver-instance">
    <container-id>optacloud-kiecontainer-1</container-id>
    <solver-id>solver1</solver-id>
    <solver-config-file>opta/optacloud/cloudSolverConfig.solver.xml</solver-config-file>
    <status>TERMINATING_EARLY</status>
    <score class="org.optaplanner.core.api.score.buildin.hardsoft.HardSoftScore">
      <hardScore>0</hardScore>
      <softScore>-3000</softScore>
    </score>
  </result>
</org.kie.server.api.model.ServiceResponse>
```

This doesn't delete the solver, the best solution can still be retrieved.

5.7.5. [GET] /containers/{containerId}/solvers/{solverId}/bestsolution

Returns the best solution found at the time the request is made. If the solver hasn't terminated yet (so the `status` field is still `SOLVING`), it will return the best solution found up to then, but later calls can return a better solution.

For example, the problem submitted above would return this solution, with the process assigned to the second computer (because the first one doesn't have enough memory).

Example 5.30. Example Server Response (XStream)

```
<org.kie.server.api.model.ServiceResponse>
  <type>SUCCESS</type>
  <msg>Best computed solution for 'solver1' successfully retrieved from container 'optacloud-kiecontainer-1'</msg>
   <result class="solver-instance">
    <container-id>optacloud-kiecontainer-1</container-id>
    <solver-id>solver1</solver-id>
    <solver-config-file>opta/optacloud/cloudSolverConfig.solver.xml</solver-config-file>
    <status>SOLVING</status>
    <score class="org.optaplanner.core.api.score.buildin.hardsoft.HardSoftScore">
      <hardScore>0</hardScore>
      <softScore>-3000</softScore>
    </score>
    <best-solution class="opta.optacloud.CloudSolution">

 <score class="org.optaplanner.core.api.score.buildin.hardsoft.HardSoftScore" reference="../../score" />
      <computerList>
        <opta.optacloud.Computer>
          <cpuPower>10</cpuPower>
          <memory>4</memory>
          <networkBandwidth>100</networkBandwidth>
          <cost>1000</cost>
        </opta.optacloud.Computer>
        <opta.optacloud.Computer>
          <cpuPower>20</cpuPower>
          <memory>8</memory>
          <networkBandwidth>100</networkBandwidth>
          <cost>3000</cost>
        </opta.optacloud.Computer>
      </computerList>
      <processList>
        <opta.optacloud.Process>
          <requiredCpuPower>1</requiredCpuPower>
          <requiredMemory>7</requiredMemory>
          <requiredNetworkBandwidth>1</requiredNetworkBandwidth>
          <computer reference="../../../computerList/opta.optacloud.Computer[2]" />
        </opta.optacloud.Process>
      </processList>
    </best-solution>
```

```
  </result>
</org.kie.server.api.model.ServiceResponse>
```

5.7.6. [DELETE] /containers/{containerId}/solvers/{solverId}

Disposes the solver `{solverId}` in container `{containerId}`. If it hasn't terminated yet, it terminates it first.

Example 5.31. Example Server Response (XStream)

```
<org.kie.server.api.model.ServiceResponse>
  <type>SUCCESS</type>
  <msg>Solver 'solver1' successfully disposed from container 'optacloud-kiecontainer-1'</msg>
</org.kie.server.api.model.ServiceResponse>
```

Example 5.32. Example Server Response (JSON)

```
{
  "type" : "SUCCESS",
  "msg" : "Solver 'solver1' successfully disposed from container 'optacloud-kiecontainer-1'"
}
```

5.8. Controller REST API

When you have Managed Kie Server setup, you need to manage Kie Servers and Containers via a Controller. Generally, it's done by workbench UI but you may also use Controller REST API.

- The controller base URL is provided by kie-wb war deployment, which would be the same as org.kie.server.controller property. (for example: `http://localhost:8080/kie-wb/rest/controller`)
- All requests require basic HTTP Authentication for the role kie-server as indicated earlier.

5.8.1. [GET] /management/servers

Returns a list of Kie Server templates

Example 5.33. Example Server Response

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<server-template-list>
    <server-template>
        <server-id>demo</server-id>
        <server-name>demo</server-name>
```

```
        <container-specs>
            <container-id>hr</container-id>
            <container-name>hr</container-name>
            <server-template-key>
                <server-id>demo</server-id>
            </server-template-key>
            <release-id>
                <artifact-id>HR</artifact-id>
                <group-id>org.jbpm</group-id>
                <version>1.0</version>
            </release-id>
            <configs>
                <entry>
                    <key>RULE</key>
                     <value xsi:type="ruleConfig" xmlns:xsi="http://www.w3.org/2001/XMLSchema-
instance">
                        <scanner-status>STOPPED</scanner-status>
                    </value>
                </entry>
                <entry>
                    <key>PROCESS</key>
                            <value xsi:type="processConfig" xmlns:xsi="http://www.w3.org/2001/
XMLSchema-instance">
                        <strategy>Singleton</strategy>
                        <kie-base-name></kie-base-name>
                        <kie-session-name></kie-session-name>
                        <merge-mode>Merge Collections</merge-mode>
                    </value>
                </entry>
            </configs>
            <status>STARTED</status>
        </container-specs>
        <configs/>
        <server-instances>
            <server-instance-id>demo@localhost:8230</server-instance-id>
            <server-name>demo@localhost:8230</server-name>
            <server-template-id>demo</server-template-id>
            <server-url>http://localhost:8230/kie-server/services/rest/server</server-url>
        </server-instances>
        <capabilities>RULE</capabilities>
        <capabilities>PROCESS</capabilities>
        <capabilities>PLANNING</capabilities>
    </server-template>
</server-template-list>
```

5.8.2. [GET] /management/server/{id}

Returns a Kie Server template

Example 5.34. Example Server Response

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<server-template-details>
    <server-id>product-demo</server-id>
    <server-name>product-demo</server-name>
```

```
    <container-specs>
        <container-id>hr</container-id>
        <container-name>hr</container-name>
        <server-template-key>
            <server-id>demo</server-id>
        </server-template-key>
        <release-id>
            <artifact-id>HR</artifact-id>
            <group-id>org.jbpm</group-id>
            <version>1.0</version>
        </release-id>
        <configs>
            <entry>
                <key>RULE</key>
            <value xsi:type="ruleConfig" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
                    <scanner-status>STOPPED</scanner-status>
                </value>
            </entry>
            <entry>
                <key>PROCESS</key>
                  <value xsi:type="processConfig" xmlns:xsi="http://www.w3.org/2001/XMLSchema-
instance">
                    <strategy>Singleton</strategy>
                    <kie-base-name></kie-base-name>
                    <kie-session-name></kie-session-name>
                    <merge-mode>Merge Collections</merge-mode>
                </value>
            </entry>
        </configs>
        <status>STARTED</status>
    </container-specs>
    <configs/>
    <server-instances>
        <server-instance-id>demo@localhost:8230</server-instance-id>
        <server-name>demo@localhost:8230</server-name>
        <server-template-id>demo</server-template-id>
        <server-url>http://localhost:8230/kie-server/services/rest/server</server-url>
    </server-instances>
    <capabilities>RULE</capabilities>
    <capabilities>PROCESS</capabilities>
    <capabilities>PLANNING</capabilities>
</server-template-details>
```

5.8.3. [PUT] /management/server/{id}

Creates a new Kie Server template with the specified id

Example 5.35. Example Request to create a new Kie Server template

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<server-template-details>
    <server-id>test-demo</server-id>
    <server-name>test-demo</server-name>
    <configs/>
    <capabilities>RULE</capabilities>
```

```
    <capabilities>PROCESS</capabilities>
    <capabilities>PLANNING</capabilities>
</server-template-details>
```

5.8.4. [DELETE] /management/server/{id}

Deletes a Kie Server template with the specified id

5.8.5. [GET] /management/server/{id}/containers

Returns all containers on given server

Example 5.36. Example Server Response

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<container-spec-list>
    <container-spec>
        <container-id>hr</container-id>
        <container-name>hr</container-name>
        <server-template-key>
            <server-id>demo</server-id>
        </server-template-key>
        <release-id>
            <artifact-id>HR</artifact-id>
            <group-id>org.jbpm</group-id>
            <version>1.0</version>
        </release-id>
        <configs>
            <entry>
                <key>RULE</key>
            <value xsi:type="ruleConfig" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
                    <scanner-status>STOPPED</scanner-status>
                </value>
            </entry>
            <entry>
                <key>PROCESS</key>
                  <value xsi:type="processConfig" xmlns:xsi="http://www.w3.org/2001/XMLSchema-
instance">
                    <strategy>Singleton</strategy>
                    <kie-base-name></kie-base-name>
                    <kie-session-name></kie-session-name>
                    <merge-mode>Merge Collections</merge-mode>
                </value>
            </entry>
        </configs>
        <status>STARTED</status>
    </container-spec>
</container-spec-list>
```

5.8.6. [GET] /management/server/{id}/containers/{containerId}

Returns the Container information including its release id and configuration

Example 5.37. Example Server Response

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<container-spec-details>
    <container-id>hr</container-id>
    <container-name>hr</container-name>
    <server-template-key>
        <server-id>demo</server-id>
    </server-template-key>
    <release-id>
        <artifact-id>HR</artifact-id>
        <group-id>org.jbpm</group-id>
        <version>1.0</version>
    </release-id>
    <configs>
        <entry>
            <key>PROCESS</key>
         <value xsi:type="processConfig" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
                <strategy>Singleton</strategy>
                <kie-base-name></kie-base-name>
                <kie-session-name></kie-session-name>
                <merge-mode>Merge Collections</merge-mode>
            </value>
        </entry>
        <entry>
            <key>RULE</key>
           <value xsi:type="ruleConfig" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
                <scanner-status>STOPPED</scanner-status>
            </value>
        </entry>
    </configs>
    <status>STARTED</status>
</container-spec-details>
```

5.8.7. [PUT] /management/server/{id}/containers/{containerId}

Creates a new Container with the specified containerId and the given release id and optionally configuration

Example 5.38. Example Server Request

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<container-spec-details>
    <container-id>hr</container-id>
    <container-name>hr</container-name>
    <server-template-key>
        <server-id>demo</server-id>
    </server-template-key>
    <release-id>
        <artifact-id>HR</artifact-id>
        <group-id>org.jbpm</group-id>
        <version>1.0</version>
    </release-id>
```

```
    <configs>
        <entry>
            <key>PROCESS</key>
         <value xsi:type="processConfig" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
                <strategy>Singleton</strategy>
                <kie-base-name></kie-base-name>
                <kie-session-name></kie-session-name>
                <merge-mode>Merge Collections</merge-mode>
            </value>
        </entry>
        <entry>
            <key>RULE</key>
           <value xsi:type="ruleConfig" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
                <scanner-status>STOPPED</scanner-status>
            </value>
        </entry>
    </configs>
    <status>STARTED</status>
</container-spec-details
```

5.8.8. [DELETE] /management/server/{id}/containers/{containerId}

Disposes a Container with the specified containerId

5.8.9. [POST] /management/server/{id}/containers/{containerId}/status/started

Starts the Container. No request body required

5.8.10. [POST] /management/server/{id}/containers/{containerId}/status/stopped

Stops the Container. No request body required

5.9. Kie Server Java Client API

The Kie Server has a great Java API to wrap REST or JMS requests to be sent to the server. In this section we will explore some of the possibilities of this API.

5.9.1. Maven Configuration

if you are a Maven user, make sure you have at least the following dependencies in the project's *pom.xml*

Example 5.39. Maven Dependencies

```
<dependency>    <groupId>org.kie.server</groupId>    <artifactId>kie-server-client</artifactId>
        <version>${kie.api.version}</version></dependency><!--     Logging     --><dependency>
```

```
 <groupId>ch.qos.logback</groupId>  <artifactId>logback-classic</artifactId>  <version>1.1.2</
version></dependency><!--    Drools    Commands    --><dependency>        <groupId>org.drools</
groupId>     <artifactId>drools-compiler</artifactId>     <scope>runtime</scope>     <version>
${kie.api.version}</version></dependency>
pendency>
 <groupId>org.kie.server</groupId>  <artifactId>kie-
server-client</artifactId>
<version>${kie.api.version}</
version></dependency><!-- Logging

--><dependency>
 <groupId>ch.qos.logback</groupId>
<artifactId>logback-classic</artifactId>
 <version>1.1.2</
version></dependency><!-- Drools Commands

--><dependency>
 <groupId>org.drools</groupId>
<artifactId>drools-compiler</artifactId>
 <scope>runtime</scope>
<version>${kie.api.version}</
```

The version *kie.api.version* depends on the Kie Server version you are using. For jBPM 6.3, for example, you can use 6.3.1-SNAPSHOT.

5.9.2. Client Configuration

The client requires a configuration object where you set most of the server communication aspects, such as the protocol (REST and JMS) credentials and the payload format (XStream, JAXB and JSON are the supported formats at the moment). The first thing to do is create your configuration then create the **`KieServicesClient`** object, the entry point for starting the server communication. See the source below where we use a REST client configuration:

Example 5.40. Client Configuration Example

```
import org.kie.server.api.marshalling.MarshallingFormat;
import org.kie.server.client.KieServicesClient;
import org.kie.server.client.KieServicesConfiguration;
import org.kie.server.client.KieServicesFactory;

public class DecisionServerTest {

    private static final String URL = "http://localhost:8080/kie-server/services/rest/server";
    private static final String USER = "kieserver";
    private static final String PASSWORD = "kieserver1!";

    private static final MarshallingFormat FORMAT = MarshallingFormat.JSON;

    private KieServicesConfiguration conf;
    private KieServicesClient kieServicesClient;

    public void initialize() {
        conf = KieServicesFactory.newRestConfiguration(URL, USER, PASSWORD);
        conf.setMarshallingFormat(FORMAT);
```

```
        kieServicesClient = KieServicesFactory.newKieServicesClient(conf);
    }
```

5.9.2.1. JMS interaction patterns

In version 6.5 KIE Server Client JMS integration has been enhanced with possibility to use various interaction patterns. Currently available are:

- request reply (which is the default) - that makes the JMS integration synchronous - it blocks client until it gets the response back - not suited for JMS transactional use case
- fire and forget - makes the integration one way only, suitable for notification like integration with kie server - makes perfect fit for transactional JMS delivery - deliver message to kie server only if transaction that ckie server client was invoked in was committed successfully
- async with callback - allows to not block a client after sending message to kie server and receive response asynchronously - can be integrated with transactional JMS delivery

Response handlers can be either set globally - when KieServicesConfiguration is created or it can be changed on runtime on individual client instances (like RuleServiceClient, ProcessServicesClient, etc)

While 'fire and forget' and 'request reply' patterns do not require any additional configuration 'async with callback' does. And the main thing is actually the callback. KIE Server CLient comes with one out of the box - `BlockingResponseCallback` that provides basic support backed by blocking queue internally. Size of the queue is confgurable and thus allow receiving multiple messages, though intention of this callback is that it will only receive one message at a time - so it's like one message (request) and then one response per client interaction.

Note

Kie Server Client when switching response handler is not thread safe, meaning change of the handler will affect all threads using same client instance. So in case of dynamic changes of the handler it's recommended to use separate client instances. A good approach is to maintain set of clients that use dedicated response handler and then use these clients dependeing on which handler is required.

Example

client 1 will use fire and forget while client 2 will use request reply. So client 1 can be used to start processes and client 2 can be used to query for user tasks.

Users can provide their own callbacks by implementing *org.kie.server.client.jms.ResponseCallback* interface.

```
InitialContext       context       =       ...;Queue       requestQueue       =       (Queue)
      context.lookup("jms/queue/KIE.SERVER.REQUEST"));Queue       responseQueue       =       (Queue)
```

```
     context.lookup("jms/queue/KIE.SERVER.RESPONSE");ConnectionFactory     connectionFactory     =
    (ConnectionFactory)    context.lookup("jms/RemoteConnectionFactory");KieServicesConfiguration
 jmsConfiguration  =  KieServicesFactory.newJMSConfiguration(  connectionFactory,  requestQueue,
    responseQueue,     "user",     "password");//     here     you     set     response     handler
globallyjmsConfiguration.setResponseHandler(new FireAndForgetResponseHandler());
= ...;Queue requestQueue = (Queue)
context.lookup("jms/queue/KIE.SERVER.REQUEST"));Queue responseQueue = (Queue)
     context.lookup("jms/queue/KIE.SERVER.RESPONSE");ConnectionFactory     connectionFactory     =

(ConnectionFactory)                          context.lookup("jms/RemoteConnectionFactory");KieServicesConfigurati
   jmsConfiguration   =   KieServicesFactory.newJMSConfiguration(   connectionFactory,
requestQueue, responseQueue,
"user", "password");// here you set response
handler
```

Alternatively, might be actually more common, is to set the handler on individual clients before they are used

```
ProcessServiceClient  processClient  =  client.getServicesClient(ProcessServicesClient.class);//
      change      response      handler      for      processClient      others      are      not
affectedprocessClient.setResponseHandler(new FireAndForgetResponseHandler());
= client.getServicesClient(ProcessServicesClient.class);// change response handler for processClient others are
not affected
```

5.9.3. Server Response

All the service responses are represented by the object `org.kie.server.api.model.ServiceResponse<T>` where T is the type of the payload. It has the following attributes:

String msg: The response message;

`org.kie.server.api.model.ServiceResponse.ResponseType` **type:** the response type enum, which can be SUCCESS or FAILURE;

T result: The actual payload of the response, the requested object.

Notice that this is the same object returned if you are using REST or JMS, in another words it is agnostic to protocol.

5.9.4. Server Capabilities

Decision Server initially only supported rules execution, starting in version 6.3 it started supporting business process execution. To know what exactly your server support, you can list the server capabilities by accessing the object `org.kie.server.api.model.KieServerInfo` using the client:

Example 5.41. Listing Server capabilities

```
public void listCapabilities() {
    KieServerInfo serverInfo = kieServicesClient.getServerInfo().getResult();
```

```
    System.out.print("Server capabilities:");
    for(String capability: serverInfo.getCapabilities()) {
        System.out.print(" " + capability);
    }
    System.out.println();
}
```

If the server supports rules and process, the following should be printed when you run the code above:

Server capabilities: BRM KieServer BPM

5.9.5. Kie Containers

If you want to publish a kjar to receive requests, you must publish it in a container. The container is represented in the client by the object `org.kie.server.api.model.KieContainerResource`, and a list of resources is `org.kie.server.api.model.KieContainerResourceList`. Here's an example of how to print a list of containers:

Example 5.42. Listing Kie Containers

```
public void listContainers() {
    KieContainerResourceList containersList = kieServicesClient.listContainers().getResult();
    List<KieContainerResource> kieContainers = containersList.getContainers();
    System.out.println("Available containers: ");
    for (KieContainerResource container : kieContainers) {
        System.out.println("\t" + container.getContainerId() + " (" + container.getReleaseId() + ")");
    }
}
```

It is also possible to list the containers based on specific `ReleaseId` (and its individual parts) or container status:

Example 5.43. Listing Kie Containers with custom filter

```
public void listContainersWithFilter() {
           //   the   following   filter   will   match   only   containers   with   ReleaseId
 "org.example:contatner:1.0.0.Final" and status FAILED
    KieContainerResourceFilter filter = new KieContainerResourceFilter.Builder()
            .releaseId("org.example", "container", "1.0.0.Final")
            .status(KieContainerStatus.FAILED)
            .build();
    KieContainerResourceList containersList = kieServicesClient.listContainers(filter).getResult();
    List<KieContainerResource> kieContainers = containersList.getContainers();
    System.out.println("Available containers: ");
    for (KieContainerResource container : kieContainers) {
        System.out.println("\t" + container.getContainerId() + " (" + container.getReleaseId() + ")");
    }
}
```

5.9.6. Managing Containers

You can use the client to dispose and create containers. If you dispose a containers, a ServiceResponse will be returned with Void payload(no payload) and if you create it, the KieContainerResource object itself will be returned in the response. Sample code:

Example 5.44. Disposing and creating containers

```
public void disposeAndCreateContainer() {
    System.out.println("== Disposing and creating containers ==");
    List<KieContainerResource> kieContainers = kieServicesClient.listContainers().getResult().getContainers();
    if (kieContainers.size() == 0) {
        System.out.println("No containers available...");
        return;
    }
    KieContainerResource container = kieContainers.get(0);
    String containerId = container.getContainerId();
    ServiceResponse<Void> responseDispose = kieServicesClient.disposeContainer(containerId);
    if (responseDispose.getType() == ResponseType.FAILURE) {
        System.out.println("Error disposing " + containerId + ". Message: ");
        System.out.println(responseDispose.getMsg());
        return;
    }
    System.out.println("Success Disposing container " + containerId);
    System.out.println("Trying to recreate the container...");
    ServiceResponse<KieContainerResource> createResponse = kieServicesClient.createContainer(containerId, containe
    if(createResponse.getType() == ResponseType.FAILURE) {
        System.out.println("Error creating " + containerId + ". Message: ");
        System.out.println(responseDispose.getMsg());
        return;
    }
     System.out.println("Container recreated with success!");
}
```

5.9.7. Available Clients for the Decision Server

The KieServicesClient is also the entry point for others clients to perform specific operations, such as send BRMS commands and manage processes. Currently from the KieServicesClient you can have access to the following services available in `org.kie.server.client` package:

- JobServicesClient: This client allows you to schedule, cancel, requeue and get job requests;
- ProcessServicesClient: Allows you to start, signal abort process; complete and abort work items among other capabilities;
- QueryServicesClient: The powerful query client allows you to query process, process nodes and process variables;
- RuleServicesClient: The simple, but powerful rules client can be used to send commands to the server to perform rules related operations(insert objects in the working memory, fire rules, get globals...);

- UserTaskServicesClient: Finally, the user tasks clients allows you to perform all operations with an user tasks(start, claim, cancel, etc) and query tasks by certain fields(process instances id, user, etc).

For further information about these interfaces check github: https://github.com/droolsjbpm/drool-sjbpm-integration/tree/master/kie-server-parent/kie-server-remote/kie-server-client/src/main/java/org/kie/server/client

You can have access to any of these clients using the method `getServicesClient` in the KieServicesClient class. For example: `RuleServicesClient rulesClient = kieServicesClient.getServicesClient(RuleServicesClient.class);`

5.9.8. Sending commands to the server

To build commands to the server you must use the class org.kie.api.command.KieCommands, that can be created using `org.kie.api.KieServices.get().getCommands()`. The command to be send must be a **BatchExecutionCommand** or a single command(if a single command is sent, the server wraps it into a BatchExecutionCommand):

Example 5.45. Sending commands to a container

```
public void executeCommands() {
    System.out.println("== Sending commands to the server ==");
    RuleServicesClient rulesClient = kieServicesClient.getServicesClient(RuleServicesClient.class);
    KieCommands commandsFactory = KieServices.Factory.get().getCommands();
    Command<?> insert = commandsFactory.newInsert("Some String OBJ");
    Command<?> fireAllRules = commandsFactory.newFireAllRules();
    Command<?> batchCommand = commandsFactory.newBatchExecution(Arrays.asList(insert, fireAllRules));
    ServiceResponse<String> executeResponse = rulesClient.executeCommands("hello", batchCommand);
    if(executeResponse.getType() == ResponseType.SUCCESS) {
        System.out.println("Commands executed with success! Response: ");
        System.out.println(executeResponse.getResult());
    }
    else {
        System.out.println("Error executing rules. Message: ");
        System.out.println(executeResponse.getMsg());
    }
}
```

The result in this case is a String with the command execution result. In our case it will print the following:

```
    == Sending commands to the server ==      Commands executed with success! Response:
  {        "results" : [ ],        "facts" : [ ]      }
==      Commands executed with success! Response:

{        "results" : [
],        "facts" : [
]
```

** You must add **org.drools:drools-compiler** dependency to have this part working*

5.9.9. Listing available business processes

To list process definitions we use the QueryClient. The methods of the QueryClient usually uses pagination, which means that besides the query you are making, you must also provide the current page and the number of results per page. In the code below the query for process definitions from the given container starts on page 0 and list 1000 results, in another words, the 1000 first results.

Example 5.46. Listing Business Processes Definitions Example

```
public void listProcesses() {
    System.out.println("== Listing Business Processes ==");
    QueryServicesClient queryClient = kieServicesClient.getServicesClient(QueryServicesClient.class);
    List<ProcessDefinition> findProcessesByContainerId = queryClient.findProcessesByContainerId("rewards", 0, 1000
    for (ProcessDefinition def : findProcessesByContainerId) {
        System.out.println(def.getName() + " - " + def.getId() + " v" + def.getVersion());
    }
}
```