Eclipse Scout Beginners Guide

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Table of Contents

Preface

The goal of this book is to get you familiar with the Scout framework in a short time. Scout's core features and concepts are introduced and explained by writing actual Scout applications. As Scout applications are written in Java, we make the assumption that you are familiar with the Java language and its core concepts.

We hope that this book helps you to get started quickly and would love to get your feedback. This feedback is very valuable to us as it helps to improve both the book's content and the quality for all future readers.

To allow for contributions to this book, the technical setup and the book's licence have been selected to minimize restrictions. According to the terms of the Creative Commons (CC-BY) license, you are allowed to freely use, share and adapt this book. All source files of the book including the Scout projects described in the book are available on Github.

Chapter 1. Introduction

Scout is an open source framework for implementing business applications. The framework is based on Java and HTML5 and covers most recurring aspects of enterprise applications.

Scout defines an abstract application model that makes developing applications faster and helps to decouple the business code as much as possible from any specific technologies. This is particularly useful as the life span of today's web technologies is substantially shorter then the life span of large enterprise applications.

Scout comes with multi-device support. With a single code base Scout applications run on desktop, tablet and mobile devices. The framework automatically adapts the rendering of the application to the form factor of the used device. An example of a commercial application built with Scout is provided in Figure 1.

Figure 1. A commercial enterprise application built with Eclipse Scout.

Scout supports a modularization of applications into layers and slices. This helps to define a clean architecture for large applications. The layering is driven by the fact the Scout applications have a rendering part, a frontend part and a backend part. The modularization into slices is controlled by different business needs such as front office, back office, reporting or the administration of application users, roles and permissions.

The goals of the Scout framework can be summarized as follows.

- Boost developer productivity
- Make the framework simple to learn
- Support building large applications with long life spans

Boosting developer productivity is of a very high importance and developers should be able to focus on the business value of the application. This is why Scout provides abstractions for areas/topics that are needed in most business applications again and again. Example areas/topics that are abstracted by the Scout framework are user interface (UI) technologies, databases, client-

server communication or logging. For each of these abstractions Scout provides a default implementation out of the box. Typically, the default implementation of such an abstraction integrates a framework or technology that is commonly used.

Learning a new framework should be efficient and enjoyable. For developers that have a good understanding of the Java language learning the Scout framework will be straight forward. The required skill level roughly corresponds to the Oracle Certified Professional Java SE Programmer for Java version 11 or higher. As the Scout framework takes care of the transformation of the user interface from Java to HTML5, Scout developers only needs a minimal understanding of HTML5/CSS3/JavaScript. In the case of writing project specific UI components a deeper understanding of today's web technologies might be required of course.

When needing a working prototype application by the end of the week, the developer just needs to care about the desired functionality. The necessary default implementations are then automatically included by the Scout tooling into the Scout project setup. The provided Scout SDK tooling also helps to get started quickly with Scout. It also allows to efficiently implement application components such as user interface components, server services or connections to databases.

In the case of applications with long life spans, the abstractions provided by Scout help the developer to concentrate on the actual business functionality. As all the implemented business functionality is written against abstractions only, no big rewrite of the application is necessary when individual technologies reach their end of life. In such cases it is sufficient to exchange the implementation of the adaptor for the legacy technology with a new one.

Chapter 2. “Hello World” Tutorial

The “Hello World” chapter walks you through the creation of an Eclipse Scout client server application. When the user starts the client part of this application, the client connects to the server. [1: The Scout server part of the “Hello World” application will be running on a web server.] and asks for some text content that is to be displayed to the user. Next, the server retrieves the desired information and sends it back to the client. The client then copies the content obtained from the server into a text field widget. Finally, the client displays the message obtained from the server in a text field widget.

The goal of this chapter is to provide a first impression of working with the Scout framework using the Scout SDK. We will start by building the application from scratch and then we’ll deploy the complete application to a Tomcat web server.

2.1. Installation and Setup

Before you can start with the “Hello World” example you need to have a complete and working Scout installation. For this, see the step-by-step installation guide provided in Appendix B. Once you have everything installed, you are ready to create your first Scout project.

2.2. Create a new Project

Start your Eclipse IDE and select an empty directory for your workspace as shown in Figure 2. This workspace directory will then hold all the project code for the `Hello World` application. Once the Eclipse IDE is running it will show the Java perspective.

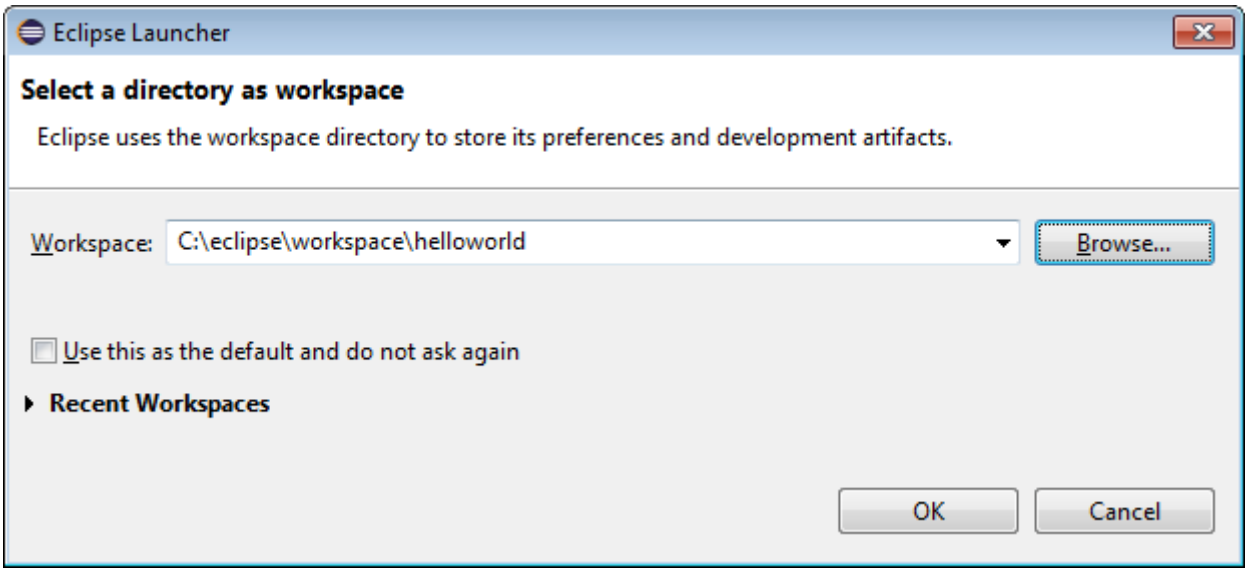


Figure 2. Select a new empty folder to hold your project workspace

To create a new Scout project select the menu **File › New › Project...** and type “Scout Project” in the wizard search field. Select the Scout Project wizard and press **[Next]**. The *New Scout Project* wizard is then started as shown in Figure 3.

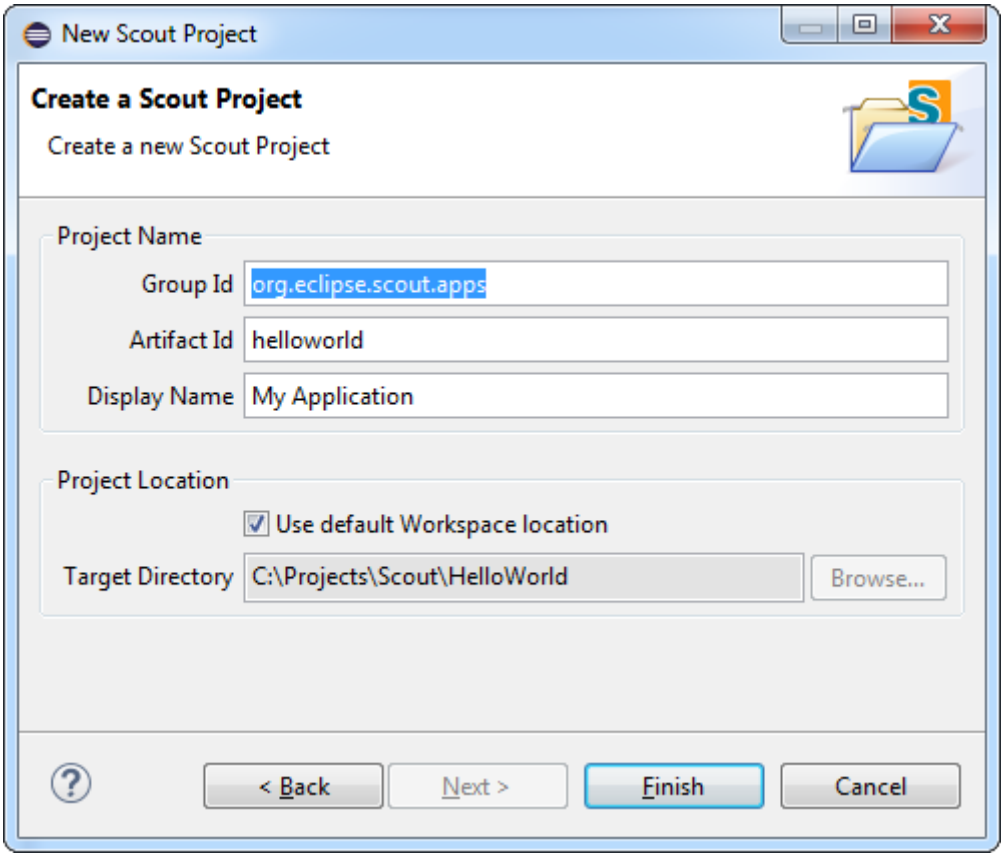


Figure 3. The new Scout project wizard.

In the *New Scout Project* wizard you have to enter a `group id`, `artifact id` and a `display name` for your Scout project. As the created project will make use of Apache Maven please refer to the Maven naming conventions to choose `group id` and `artifact id` for your project. The `artifact id` will then also be the project name in the Eclipse workspace. The `display name` is used as the application name presented to the user (e.g. in the Browser title bar).

For the `Hello World` application just use the already prefilled values as sown in Figure 3. Then, click the **[Finish]** button to let the Scout SDK create the initial project code for you.

Depending on your Eclipse installation some `Maven plugin connectors` may be missing initially. In that case a dialog as shown in Figure 4 may be shown. To continue click on **[Finish]** to resolve the selected connectors. Afterwards confirm the installation, accept the license and the message that some content has not been signed. Finally, the installation of the maven plugin connectors requires a restart of the Eclipse IDE.

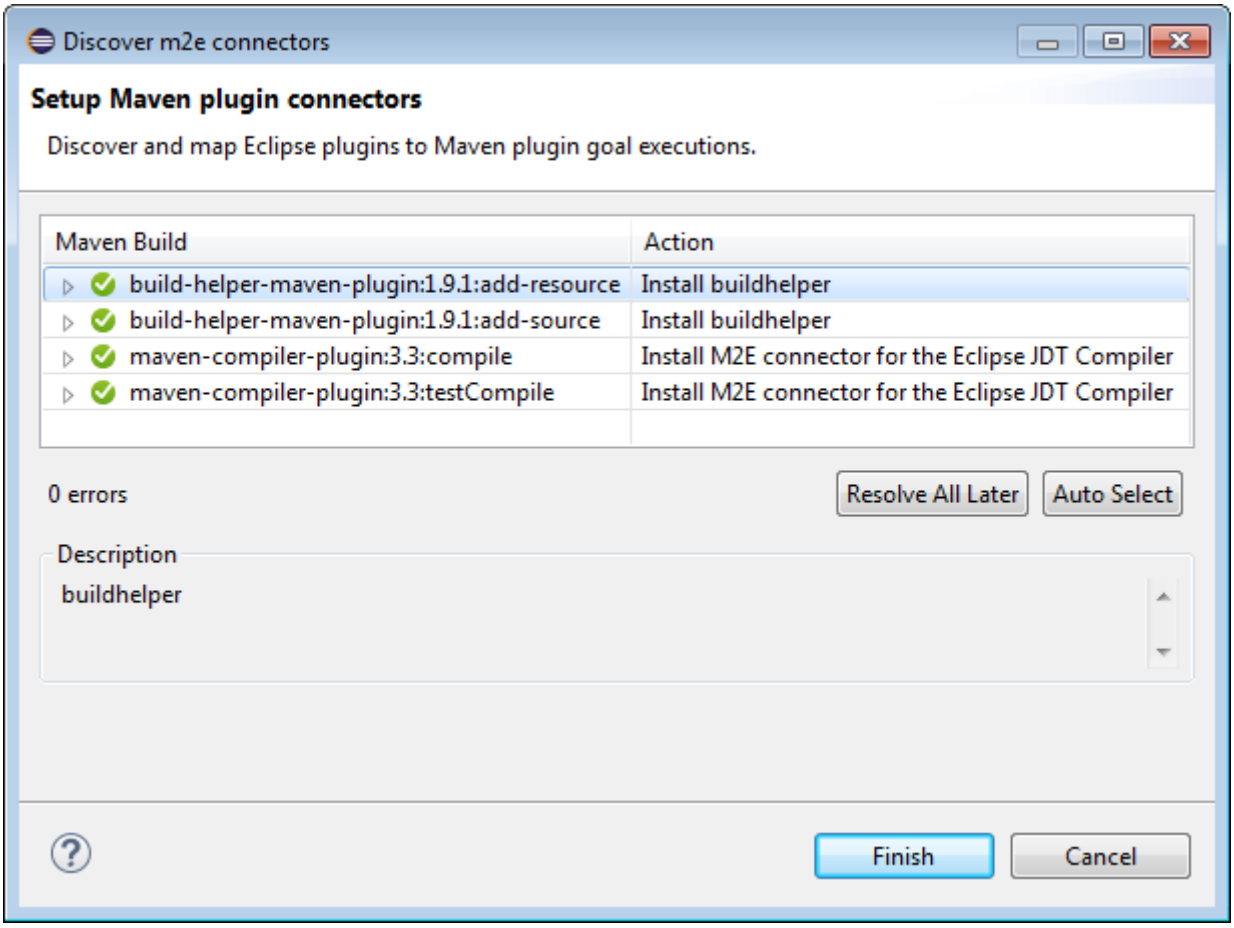


Figure 4. The Maven plugin connector installation dialog.

After the *New Scout Project* wizard has created the initial Maven modules for the `Hello World` application these modules are compiled and built by the Eclipse IDE. In case of a successful Eclipse Scout installation your Eclipse IDE should display all created Maven modules in the Package Explorer and have an empty Problems view as shown in Figure 5.

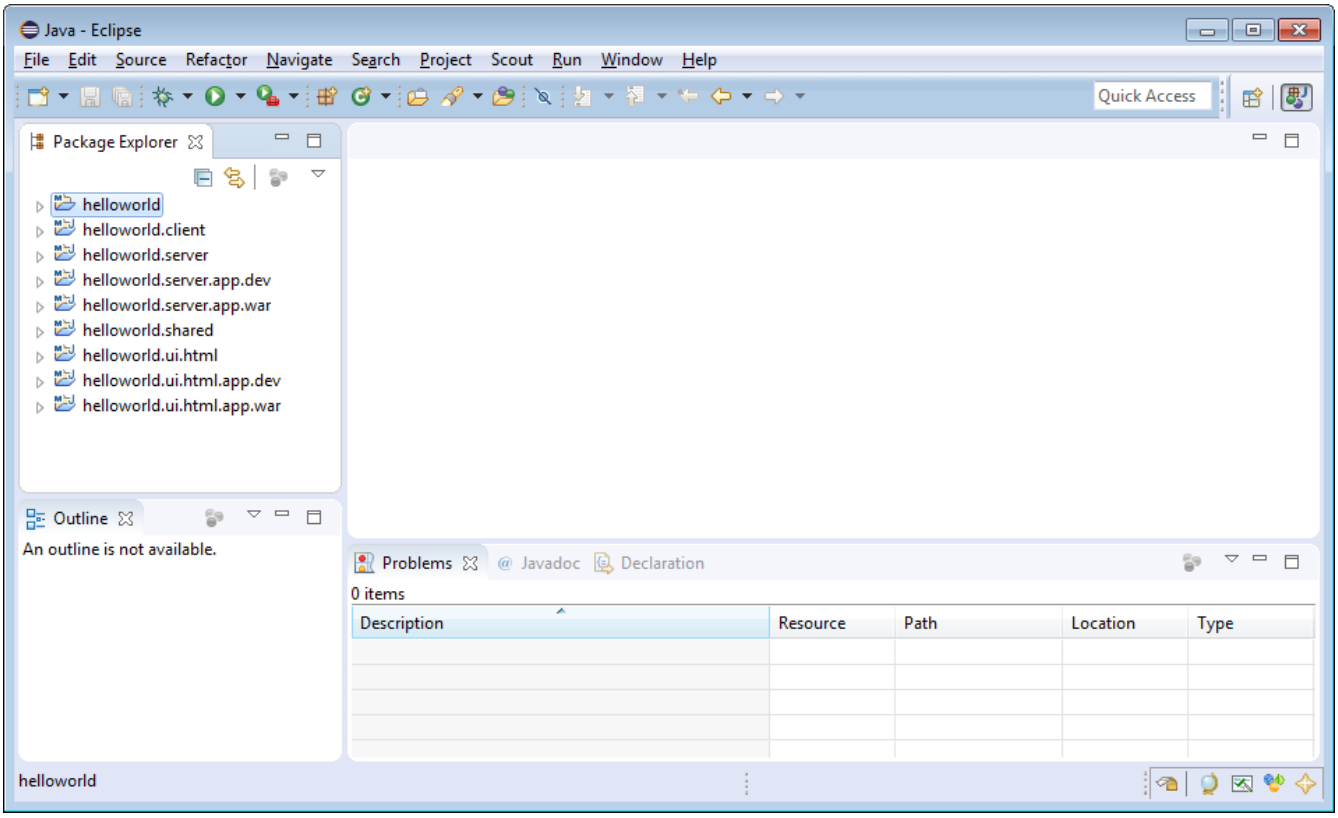


Figure 5. The inital set of Maven modules created for the Hello World application.

2.3. Run the Initial Application

After the initial project creation step we can start the Scout application for the first time. For this, the following three steps are necessary

1. Start the Scout backend server
2. Start the Scout frontend server
3. Open the application in the browser

To start the Scout backend server we first select the `[webapp] dev server.launch` file in the Package Explorer view of the Eclipse IDE and then use the *Run As* menu as shown in Figure 6.

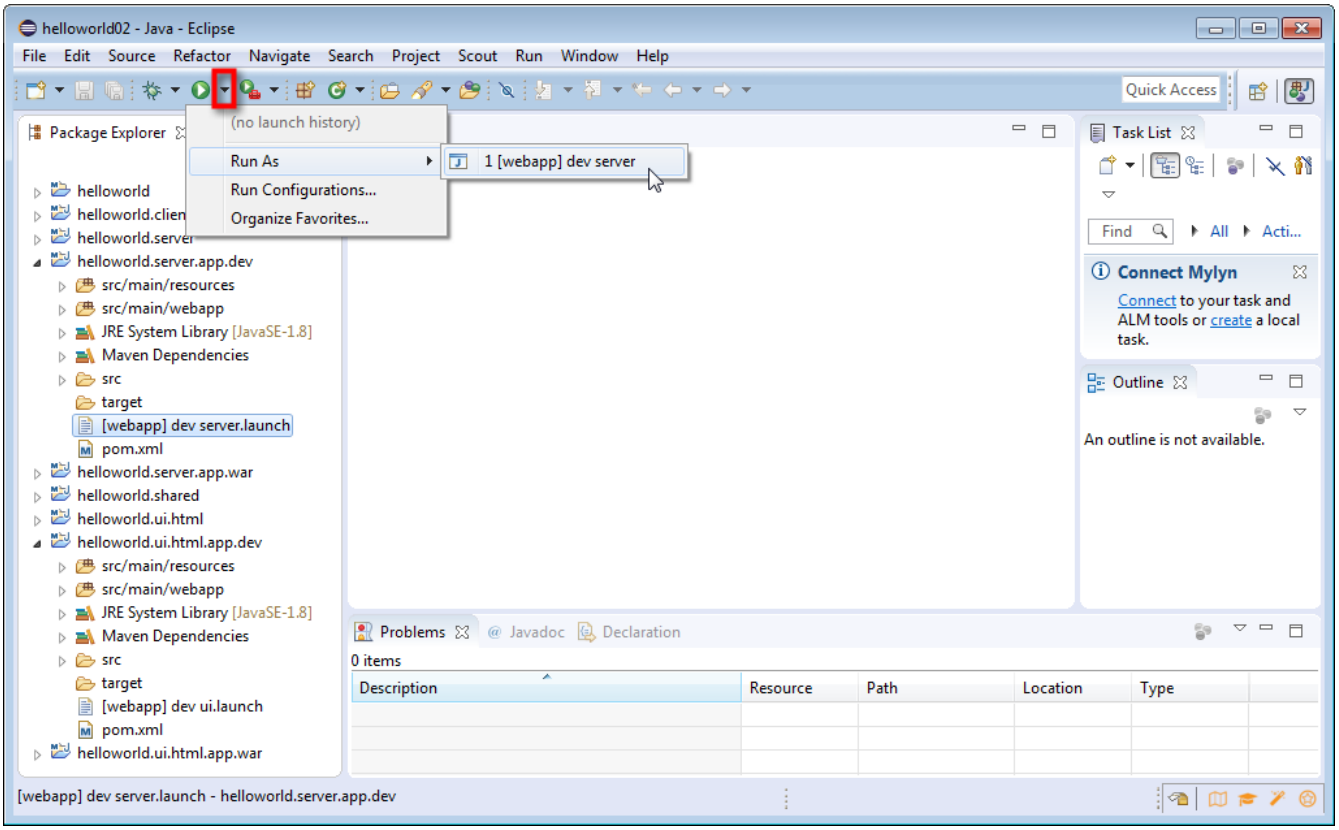


Figure 6. Starting the Hello World application.

Starting the Scout frontend server works exactly the same. But first select the `[webapp] dev ui.launch` file in the Eclipse IDE. This launch file is located under module `helloworld.ui.html.app.dev` in the Package Explorer.

During startup of the Scout applications you should see console output providing information about the startup. After having successfully started the Scout backend and frontend servers the Hello World application can then be accessed by navigating to http://localhost:8082/ in your favorite web browser.

The running Hello World application should then be started in your browser as shown in Figure 7.

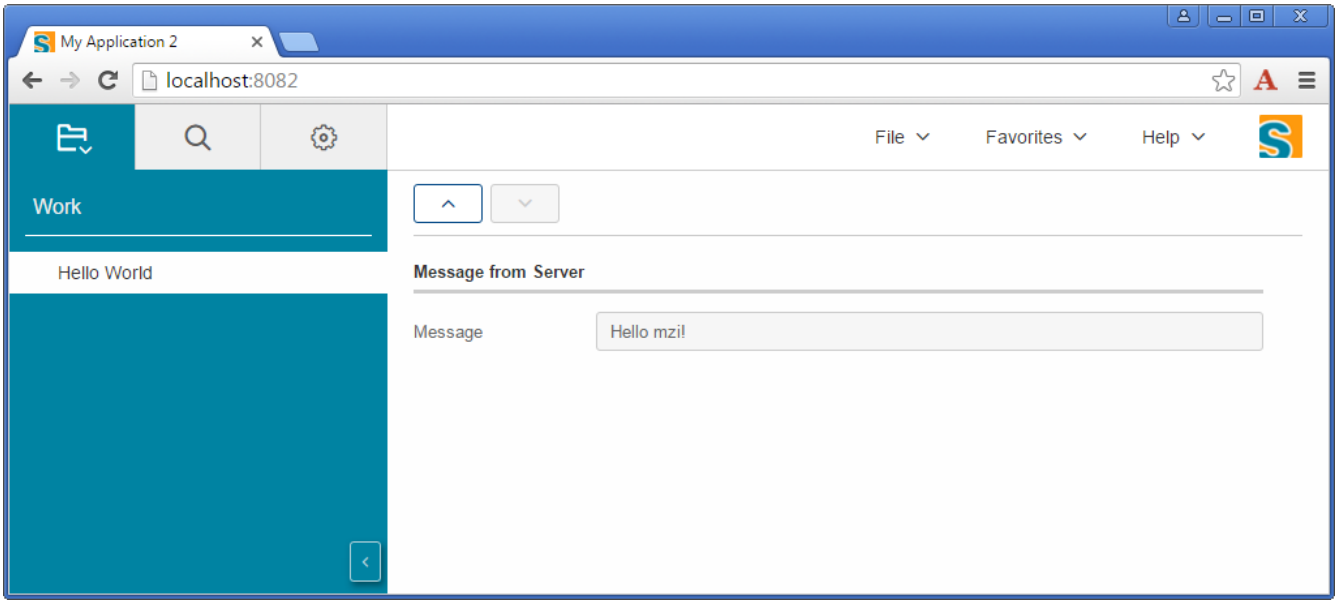


Figure 7. The Hello World application in the browser.

2.4. Export the Application

At some point during the application development you will want to install your software on a machine that is intended for productive use. This is the moment where you need to be able to build and package your Scout application in a way that can be deployed to an application server.

As Scout applications just need a servlet container to run, Scout applications can be deployed to almost any Java application server. For the purpose of this tutorial we will use Apache Tomcat.

2.4.1. Verify the Container Security Settings

First you need to decide if the users of your application should communicate via HTTPS with the Scout frontend server. We strongly recommended this setup for any productive environment. This is why even the Scout “Hello World” example is configured to use HTTPS.

As a default Tomcat installation is configured to use HTTP only, we need to first verify if the installtion is properly configured for HTTPS too. In case HTTPS support is already enabled for your Tomcat installation, you may skip this section.

Otherwise, check out the configuration process described in the Tomcat Documentation to enable SSL/TLS.

2.4.2. Create and Install a Self-Signed Certificate

This section describes the creation and usage of a self-signed certificat in a localhost setting.

1. Create a keystore file with a self-signed certificate
2. Uncomment/adapt the HTTPS connector port in Tomcat’s server.xml configuration
3. Export the self-signed certificate from the keystore
4. Import the self-signed certificate into the Java certificate store

The first step is to create a self-signed certificate using the keytool provided with the Java runtime. The example command line below will create such a certificate using the alias `tomcat_localhost` and place it into the keystore file `tomcat_localhost.jks`

```
keytool.exe -genkey -keyalg RSA -dname CN=localhost -alias tomcat_localhost -keystore
tomcat_localhost.jks -keypass changeit -storepass changeit
```

The second step is to uncomment the HTTPS connector element in the Tomcat’s `server.xml` configuration file. Make sure that parameter `keystoreFile` points to your newly created keystore file (if you are using a windows box, make sure not to use the backslash characters in the path to the keystore). After a restart of Tomcat you should then be able to access Tomcat on https://localhost:8443/manager/html

```
    <Connector port="8443" protocol="org.apache.coyote.http11.Http11NioProtocol"
               maxThreads="150" SSLEnabled="true" scheme="https" secure="true">
        <SSLHostConfig>
            <Certificate certificateKeystoreFile="/keystore/tomcat_localhost.jks"
                         type="RSA" />
        </SSLHostConfig>
    </Connector>
```

The third step is to export the newly created self-signed certificate from the `tomcat_localhost.jks` keystore file into the `tomcat_localhost.der` certificate file.

```
keytool.exe -exportcert -alias tomcat_localhost -storepass changeit -keystore
tomcat_localhost.jks -file tomcat_localhost.der
```

In the fourth and last step we add the self-signed certificate to the known certificates of the Java runtime. Make sure that you modify the `cacerts` file of the Java runtime that is used in your Tomcat installation and modify the path to the `cacerts` file accordingly.

```
keytool.exe -import -alias tomcat_localhost -trustcacerts -storepass changeit
-keystore C:\java\jre8\lib\security\cacerts -file tomcat_localhost.der
```

Your Scout application should now properly communicate over HTTPS in your Tomcat installation and after having installed the "Hello World" application to Tomcat it should become available on https://localhost:8443/org.eclipse.scout.apps.helloworld.ui.html/.

In case the Scout frontend server cannot access the Scout backend server your self-signed certificate might be missing in the Java installation. To verify that the certificate has been included in file `cacerts` file use the following command.

```
keytool.exe -list -storepass changeit -keystore C:\java\jre8\lib\security\cacerts |
find "localhost"
```

Once you no longer need the self-signed certificate file in your Java installation make sure to remove the certificate again.

```
keytool.exe -delete -alias tomcat_localhost -storepass changeit -keystore
C:\java\jre8\lib\security\cacerts
```

2.4.3. Update the Scout Application to work with HTTP

If you should prefer to work with HTTP only, you need to modify the security settings of your Scout application. This can be done with the steps described below.

- In file `config.properties` (in folder `helloworld.ui.html.app.war/src/main/resources`):

    - Add the property `scout.auth.cookieSessionValidateSecure=false` to disable the check for an encrypted channel (HTTPS).
    - Change the `scout.backendUrl` property to use HTTP instead of HTTPS and change the port according to your Tomcat setup, typically 8080.
- In file `web.xml` (in folder `helloworld.ui.html.app.war/src/main/webapp/WEB-INF`) delete the `<secure>true</secure>` flag in the `<cookie-config>` element.
- In file `web.xml` (in folder `helloworld.server.app.war/src/main/webapp/WEB-INF`) delete the `<secure>true</secure>` flag in the `<cookie-config>` element.

More on this topic can be found in the Scout Architecture Documentation.

2.4.4. Create WAR Files

We are now ready to move the `Hello World` application from our development environment to a productive setup. The simplest option to move our application into the 'wild' is to build it using Maven. This produces two WAR files [2: Web application ARchive (WAR): http://en.wikipedia.org/wiki/WAR_file_format_%28Sun%29].

The first WAR file contains the Scout backend server with all business logic. The second WAR file contains the Scout frontend server that is responsible for communicating with the web browser part of the Scout application.

To start the build right click on the project `helloworld` and select the context menu **Run As → Maven build... ›] as shown in <<img-sdk_export_war › › . In the dialog that appears enter `clean verify` into the `Goals` field and press [Run** .

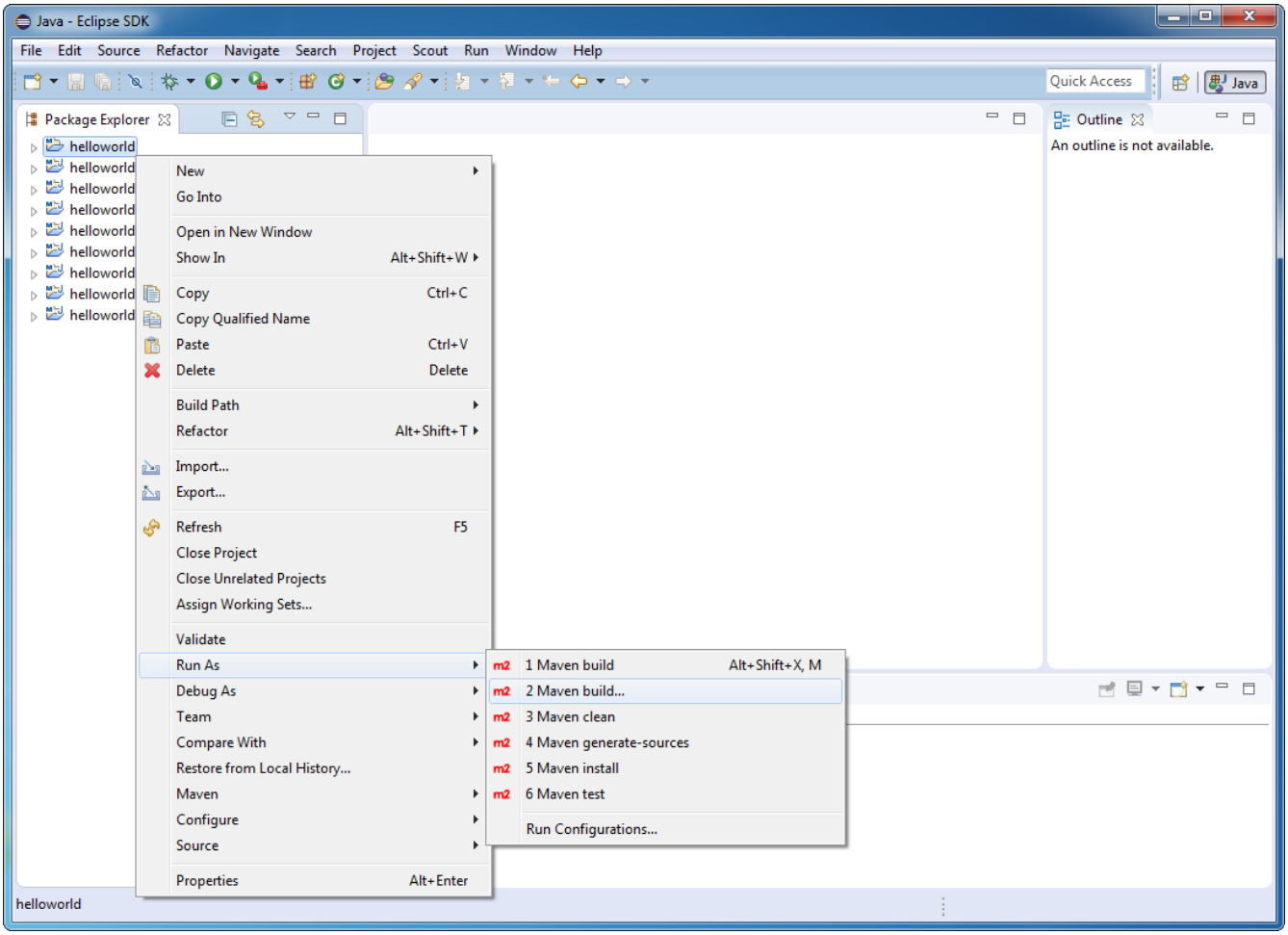


Figure 8. Starting the Maven build.

Afterwards the compilation starts, executes all test cases and bundles the result into two WAR files. The output of the build is shown in the Console view within Eclipse. As soon as the build is reporting success you can find the built WAR files:

- The Scout backend WAR file `org.eclipse.scout.apps.helloworld.server.war` in folder `workspace_root/helloworld.server.app.war/target`
- The Scout frontend WAR file `org.eclipse.scout.apps.helloworld.ui.html.war` in folder `workspace_root/helloworld.ui.html.app.war/target`

To see the new files within Eclipse you may need to refresh the `target` folder below each project using the F5 keystroke.

2.5. Deploy to Tomcat

As the final step of this tutorial, we deploy the two WAR files representing our “Hello World” application to a Tomcat web server. For this, we first need a working Tomcat installation. If you do not yet have such an installation you may want to read and follow the instructions provided in Appendix C. To verify a running Tomcat instance, type http://localhost:8080/ into the address bar of the web browser of your choice. You should then see the page shown in Figure 9.

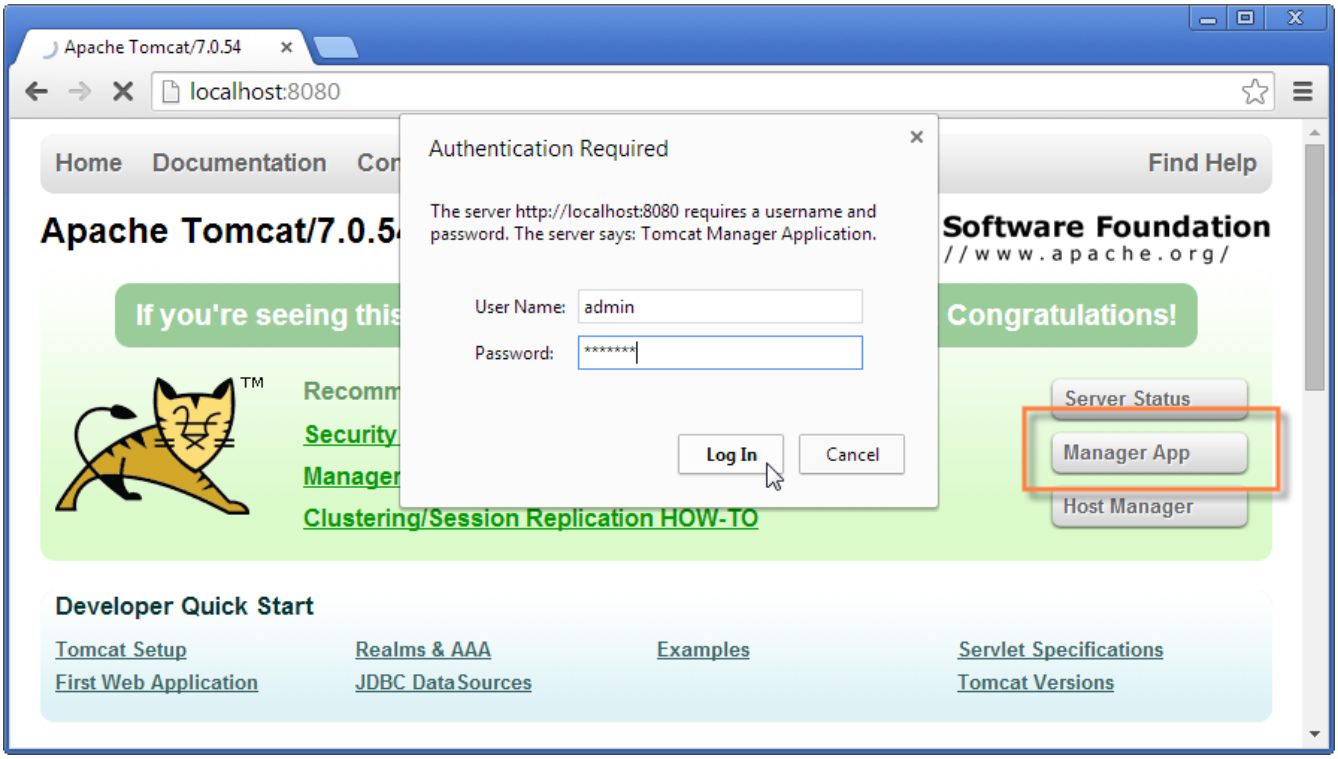


Figure 9. The Tomcat shown after a successful installation. After clicking on the "Manager App" button (highlighted in red) the login box is shown in front. A successful login shows the "Tomcat Web Application Manager".

Once the web browser displays the successful running of your Tomcat instance, switch to its "Manager App" by clicking on the button highlighted in Figure 9. After entering user name and password the browser will display the "Tomcat Web Application Manager" as shown in Figure 10. If you don't know the correct username or password you may look it up in the file tomcat-users.xml as described in Section C.2.

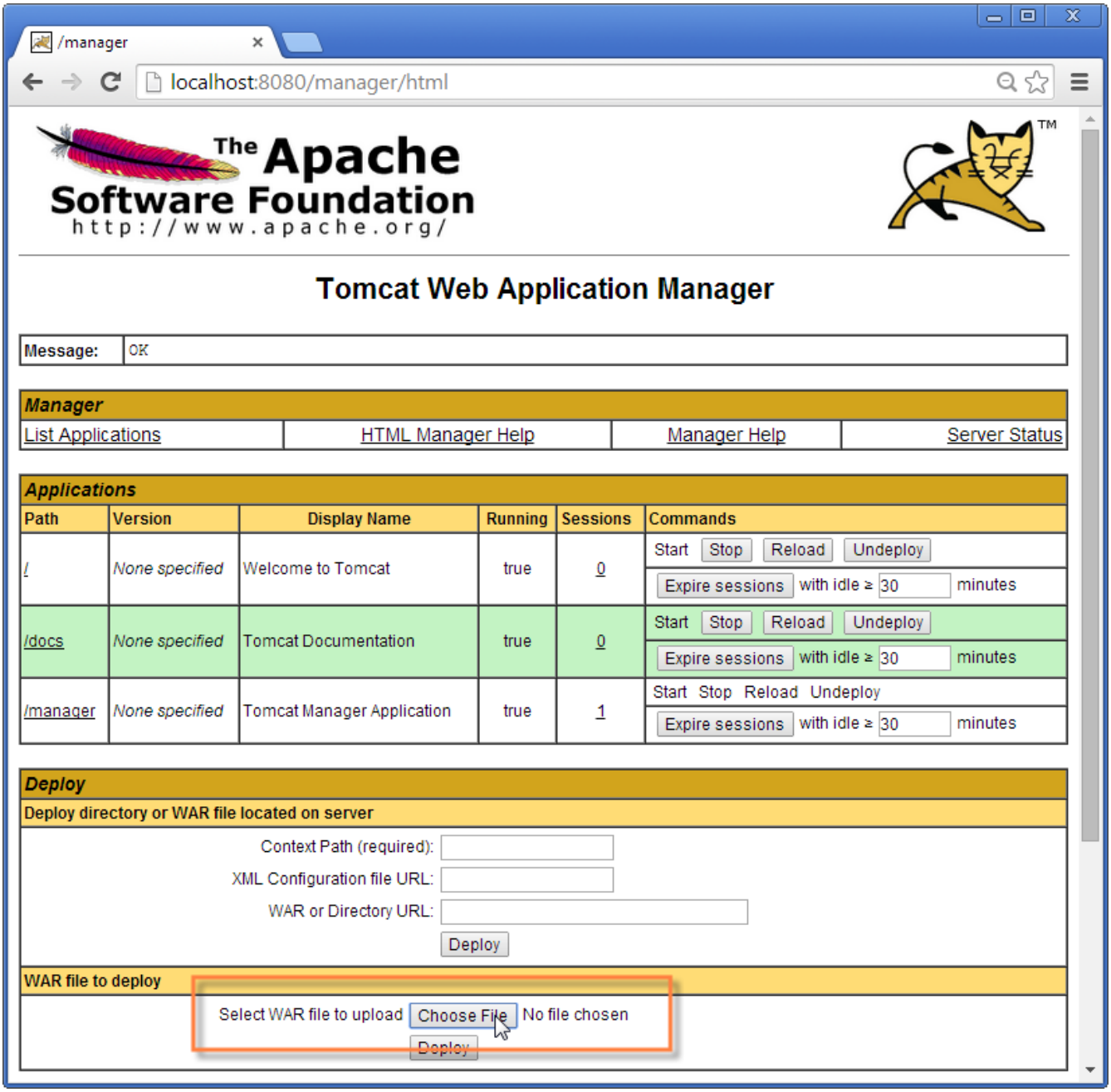


Figure 10. The "Tomcat Web Application Manager". The WAR files to be deployed can then be selected using button "Choose File" highlighted in red.

After logging into Tomcat's manager application, you can select the WAR files to be deployed using button "Choose File" according to the right hand side of Figure 10. After picking your just built org.eclipse.scout.apps.helloworld.server.war and closing the file chooser, click on button "Deploy" (located below button "Choose File") to deploy the application to the Tomcat web server. Then we repeat this step with the second WAR file org.eclipse.scout.apps.helloworld.ui.html.war.

This will copy the selected WAR files into Tomcats webapps directory and unpack its contents into subdirectories with the same name. You can now connect to the application using the browser of your choice and enter the following address:

```
http://localhost:8080/org.eclipse.scout.apps.helloworld.ui.html/
```

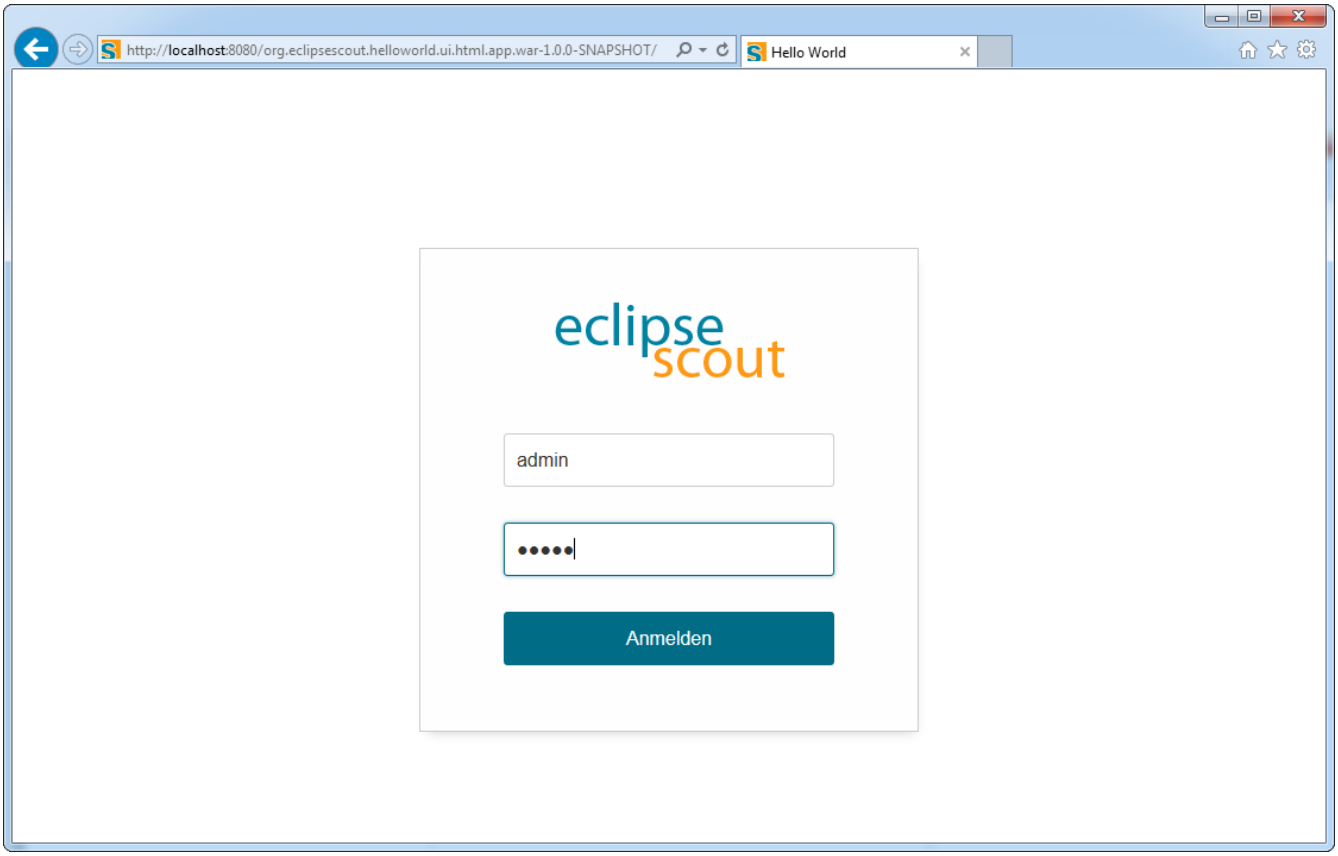


Figure 11. The “Hello World” login page.

Then you will see the login page as shown in Figure 11. Two users have been pre defined: “admin” with password “admin” and “scott” with password “tiger”. You can find this configuration in the config.properties file of the application.

Please note: In a productive environment it is recommended to deploy the server and the user interface into two different servlet containers running on dedicated machines. This is because these two tiers have different requirements on resources, load balancing and access protection. Furthermore, it is strongly recommended to use an encrypted connection (e.g. TLS 1.2 [3: TLS: https://en.wikipedia.org/wiki/Transport_Layer_Security]) between client browsers and the Scout frontend server AND between the Scout frontend and backend server!

Chapter 3. Scout Tooling

This chapter presents the Scout SDK tooling that is included with the Eclipse Scout. The Scout SDK provides wizards to create new project and application components, adds code assistance to the Java Editor and comes with a NLS editor to manage all translated text entries of the application.

The chapter is organized as follows. Section 3.1 describes the goals and benefits of the tooling included. Because the Scout Tooling is based on the Eclipse IDE, Section 3.2 provides a short overview of frequently used Eclipse features. A high level description of the Scout tooling is provided in Section 3.3. Section 3.4, Section 3.5 and Section 3.6 then provide detailed descriptions of the functionality offered by the Scout SDK.

3.1. Motivation for the Tooling

Thanks to this tooling, developing Scout applications is made simpler, more productive and also more robust. Initially, a solid understanding of the Java language is sufficient to start developing Scout applications and only a rough understanding of the underlying Maven/JEE technologies is required.

The Scout SDK also helps developers to become more productive. Many repetitive and error prone tasks run automatically in the background or are taken care of by the component wizards of the Scout SDK.

The application code created by the Scout SDK wizards helps to ensure that the resulting Scout application has a consistent and robust code base and is well aligned with the application model defined by the Scout runtime framework.

3.2. Eclipse IDE tooling

The Scout tooling is an extension of the Eclipse IDE. The goal of this section is not to provide a complete overview on the features contained in the Eclipse IDE. It provides a short overview of the important eclipse features, frequently used during the development of a Scout Application. Experienced Eclipse IDE users might skip this section.

3.2.1. Start the New Wizard

To start the **New Wizard** wizard press `Ctrl+N` or use menu **File › New › Other...**. In the first wizard step type the name of the object you want to create into the **Wizards** field as shown in Figure 12.

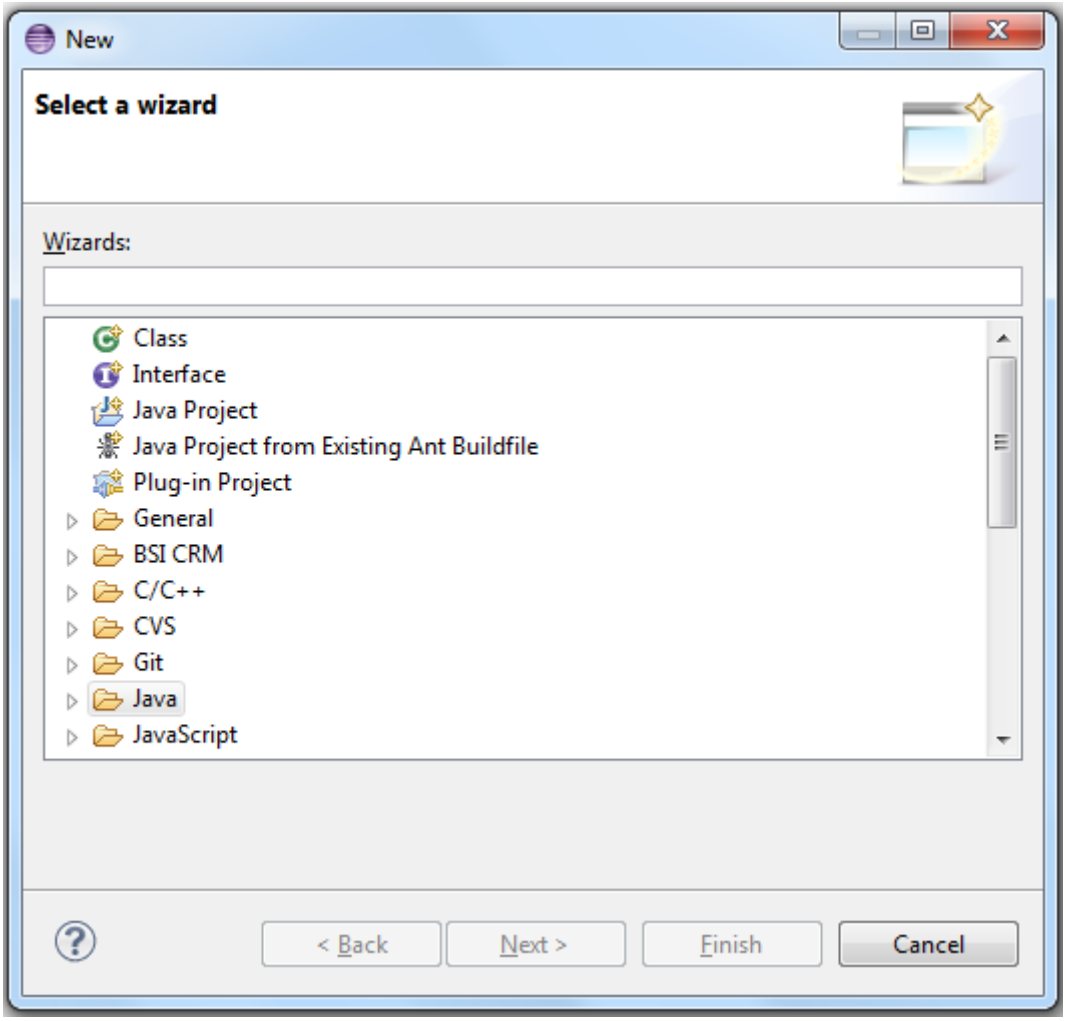


Figure 12. "New" Wizard

3.2.2. Create a new Java class

Start the **New Wizard** and type **Class** in the Wizards field. Select **Class** Click on **[Next]** to open the **New class wizard**

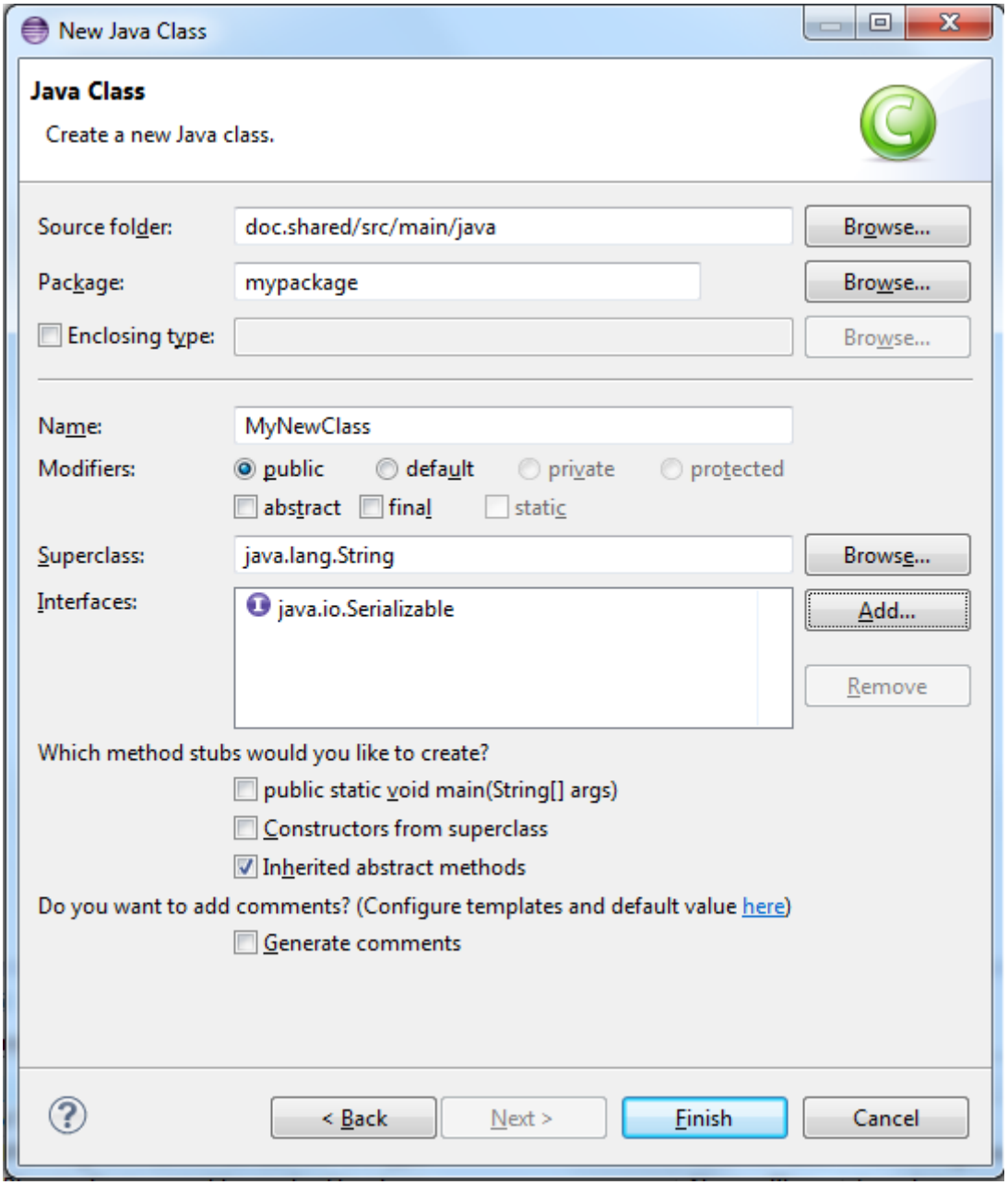


Figure 13. "New Java Class" Wizard

You can choose define the following properties:

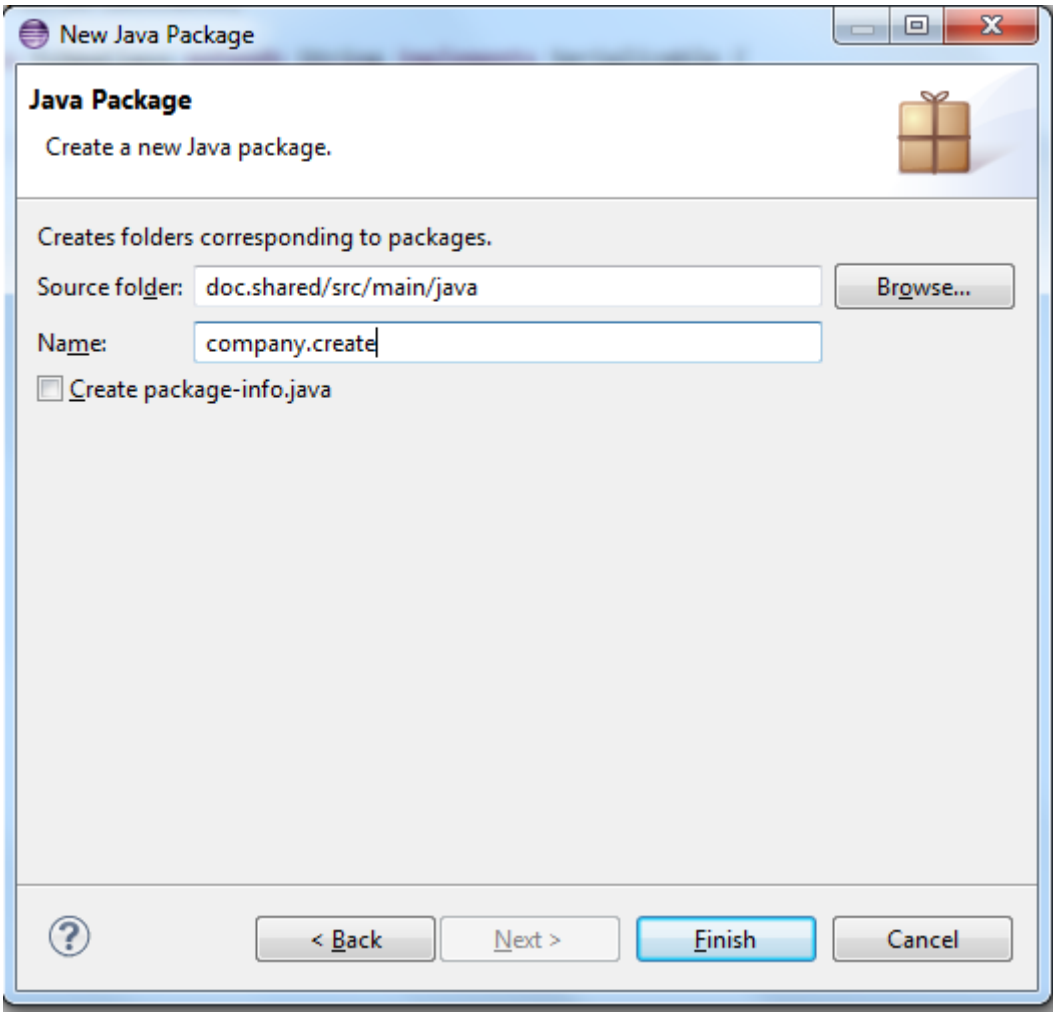
- **Source folder**: Click on **[Browse]** to choose the project where the class belongs.
- **Package**: Click on **[Browse]** to choose the package in the given project. If the package does not exist it will be created a new one automatically.
- **Name**: Type the class name
- **Modifiers**: Choose public or default. Or abstract and/or final.
- **Superclass**: Choose the parent class clicking on **[Browse]**
- **Interfaces**: Click on **[Add]** to add the list of interfaces your class implements.
- **Method stubs**: Include methods in your class.
- **Comments**: Generate predefine comments.

Click on **[Finish]** when you are done with the class definition. The java editor will open and you

can start editing.

3.2.3. Create a new Java package

Start the **New Wizard** and type **Package** in the Wizards field. Select **Package** Click on **[Next]** to open the **New package wizard**



In the **New package wizard** you can define the following properties:

- **Source folder**: Click on **[Browse]** to choose the project where the package belongs.
- **Name**: Write the name of the package.
- **Package info**: Choose the checkbox if you want package-info

Click on **[Next]** to create the project. The **Project Browser**

3.2.4. Organize Java imports

The *import* section of a java class needs to be kept up-to-date. New imports need to be added and no longer used ones should be removed. Eclipse offers a the shortcut `Ctrl+Shift+O` to accomplish this task.

In case an import cannot be resolved because several candidates exist, a selection list is displayed.

3.2.5. Rename a class

Renaming a class without SDK support is not so easy. The class and possibly the compilation unit need to be renamed. Then every reference to the class within the workspace needs to be updated.

All this work is accomplished by using the *Class rename Wizard*.

1. Open the Wizard using one of the following methods
   - `Alt`+`Shift`+`R`
   - **Context Menu › Refactor › Rename...**
   - Select the class in the tree and press `F2`
2. Choose the new name for the class
3. Specify which references need to be updated
4. Click **[Finish]** or **[Next]** to continue

Alternative Method

A class can be renamed by select the class name anywhere in code and pressing `Ctrl`+`1`. The option **[Rename in Workspace]** will rename the class without using a the wizard.

3.2.6. Rename a package

Renaming a package without SDK support would be a tedious undertaking. All classes in the package and its subpackages would have to be modified as well as the directory structure on disk. Then every reference to the package within the workspace needs to be updated.

All this work is accomplished by using the *Package rename Wizard*.

1. Open the Wizard using one of the following methods
   - `Alt`+`Shift`+`R`
   - **Context Menu › Refactor › Rename...**
   - Select the package in the tree and press `F2`
2. Choose the new name for the package
3. Specify which references need to be updated
4. Click **[OK]** or **[Prview]** to continue

3.3. Scout SDK Overview

The Scout SDK tooling helps the Scout developer to quickly create frequently used Scout components. This Scout Tooling is implemented as extensions of the Eclipse IDE in the form of wizards, content assist extension to the Eclipse Java editor and support for dealing with translated texts called NLS support.

Scout Wizards

The Scout SDK tooling includes a number of wizards for the creation of frequently used Scout components. In many cases the execution of such wizards involves the creation/editing of several source files. In the case of the creation of a new Scout form this includes the form class in the client module of the Scout application, a form data class and a service that communicates Descriptions for the individual wizards are provided in Section 3.4.

Content Assist

In the Scout framework the hierarchical organization of Scout components if frequently reflected in the form of inner classes. This allows the Scout tooling to provide context specific proposals in the form of content assist proposals offered in the Java editor of the Eclipse IDE. Examples for this form of the tooling includes the creation of form fields or adding columns and context menus to tables. Content assist support is described in detail in Section 3.5.

NLS Tooling

Eclipse Scout comes with NLS (National Language Support). To support Scout developers in using Scout's NLS (National Language Support) the Scout SDK offers corresponding tooling to work with translated texts. This tooling is described in Section 3.6.

3.4. Scout Wizards

The Scout SDK provides a set of wizards to create new Scout projects and various components for your Scout applications.

To start any of these wizards press `Ctrl`+`N` or use menu **File › New › Other...**. In the first wizard step type "*Scout*" into the **Wizards** field as shown in Figure 14.

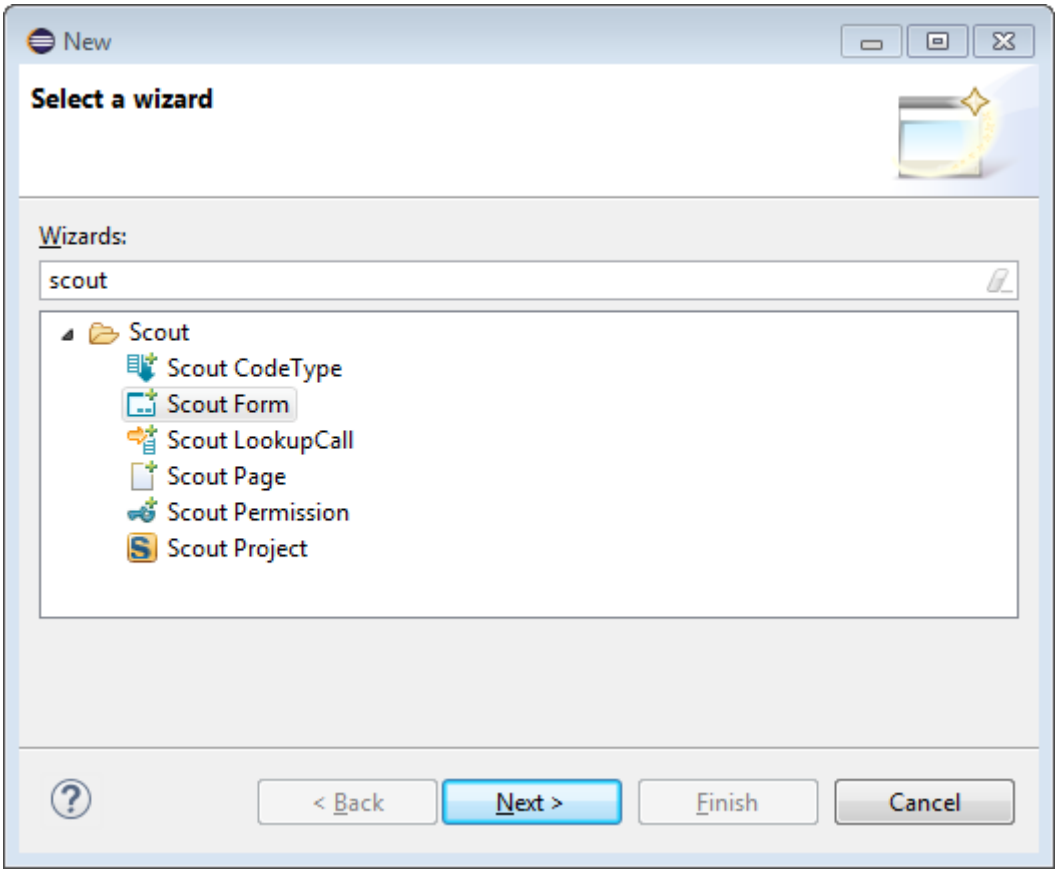


Figure 14. Selecting Scout Wizards in the Eclipse wizard dialog

The wizards provided by the Scout SDK are introduced and described in the sections listed below.

- New Project Wizard (Section 3.4.1)
- New Page Wizard (Section 3.4.2)
- New Form Wizard (Section 3.4.3)

3.4.1. New Project Wizard

The *New Scout Project* wizard can be used to create a new Scout project from scratch.

To open the wizard press `Ctrl`+`N` or use **File › New › Other...** and type "*Scout*" into the **Wizards** search field. Then, select the entry "*Scout Project*" and click on **[Next]**. This leads to the initial dialog of the *New Scout Project* wizard as shown in Figure 15.

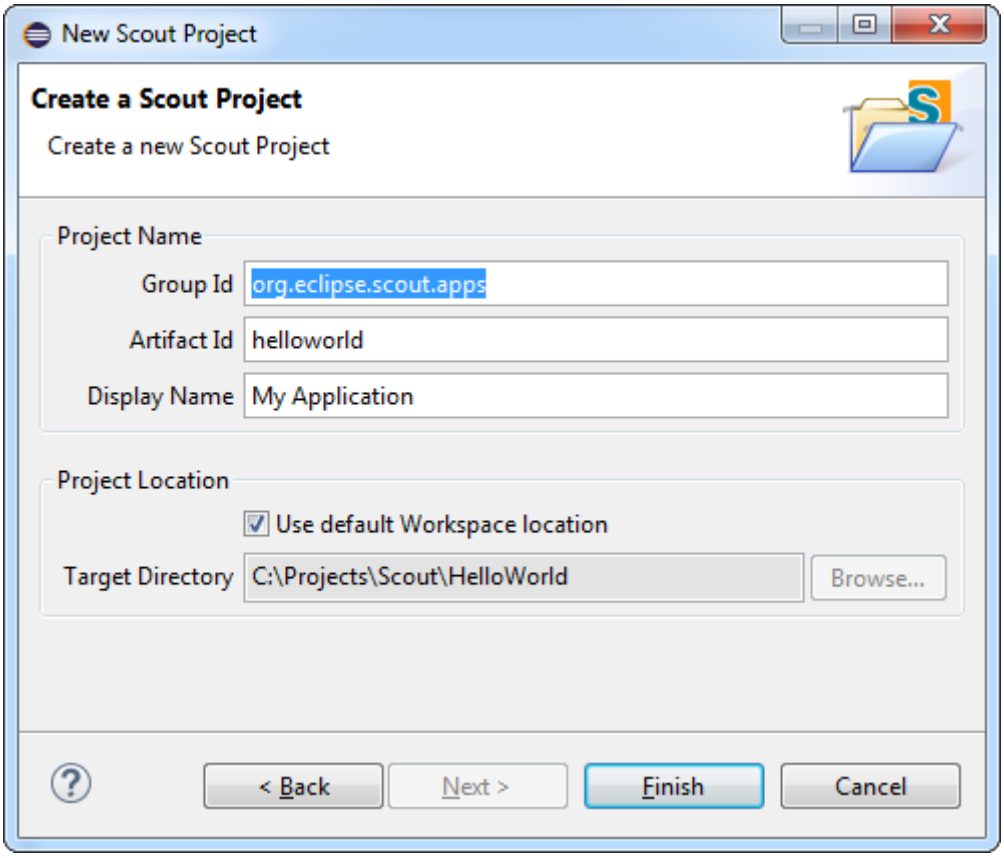


Figure 15. The new Project Wizard

A detailed description of the indiviudal wizard fields of Figure 15 is provided in the next section.

By clicking on the **[Finish]** button the wizard is started and a new Scout client server application is created in the form of a Maven multi-module project.

Wizard Fields and Default Values

All fields of the Figure 15 are initially filled with default values.

Group Id

Maven groupId used for all created projects. The default value is `org.eclipse.scout.apps`.

Artifact Id

Maven artifactId for the parent project. The additional projects are derived from this name. The default value is **helloworld**.

Display Name

The name of the application presented to the user. This name is shown in the Browser title bar. The default value is *"My Application"*

With the *Project Location* group box, you can control where the project will be created. Unchecked the *Use default Workspace location* checkbox to enter an other value in the *Target Directory* Field. The **[Browse...]** button can help you to find the appropriate path.

Created Components

With the Figure 15 wizard a complete Maven multi-module project is created. Using the default

artifact Id **helloworld** the following Maven modules are created.

- Maven module **helloworld**
  - Contains the project's parent `pom.xml` file
- Maven module **helloworld.client**
  - Contains model components of the client application in `src/main/java` and model tests in `src/test/java`.
  - The class `HelloWorldForm` in package `org.eclipse.scout.apps.helloworld.client.helloworld` is an example of a model class.
- Maven module **helloworld.shared**
  - Contains components needed in both the client and the server application.
  - For examples see the `IHelloWorldService` interface in `src/main/java` and class `HelloWorldFormData` in `src/generated/java`.
  - The `Texts.nls` file that can be opened in the Scout NLS Editor.
- Maven module **helloworld.server**
  - Contains the model components of the server application in `src/main/java` and model tests in `src/test/java`.
  - The class `HelloWorldService` in package `org.eclipse.scout.apps.helloworld.server.helloworld` is an example of such a model class.
- Maven module **helloworld.server.app.dev**
  - Contains all components to run the Scout server application from within the Eclipse IDE.
  - The file `config.properties` in folder `src/main/resources` contains the development configuration for the Scout server application.
  - The file `pom.xml` bundles the Jetty web server with the server application.
  - The file `[webapp] dev server.launch` contains the launch configuration for the Eclipse IDE.
- Maven module **helloworld.server.app.war**
  - Contains all components to create a Scout server WAR file to deploy to an external web server.
  - The file `config.properties` in folder `src/main/resources` contains the server configuration.
  - The file `pom.xml` is used to build the Scout server WAR file.
- Maven module **helloworld.ui.html**
  - Contains servlet filters and the HTML pages as well as custom CSS and JavaScript files for the Scout UI Server.
  - See class `UiServletFilter` in `src/main/java` and folder `WebContent` in `source/main/resources`.
- Maven module **helloworld.ui.html.app.dev**
  - Contains all components to run the Scout UI application from within the Eclipse IDE.
  - The file `config.properties` in folder `src/main/resources` contains the development configuration for the application.

- The file `web.xml` in folder `src/main/webapp` contains the web configuration for the application.
- The file `pom.xml` bundles the Jetty web server with the application.
- The file `[webapp] dev ui.launch` contains the launch configuration for the Eclipse IDE.

- Maven module **helloworld.ui.html.app.war**
  - Contains all components to create a Scout UI WAR file to deploy to an external web server.
  - The file `config.properties` in folder `src/main/resources` contains the application configuration.
  - The file `web.xml` in folder `src/main/webapp` contains the web configuration.
  - The file `pom.xml` is used to build the Scout UI WAR file.

3.4.2. New Page Wizard

The *New Scout Page* wizard can be used to create a new page and related classes. To start the wizard use **File › New › Other...** or press `Ctrl+N`.

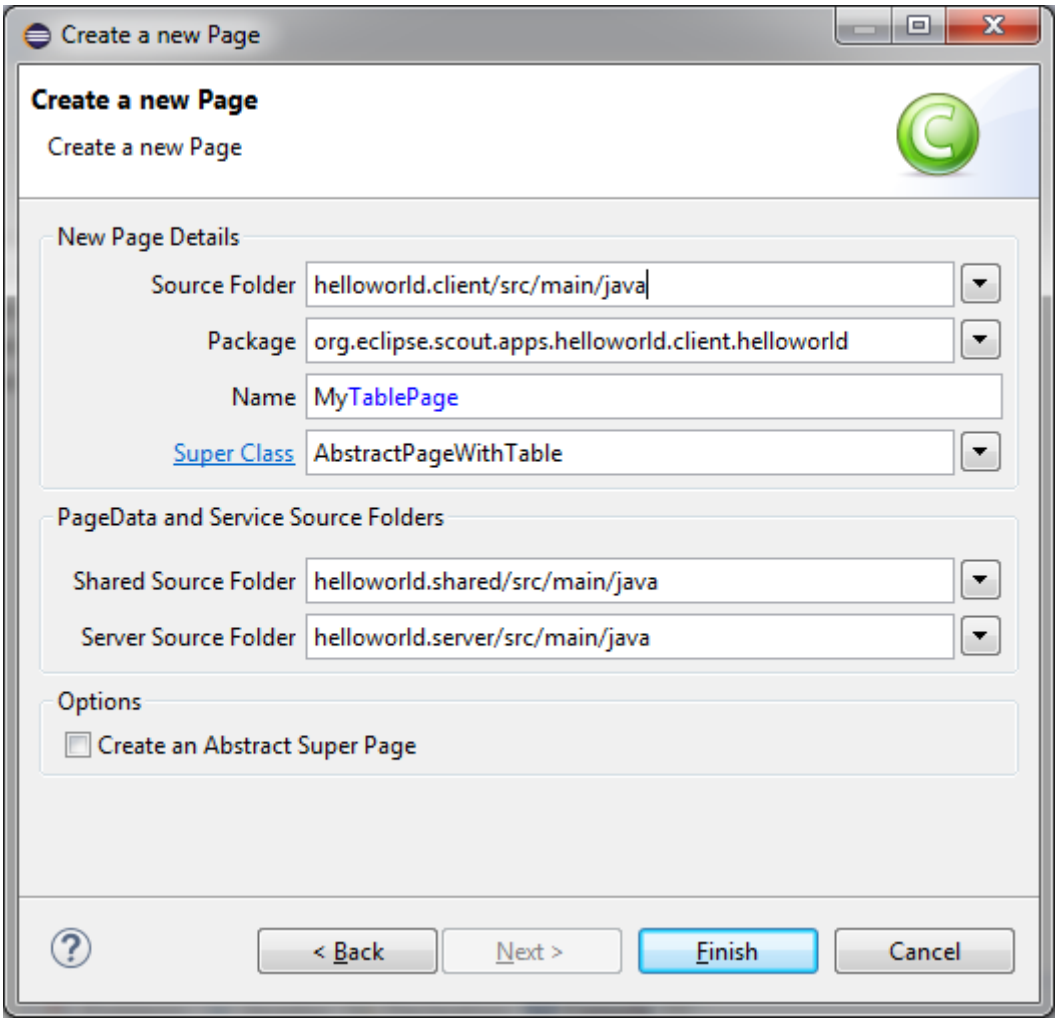


Figure 16. The new Page Wizard

In the case of Figure 16 the package `org.eclipse.scout.apps.helloworld.client.helloworld` has been selected in the Package Explorer. The only wizard field that then needs to be filled in manually is

the **Name** field.

By clicking on the **[Finish]** button the wizard is started and the specified components are created.

Wizard Fields and Default Values

Most of the fields of the Figure 16 will be filled with default values depending on the current context of the IDE. The context can be derived from a package selected in the Package Explorer or from the class in the active Java Editor.

Source Folder

The source folder of the Maven client module used for the creation of the page. The default value is the `src/main/java` folder in the Maven client module.

Package

The Java package that will contain the page class. The Scout SDK will try to guess the package name from the current context and derive matching package names for the Maven shared module.

Name

The name of the page class. According to Scout conventions the class name ends with the suffix `TablePage` (for subclasses of `AbstractPageWithTable`) or `NodePage` (for `AbstractPageWithNodes`).

Super Class

The super class for the form. `AbstractPageWithTable` is the default value.

Shared Source Folder

The source folder of the Maven shared module used for creation of the page data and the service interface. The default value is the `src/main/java` folder in the Maven shared module.

Server Source Folder

The source folder of the Maven server module used for creation of the service implementation. The default value is the `src/main/java` folder in the Maven server module.

Created Components

In the Figure 16 example shown above the Scout SDK will create the following components.

- In Maven module **helloworld.client**
  - The `MyTablePage` page class in folder `src/main/java` and package `org.eclipse.scout.apps.helloworld.client.helloworld`
- In Maven module **helloworld.shared**
  - The `IMyService` service interface in folder `src/main/java` and package `org.eclipse.scout.apps.helloworld.shared.helloworld`
  - `MyTablePageData` page data class in folder `src/generated/java` and package `org.eclipse.scout.apps.helloworld.shared.helloworld`
- In Maven module **helloworld.server**
  - The `MyService` implementation in folder `src/main/java` and package

`org.eclipse.scout.apps.helloworld.server.helloworld`

3.4.3. New Form Wizard

The *New Form* wizard is be used to create a new form including a form data, permissions and and related service. To start the wizard use **File › New › Other...** or press `Ctrl`+`N`.

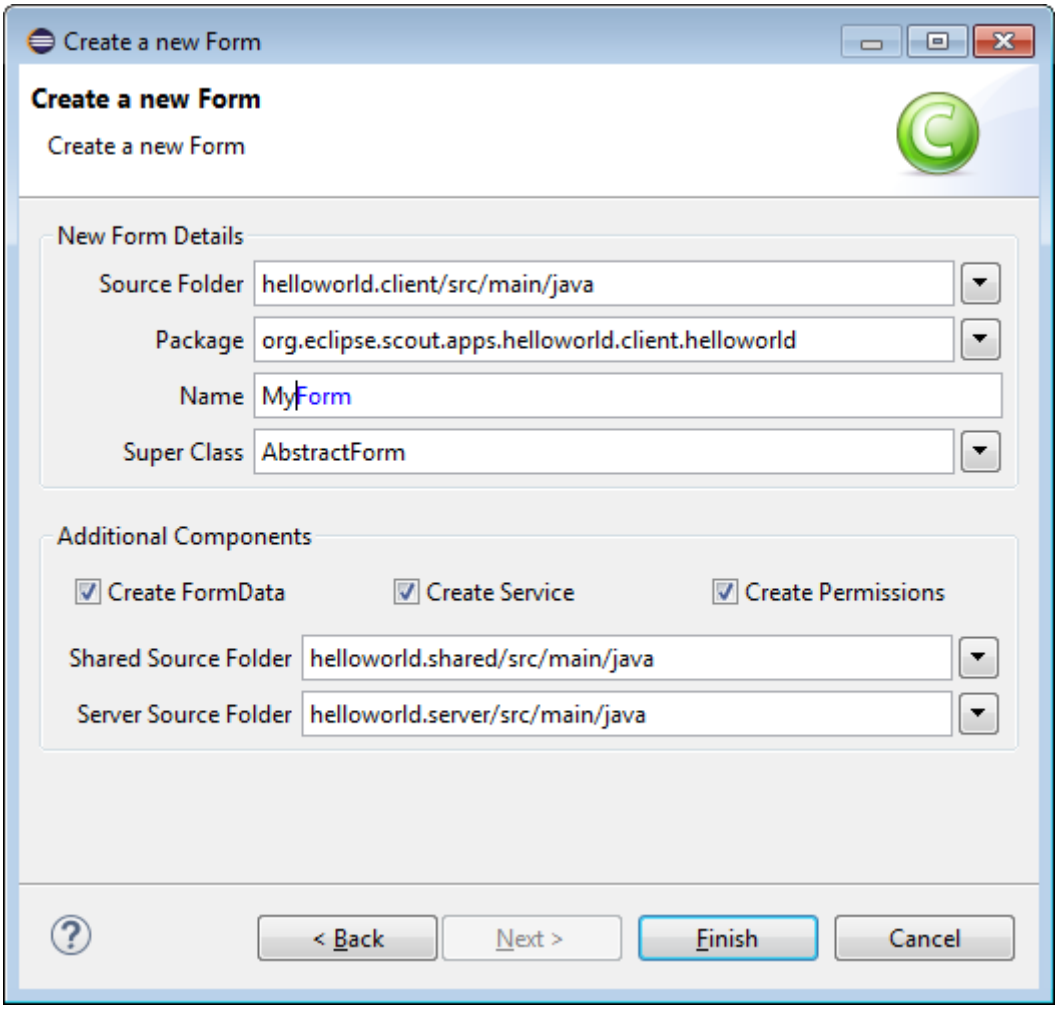


Figure 17. The new Form Wizard

In the case of Figure 17 the package `org.eclipse.scout.apps.helloworld.client.helloworld` has been selected in the Package Explorer. The only wizard field that then needs to be filled in manually is the **Name** field.

By clicking on the **[Finish]** button the wizard is started and the specified components are created.

Wizard Fields and Default Values

Most of the fields of the Figure 17 will be filled with default values depending on the current context of the IDE. The context can be derived from a package selected in the Package Explorer or from the class in the active Java Editor.

Source Folder

The source folder of the Maven client module used for the creation of the form class. The default

value is the `src/main/java` folder in the Maven client module.

Package

The Java package that will contain the form class. The Scout SDK will try to guess the package name from the current context and derive matching package names for the Maven shared and server modules.

Name

The name of the form class. According to Scout conventions the class name ends with the suffix `Form`.

Super Class

The super class for the form. `AbstractForm` is the default value.

Create FormData

If ticked, a form data class will be created in the shared module.

Create Service

If ticked, a service interface is created in the shared module and a service implementation is created in the Maven server module.

Create Permissions

If ticked, read and update permissions are created in the Maven shared module.

Shared Source Folder

The source folder of the Maven shared module used for creation of the form data, the service interface and the permission classes. The default value is the `src/main/java` folder in the Maven shared module.

Server Source Folder

The source folder of the Maven server module used for the service class creation. The default value is the `src/main/java` folder in the Maven server module.

Created Components

In the Figure 17 example shown above the Scout SDK will create the following components.

- In Maven module **helloworld.client**
  - The `MyForm` form class in folder `src/main/java` and package `org.eclipse.scout.apps.helloworld.client.helloworld`
- In Maven module **helloworld.shared**
  - In folder `src/main/java` and package `org.eclipse.scout.apps.helloworld.shared.helloworld`
    - The `IMyService` service interface
    - The `ReadMyPermission` permission class
    - The `UpdateMyPermission` permission class
  - The `MyFormData` form data class in folder `src/generated/java` and package

`org.eclipse.scout.apps.helloworld.shared.helloworld`

- In Maven module **helloworld.server**
  - The `MyService` service class in folder `src/main/java` and package `org.eclipse.scout.apps.helloworld.server.helloworld`

3.5. Scout Content Assistance

To create new Scout components that are represented by inner classes in the Scout framework, the Scout tooling extends the Java content assist of the Eclipse Java editor. The offered proposals are context specific. Depending on the current cursor position in the Java editor, possible Scout components are added to the proposal list.

In a class representing a group box in a form, the Scout content assist adds proposals for various form fields. In a table class the content assist adds proposals to add table columns or context menus. Those proposals trigger the creation of inner classes for form fields, table columns or codes. The Eclipse content assist can be started by typing `Ctrl`+`Space`.

3.5.1. Create new Form Fields

To add additional form fields to a form the current edit position needs to be inside of a Scout group box. Typing `Ctrl`+`Space` then provides access to the most frequently used Scout widgets as shown in Figure 18.

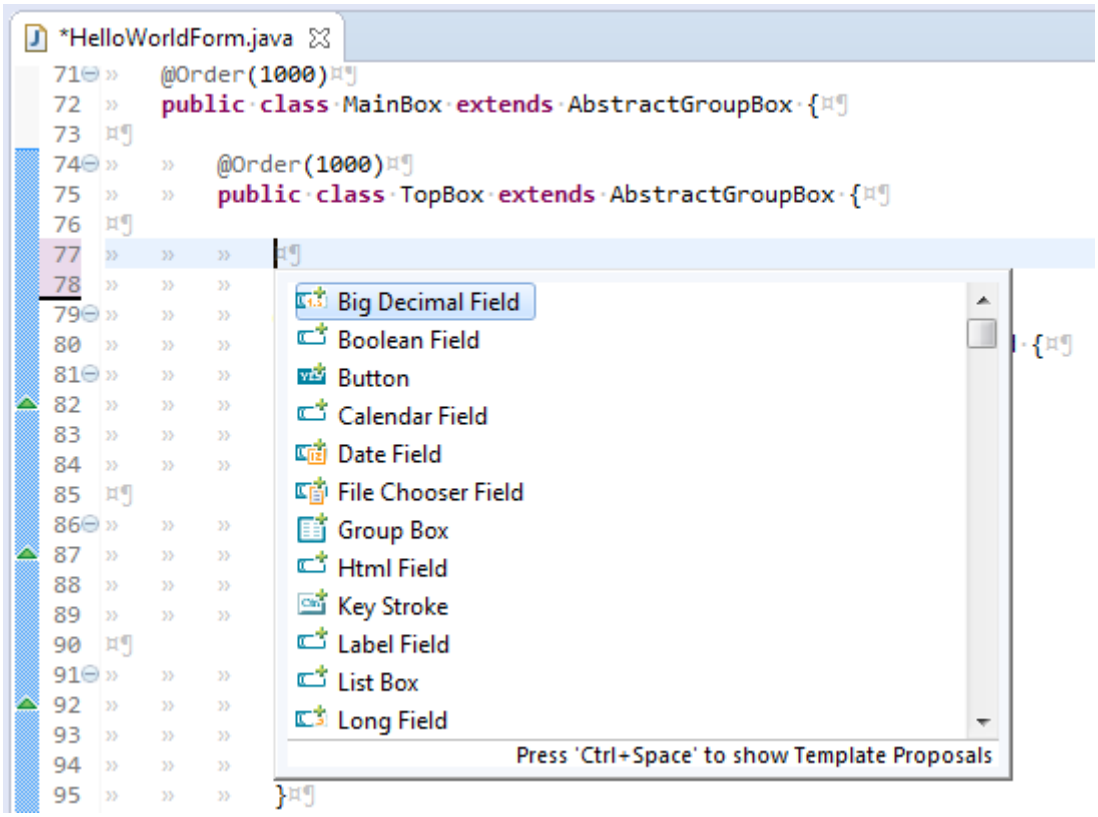


Figure 18. Proposals to create new form fields in a GroupBox

When a template is selected, it is possible to customize it by navigating between the different Edit-Groups with the `Tab` Key (this works exactly like other templates in the Eclipse Editor). With this

mechanism you can quickly define the class name, the parent class and other properties. To exit the Edit-Mode just press `Enter`.

3.5.2. Create new Table Columns

For adding new columns in a table set the current edit position inside a Scout table. The Scout table itself may be located inside of a TableField as shown in Figure 19 or can also be located inside of a Scout TablePage.

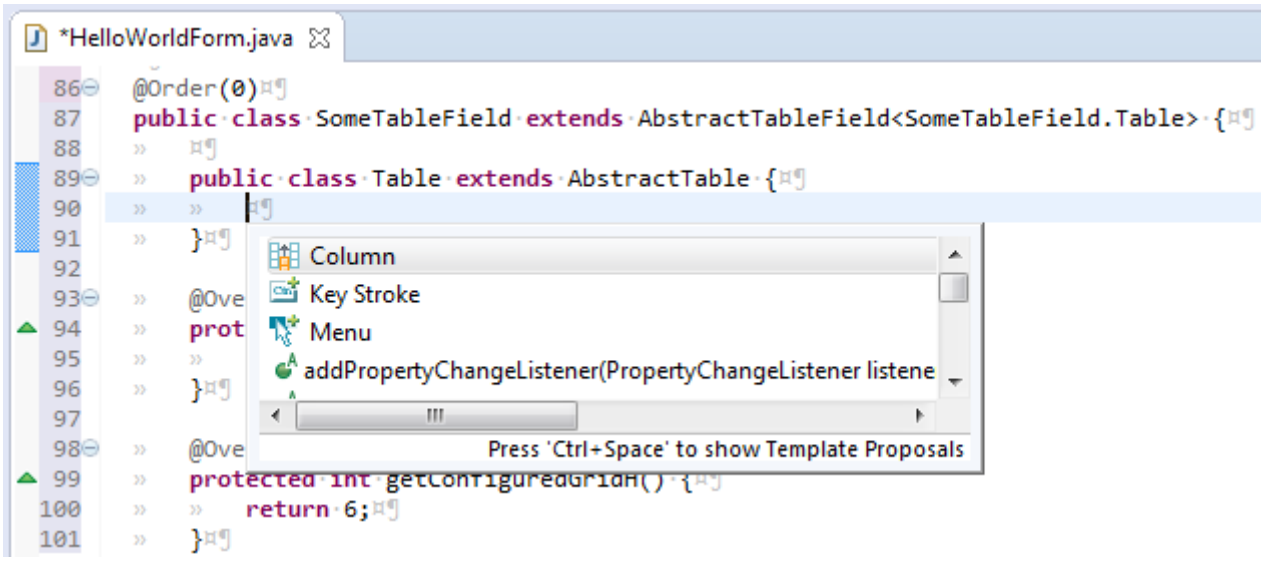


Figure 19. Proposals to create new columns in a Table

Next to adding columns the content assist shown in Figure 19 can also be used to add key stroke actions and menus to tables.

3.5.3. Create new Codes

Adding new Codes to an existing CodeType is supported by the content assist as shown in Figure 20.

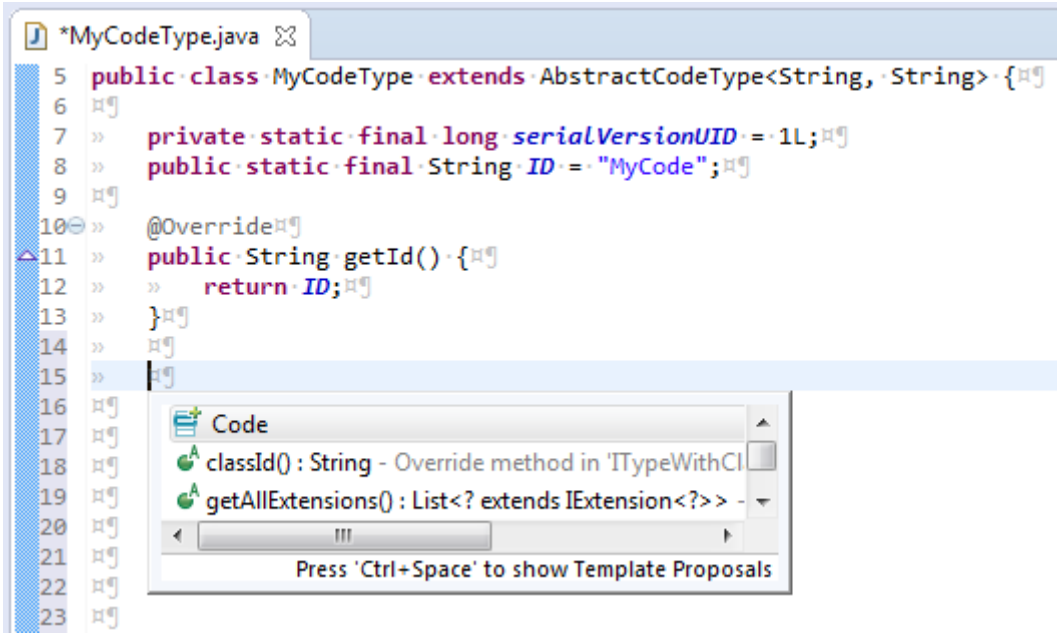


Figure 20. Proposals to create new codes in a CodeType

3.6. Scout NLS Tooling

3.6.1. Adding a new Translated Text Entry

Translated text entries are most frequently added when working in the Java editor view.

When the the current edit position is inside the String parameter of the `TEXTS.get()` code, the content assist (opened with `Ctrl` + `Space`) provides support for the NLS entries as shown in Figure 21.

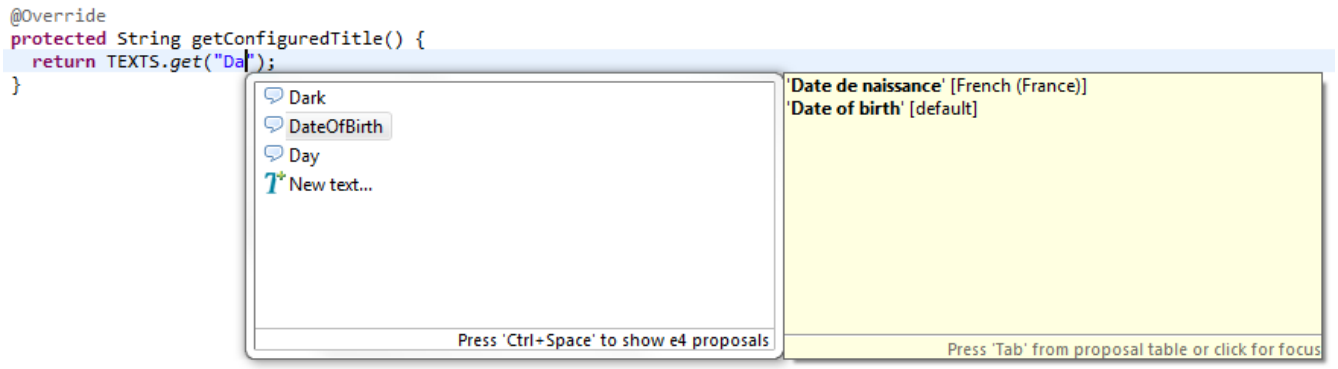


Figure 21. Proposals corresponding to NLS Support.

Selecting one of proposal entries (like "DateOfBirth" in the example) shows the available translations on the right hand side. To select a specific proposal entry you may double click on the entry or hit the `Enter` key. To create a new text entry select **New text...** at the end of the proposal list.

Adding a translated text can then be done in the *New Entry* wizard provided by the Scout SDK as shown in Figure 22.

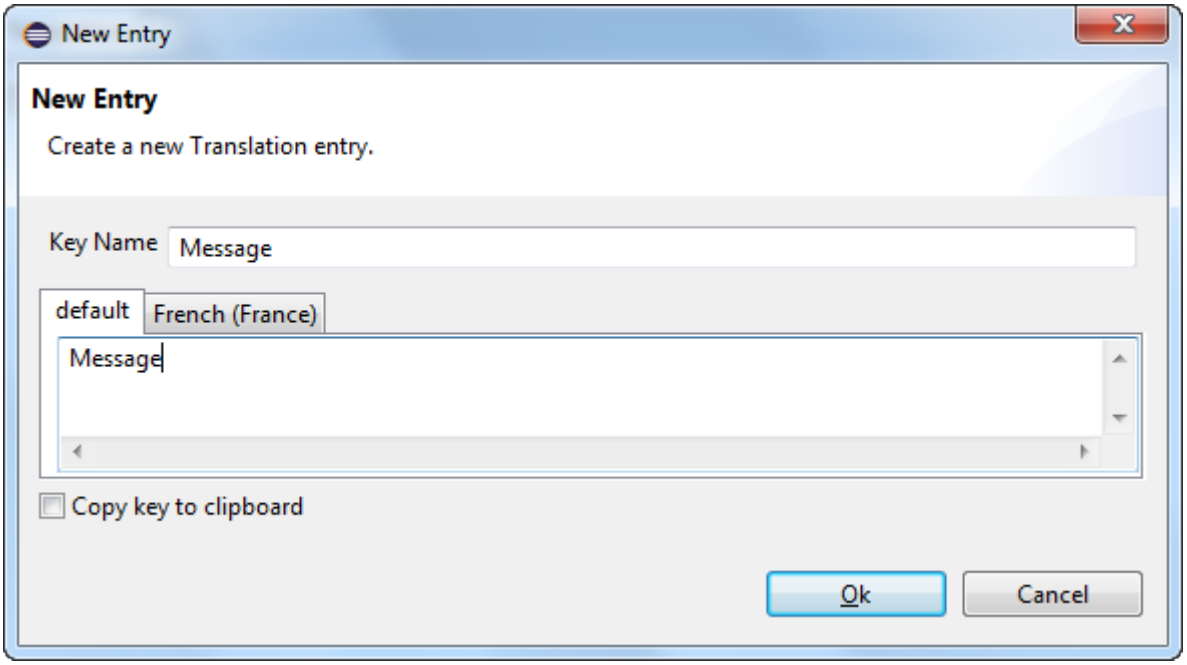


Figure 22. Adding a new text with the New Entry wizard.

Key Name

This field holds the text key that is used to access translated text.

default

This field holds the default translated text for the key. Make sure to at least provide a translated text in this tab.

French (France)

Additional tabs to enter translations for other languages may be present. Adding additional languages is described in the text for the NLS editor.

Copy key to the clipboard

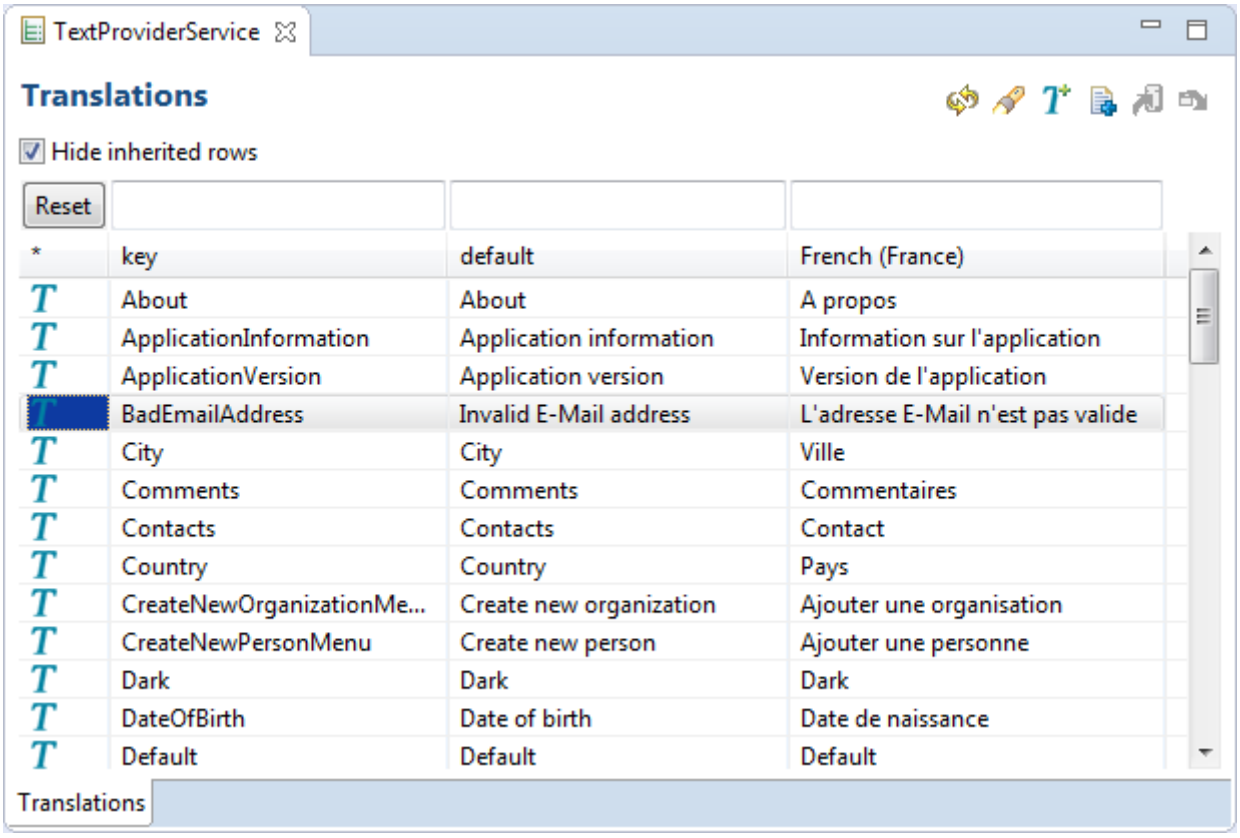
Select this checkbox to copy the key name to the clipboard and paste it later in your code.

3.6.2. The NLS Editor

To manage translated application texts for different languages the Scout SDK includes a NLS editor. This editor helps to efficiently deal to edit all the property files that are used with the default setup of Scout.

The NLS editor can be accessed for each text provider service of a Scout application via the `*.nls` files of the shared Maven modules of the application. In the case of the "Hello World" application you will find the `Texts.nls` file in module `org.eclipse.scout.helloworld.shared`. To open the editor for the "Hello World" application select the `Texts.nls` file first and then use context menu **Open With › NLS Editor**.

The screenshot below shows the opened NLS editor. In the first column the `key` values are shown that are used in accessing translations through `TEXTS.get("key")`. The second columns holds the default translations followed by columns holding the translations for other translated languages.



3.6.3. Action Buttons

Actions on the top right corner:

[icon refresh]	Refresh NLS Project	Reload the content of the editor.
[icon find obj]	Show NLS entry usage	For each row, search in the Java code where the NLS Key is used. Results are displayed in the first column.
T+	New entry...	Opens the New Text Entry Wizard
[icon fileadd pending]	New language...	Opens the Add a Language Wizard
[icon import]	Import...	Import the NLS entries of an external file
[icon export]	Export...	Export the NLS entries to an external file

Import and Export requires additional components.

Hide inherited rows checkbox

On the top of each column, the text fields allow you to filter the entries in the table. With the **[Reset]** button on the right you will empty those filters.

The entries in the table can be directly edited by pressing F2 or double-clicking into a text cell.

On each row it is possible to call following context menu:

	Modify Entry	Opens the New Text Entry Wizard
[icon find obj]	Find references to 'Xxx'	Search in the Java code where the NLS Key is used.
	Remove Xxx	Delete the NLS Entry from the files

3.6.4. Default Mapping to Properties Files

The mapping between the properties files is registered in the "Text Provider Service" class. Per default the files follow this pattern: `<your application>.shared/src/main/resources/<identifier of the project>/texts/Texts<language>.properties`

where:

- `<identifier of the project>` is a chain of folders following the same convention as the Java source files with the package name. For example the `org.eclipse.contacts.shared` project uses `org/eclipse/scout/contacts/shared` as path.
- `<language>` is an identifier of the language and the country. Some possible file names:
  - `Texts.properties` is the default language
  - `Texts_de.properties` is for German
  - `Texts_fr_BE` will be for French in Belgium

3.6.5. Find missing NLS Keys

If NLS keys are used in the code that do not exist in a properties file, an ugly placeholder is displayed to the user. To find such missing translations the Menu `Scout → Search missing text keys⋯` may be handy. The result is listed in the Eclipse `Search` view.

The search also takes the scope of each NLS key into account. So that the key is considered to be available there must be a `TextProviderService` with that key on the classpath of that module.

Reported false positives can be suppressed using the following comment at the end of the corresponding line: `NO-NLS-CHECK`. Matches on that line are then not reported in future searches anymore.

Chapter 4. A One Day Tutorial

In this chapter we will create the “Contacts” Scout application. The goal of this tutorial application is to learn about the most prominent features of the Eclipse Scout framework using a fully functional application.

The application is kept small enough to complete this tutorial within less than a day. An extended version of “Contacts” is available as a Scout sample application on Github.

As a prerequisite to this tutorial we assume that the reader has successfully completed the chapters "Hello World Tutorial" and "Import the Scout Demo Applications" as described in the Eclipse Scout user guide. To access the Scout user guide help hit F1 in the Eclipse IDE. This opens the Eclipse help view that includes the Eclipse Scout User Guide as shown in Figure 23.

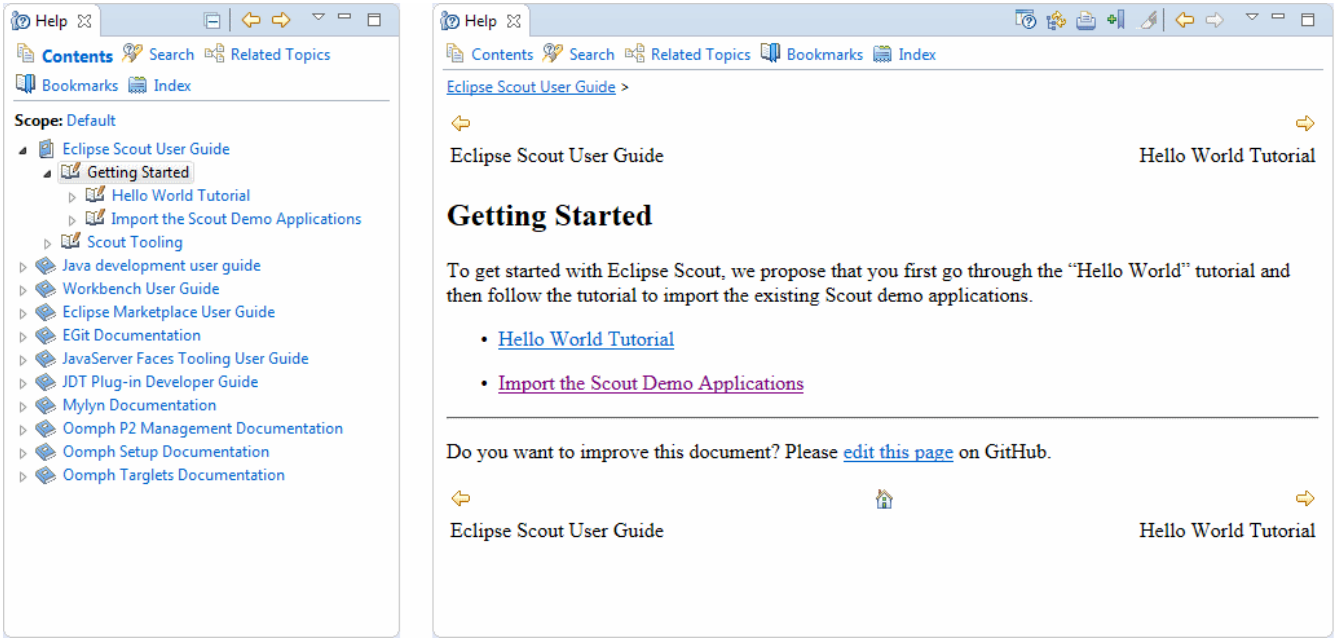


Figure 23. The Eclipse help view including the Eclipse Scout User Guide.

The “Contacts” tutorial is organized as follows. In the first section, the finished “Contacts” application is explained from the user perspective. The remaining sections focus on the individual steps to implement the “Contacts” tutorial application.

4.1. The “Contacts” Application

The “Contacts” demo application is a client server application to manage personal contacts, organizations and events. The persistence of entered data is achieved via simple JDBC access to a Derby database.

It is recommended that you first import the full “Contacts” demo application as described in the Eclipse Scout User Guide into a separate workspace. This gives you the possibility to check your source code against the full implementation during the various steps of the tutorial. Alternatively, you can also view the source code of the “Contacts” demo application on Github. [4: “Contacts” on Github.].

Figure Figure 24 below shows the “Contacts” application after connecting to the Scout UI

application.

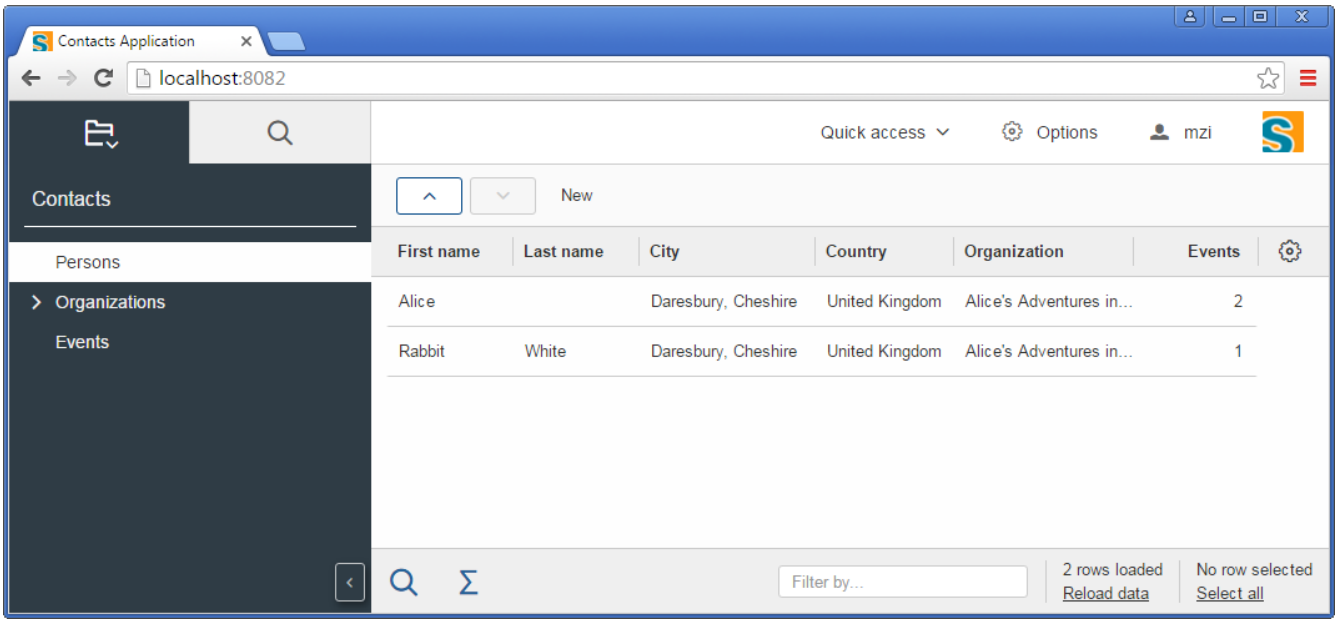


Figure 24. The “Contacts” application with the person page.

The “Contacts” application also shows the basic user interface layout of a typical Scout application. The main areas of this layout are briefly introduced below.

Outline Button

In Figure 24 the top left area shows a folder icon that represents the "Contacts" outline. The small down arrow at the folder icon indicates that additional outlines are available when clicking on this view button. On the right of the button with the folder icon is a second outline button that activates a search outline (not implemented yet).

Navigation Tree

The navigation tree on the left side of the layout shows the pages that are available for the selected outline. For the "Contacts" outline, the navigation tree provides access to the pages "Persons", "Organizations" and "Events". Selecting a page then shows associated information on the right hand side in the bench area. In the case of the selected "Persons" page the bench area shows a list of persons in the form of a table.

Header

The header area is located at the top and holds the available top level menus. In this example these are the "Quick access", "Options" menu points as well as a user menu that shows the username of the currently logged in user "mzi".

Bench

The bench represents the main display area of a Scout application. When selecting the "Persons" page, a table provides access to all available persons as shown in Figure 24. Selecting a specific person provides access to all actions that are available for the selected person. The selected person can then be opened with the *Edit* menu which opens the person in a view that is displayed in the bench area again as shown in Figure 25.

For entering and editing of data in Scout applications views are used in most cases. Views are displayed in the bench area of a Scout application. Several views can also be opened

simultaneously. To show a specific view the user has to click on the view button associated with the desired view. An example of an opened view is shown for person "Alice" in in Figure 25.

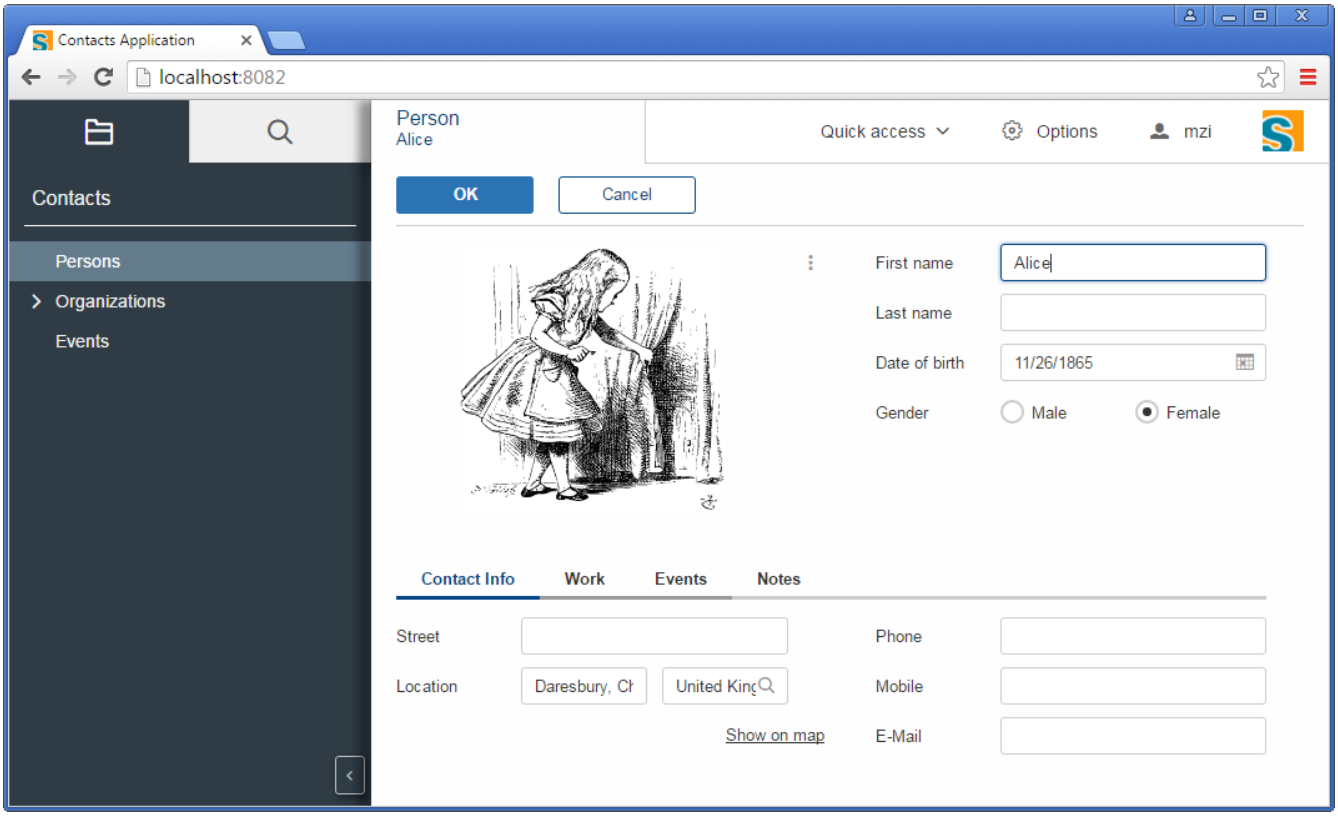


Figure 25. The “Contacts” application with a person opened in a form.

4.2. Tutorial Overview

This tutorial walks you through the implementation of a Scout application consisting of a frontend and a backend application. The frontend application contains outlines with navigation trees, pages to present information in tabular form and forms to view and edit data. In the backend application the tutorial shows how to implement services, logging, databases access, and several other aspects of Scout applications.

The tutorial is organized into the sequence of the consecutive steps listed below. Each of the step is described in a individual section that results in a executable application that can be tested and compared against the full "Contacts" demo application.

Step 1: Setting up the Initial Project (Section 4.3)

We start with an empty workspace and the "Hello World" project. At the end of step one we have a project setup that matches the "Contacts" application. This includes the organization and naming of Maven modules and the individual Java packages.

Step 2: Adding the Person and Organization Page (Section 4.4)

The second step adds the user interface components to display persons and organizations. For this a "Persons" page and an "Organizations" page are created and added to the "Contacts" outline as shown in Figure 24.

Step 3: Creating and Accessing the Database (Section 4.5)

This step concentrates on the backend of the "Contacts" application. The covered topics includes

dealing with application properties, setup and access of a database and using the database to provide data for the person and organization page created in the previous step.

Step 4: Adding a Form to Create/Edit Persons (Section 4.6)

Having access to the database is used in this step to add the components that allow a user to create and edit persons and organizations in the user interface of the "Contacts" application. In addition, this tutorial step also demonstrates how to design and implement complex form layouts with the Scout framework.

Step 5: Form Field Validation and Template Fields (Section 4.7)

This step provides an introduction into form field validation and the creation of template fields. Validation of user input is important for many business applications and template fields help to improve code quality with a mechanism to reuse application specific user interface components.

Step 6: Adding the Company Form (Section 4.8)

We create the organization form to create and enter organizations in the "Contacts" application. As we can reuse many of the components developed so far this is the shortest tutorial step.

Step 7: Linking Organizations and Persons (Section 4.9)

In this step we modify the user interface to implement a 1:n relationship between organizations and persons. This includes the creation of a hierarchical page structure for organization, adding an organization column to the person page and adding an organization field to the person form to manage the association of a person to an organization.

Step 8: Additional Concepts and Features (Section 4.10)

The last tutorial part discusses the gap between the tutorial application and the complete "Contacts" demo application.

4.3. Setting up the Initial Project

This section deals with setting up the initial workspace and codebase for the "Contacts" application. The goal of this step lies in the project setup that closely matches the "Contacts" application. This includes the organization and naming of Maven modules and the individual Java packages.

The creation up of the initial project setup described in this section consists of the tasks listed below.

- Creating the initial Codebase (Section 4.3.1)
- Removing unnecessary Components (Section 4.3.2)
- Changes to Class WorkOutline (Section 4.3.3)
- Changes to Class Desktop (Section 4.3.4)

This first step of the "Contacts" tutorial ends with a review of the results of this first tutorial step in Section 4.3.5.

4.3.1. Creating the initial Codebase

The initial code for the “Contacts” application is generated using the *New Scout Project* wizard. For the wizard fields you may use the values below and as shown in Figure 26

- *Group Id*: `org.eclipse.scout`
- *Artifact Id*: `contacts`
- *Display Name*: "Contacts Application"

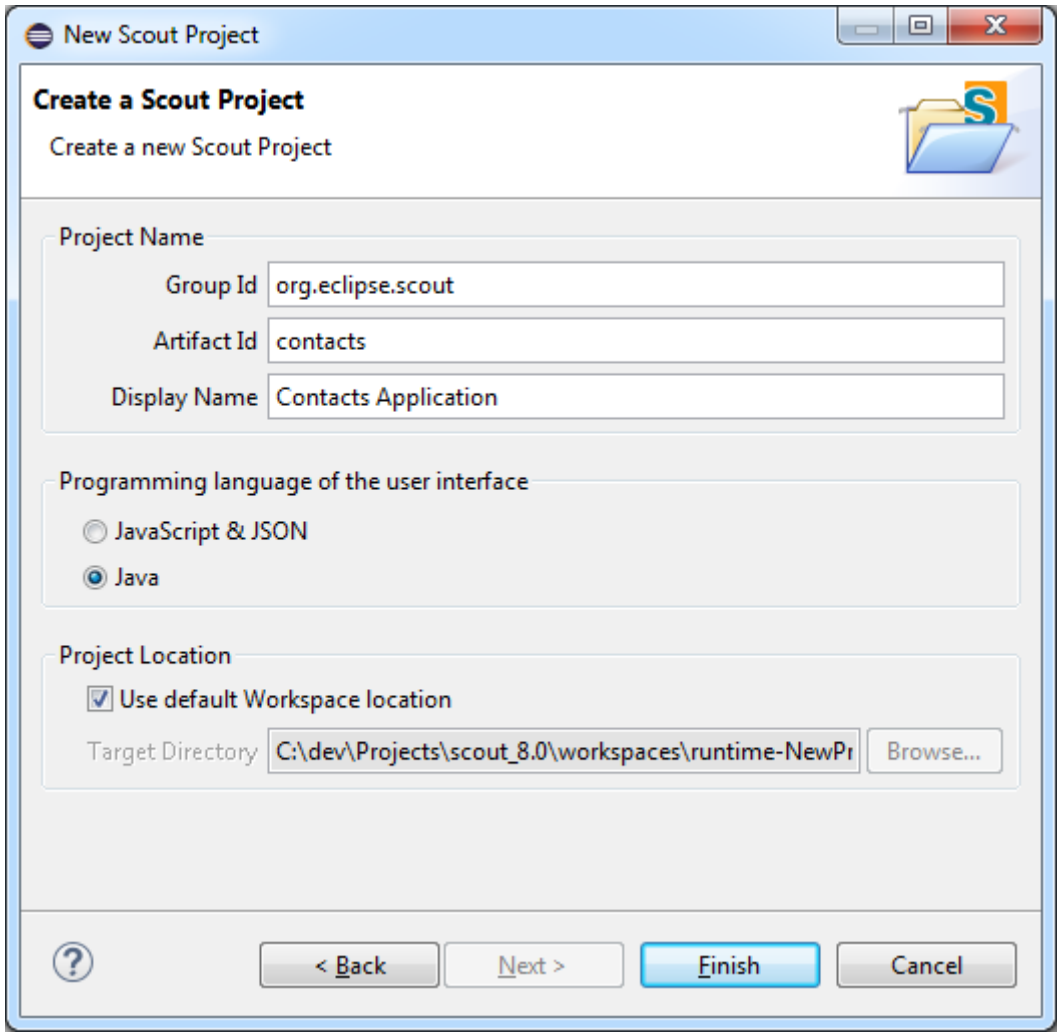


Figure 26. The creation of the initial "Contacts" application.

To create this initial application click on **[Finish]**. The project wizard then creates a number of Maven modules as shown in Figure 27.

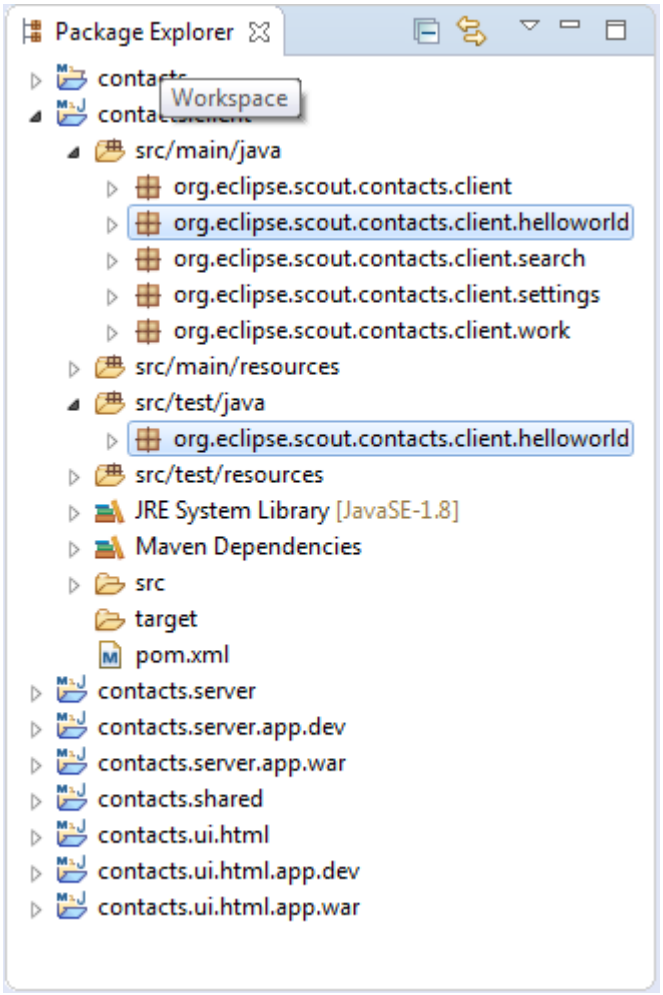


Figure 27. The package explorer with the initial Maven modules created for the "Contacts" application.

4.3.2. Removing unnecessary Components

We start with removing the `*.helloworld` and `\*.settings` packages in all Maven modules of the "Contacts" application. To delete packages, first select an individual package or packages in the Eclipse package explorer as shown in Figure 27 and then hit the `Delete` key.

The packages to delete is provided per Maven module in the list below.

Client Module `contacts.client`

- In folder `src/main/java`
  - Delete package `org.eclipse.scout.contacts.client.helloworld`
  - Delete package `org.eclipse.scout.contacts.client.settings`
- In folder `src/test/java`
  - Delete package `org.eclipse.scout.contacts.client.helloworld`

Server Module `contacts.server`

- In folder `src/main/java`
  - Delete package `org.eclipse.scout.contacts.server.helloworld`
- In folder `src/test/java`
  - Delete package `org.eclipse.scout.contacts.server.helloworld`

Shared Module `contacts.shared`

- In folder `src/main/java`
  - Delete package `org.eclipse.scout.contacts.shared.helloworld`
- In folder `src/generated/java`
  - Delete package `org.eclipse.scout.contacts.shared.helloworld`

The deletion of these outlines results in a number of compile errors in classes `WorkOutline` and `Desktop`. All these errors will be resolved in the following two sections where we modify the two classes to our needs.

4.3.3. Changes to Class WorkOutline

Instead of adding a new "Contacts" outline to the application we reuse the generated code and rename the "Work" outline into "Contacts" outline. For this, we perform the following modifications to class `WorkOutline`.

- Rename the class package to `org.eclipse.scout.contacts.client.contact`
- Rename the class to `ContactOutline`
- Change the outline title to "Contacts"
- Change the outline icon to `Icons.CategoryBold`

To quickly find class `WorkOutline` we first open the *Open Type* dialog from the Eclipse IDE by hitting `Ctrl+Shift+T` and enter "workoutline" into the search field as shown in Figure 28. In the result list, we select the desired class and click the **[OK]** button to open the file `WorkOutline.java` in the Java editor of the Eclipse IDE.

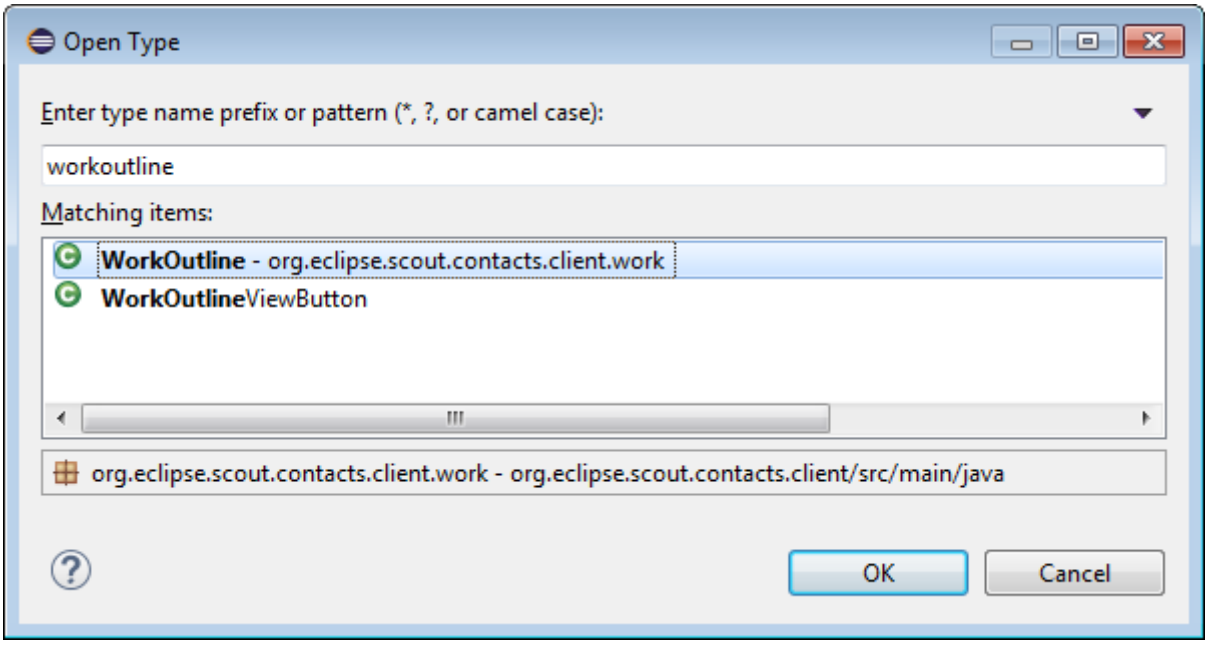


Figure 28. Use the Open Type dialog to quickly find java types in the Eclipse IDE.

We start with the package rename. To rename the package `org.eclipse.scout.contacts.client.work` to `org.eclipse.scout.contacts.client.contact` click into the word "work" of the package name and hit `Alt+Shift+R`. This opens the package rename dialog as shown in Figure 29 where we replace

"work" by "contact" in the *New name* field.

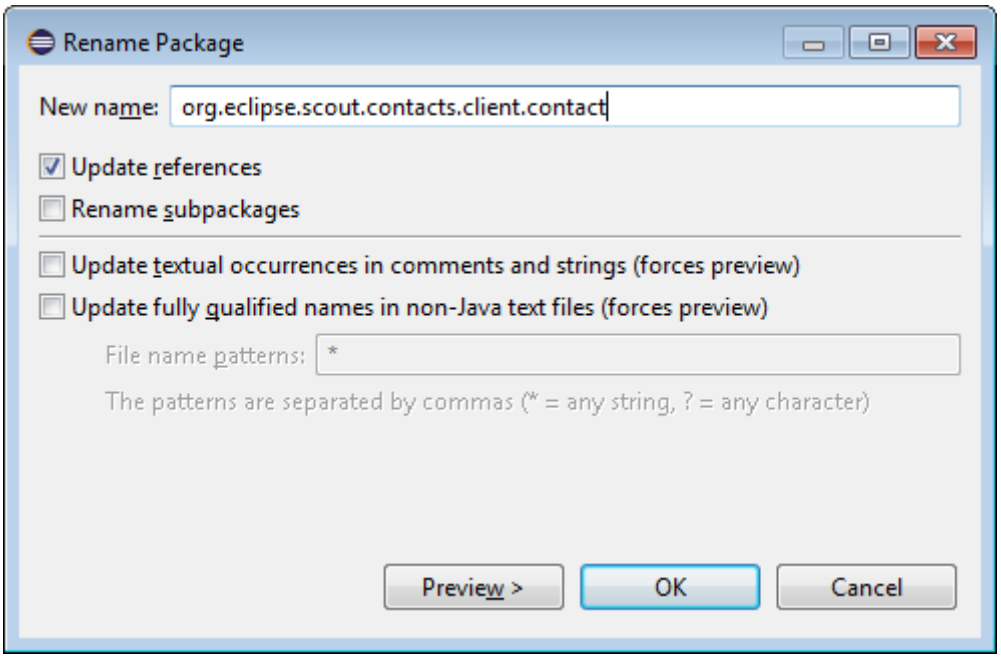


Figure 29. Use the Eclipse Rename Package dialog to rename a Java package.

In next step we rename class `WorkOutline` to `ContactOutline`. In the Java editor we can then rename the class by clicking into the class identifier `WorkOutline` and hitting `Alt+Shift+R`.

Inside the edit box we can then change the class name to `ContactOutline` and hit the **[Enter]** key to execute the change. If Eclipse shows a Rename Type dialog just hit button **[Continue]** to let Eclipse complete the rename operation. To get rid of the compile error in method `execCreateChildPages` we simply delete the content in the method body.

Next, we change the outline title in method `getConfiguredTitle` by replacing the string "Work" with "Contacts", setting the cursor at the end of the word "Contacts" and hitting `Ctrl+Space` to open the Scout content assist as shown in Figure 30.

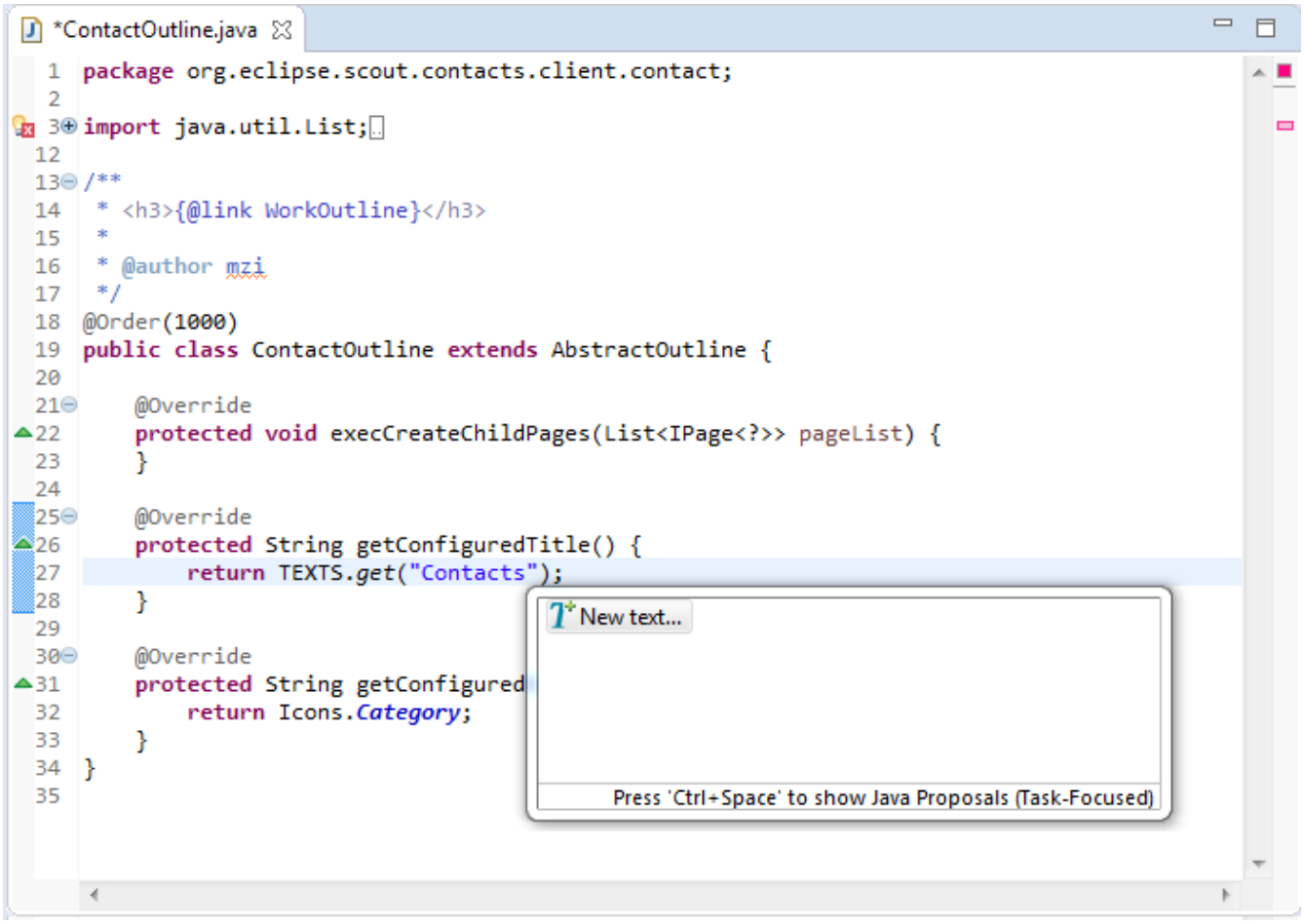


Figure 30. Use the Scout content assist to add new translations.

To enter a new translated text we double click on the proposal *New text...* to open the Scout new entry wizard as shown in Figure 31.

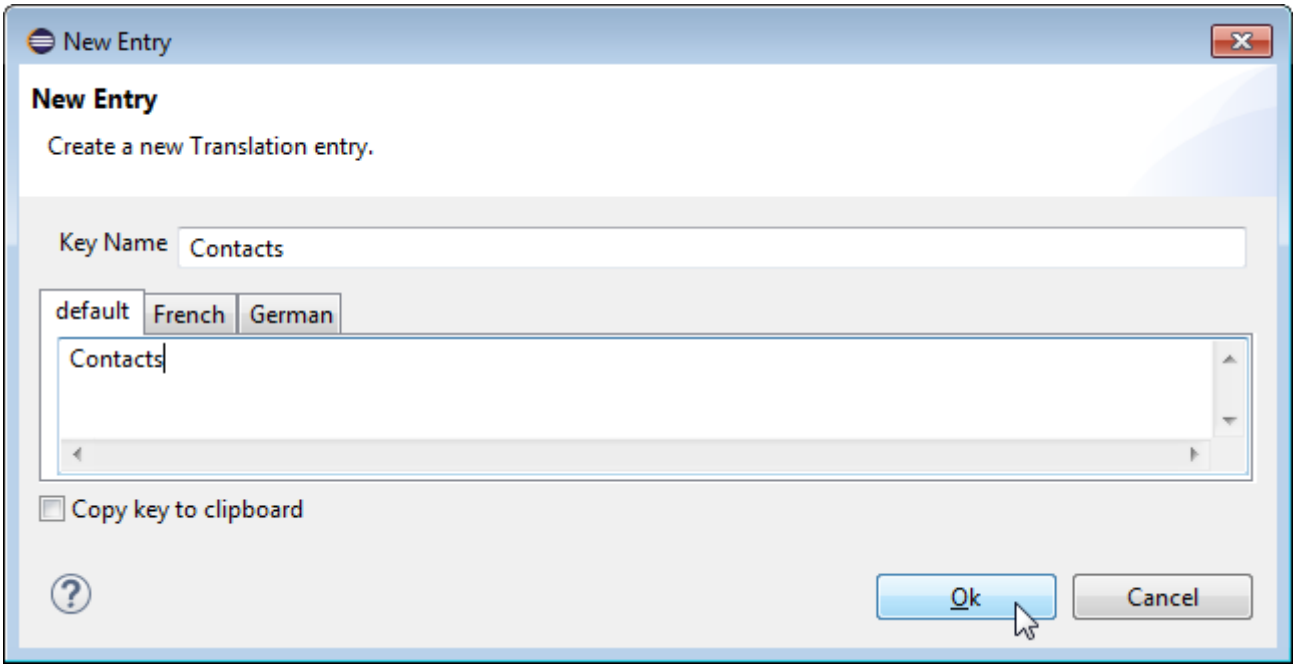


Figure 31. Use the Scout new entry wizard to add translated texts to the application.

As the last modification we change the return value of method `getConfiguredIconId` to value `Icons.CategoryBold` and end with the code shown in Listing 1.

Listing 1. Initial implementation of class ContactOutline.

```
public class ContactOutline extends AbstractOutline {

  @Override
  protected void execCreateChildPages(List<IPage<?>> pageList) {
  }

  @Override
  protected String getConfiguredTitle() {
    return TEXTS.get("Contacts");
  }

  @Override
  protected String getConfiguredIconId() {
    return Icons.CategoryBold;
  }
}
```

To conclude the modifications we update the imports by hitting `Ctrl+Shift+O` and save the modified class using `Ctrl+S`.

4.3.4. Changes to Class Desktop

The second class to adapt for the "Contacts" application is the `Desktop` class. This class is implemented exactly once in each Scout application and holds the available outlines and top level menus of the application in the form of inner classes.

For the "Contacts" application we adapt the initial implementation to have outline view buttons for the "Contacts" and "Search" outlines. The top level menus are then adapted to hold the menus "Quick Access", "Options" and a menu for the logged in user.

Start with opening the class in the Java editor using `Ctrl+Shift+T` to quickly access the class. In the source code of method `getConfiguredOutlines` remove `SettingsOutline.class` from the list of return values in as shown in Listing 2.

Listing 2. Method getConfiguredOutlines defines the outlines associated with the desktop of the application.

```
  @Override
  protected List<Class<? extends IOutline>> getConfiguredOutlines() {
    return CollectionUtility.<Class<? extends IOutline>> arrayList(ContactOutline
.class, SearchOutline.class);
  }
```

Then, perform the following changes in class `Desktop`

- Delete the inner class `SettingOutlineViewButton`
- Delete the inner class `UserProfileMenu`.
- Rename inner class WorkOutlineViewButton to `ContactOutlineViewButton`

- Create a new inner class called `QuickAccessMenu` after the `SearchOutlineViewButton`. For this navigate the cursor after the `SearchOutlineViewButton` class, press `Ctrl+Space` and select the `Menu` entry. Adapt the created code until it matches the template as shown in Listing 3.
- Create another menu called `OptionsMenu` right after the newly created `QuickAccessMenu` according to Listing 3 (for now you can skip the method `getConfiguredForm` and keep the super class as it is).
- Create a last menu called `UserMenu` after the `OptionsMenu` according to Listing 3.

At the end of these changes the inner class structure of class Desktop will look similar to the sample shown in Listing 3.

Listing 3. Structure of class Desktop with outline buttons and top level menus.

```
public class Desktop extends AbstractDesktop {

  // outline buttons of the application
  @Order(1)
  public class ContactOutlineViewButton extends AbstractOutlineViewButton {
  }

  @Order(2)
  public class SearchOutlineViewButton extends AbstractOutlineViewButton {
  }

  // top level menus for the header area of the application
  @Order(10)
  public class QuickAccessMenu extends AbstractMenu {

    @Override
    protected String getConfiguredText() {
      return TEXTS.get("QuickAccess");
    }

  }

  @Order(20)
  public class OptionsMenu extends AbstractFormMenu<OptionsForm> { ①

    @Override
    protected String getConfiguredText() {
      return TEXTS.get("Options");
    }

    @Override
    protected String getConfiguredIconId() {
      return Icons.Gear;
    }

    @Override
    protected Class<OptionsForm> getConfiguredForm() {
```

```
      return OptionsForm.class;
    }

  }

  @Order(30)
  public class UserMenu extends AbstractFormMenu<UserForm> { ②

    @Override
    protected String getConfiguredIconId() {
      return Icons.PersonSolid;
    }

    @Override
    protected Class<UserForm> getConfiguredForm() {
      return UserForm.class;
    }

  }
}
```

① In your implementation `OptionsMenu` should extend `AbstractMenu`

② In your implementation `UserMenu` should extend `AbstractMenu`

4.3.5. What have we achieved?

In the first step of the "Contacts" tutorial we have created the initial project setup that will serve as the basis for all the following tutorial steps.

As the "Contacts" application is in a clean state you can now test the application using the following steps. The user interface of the application will now look as shown in Figure 32.

- Start the backend application
- Start the frontend application
- Open address http://localhost:8082/ in your browser

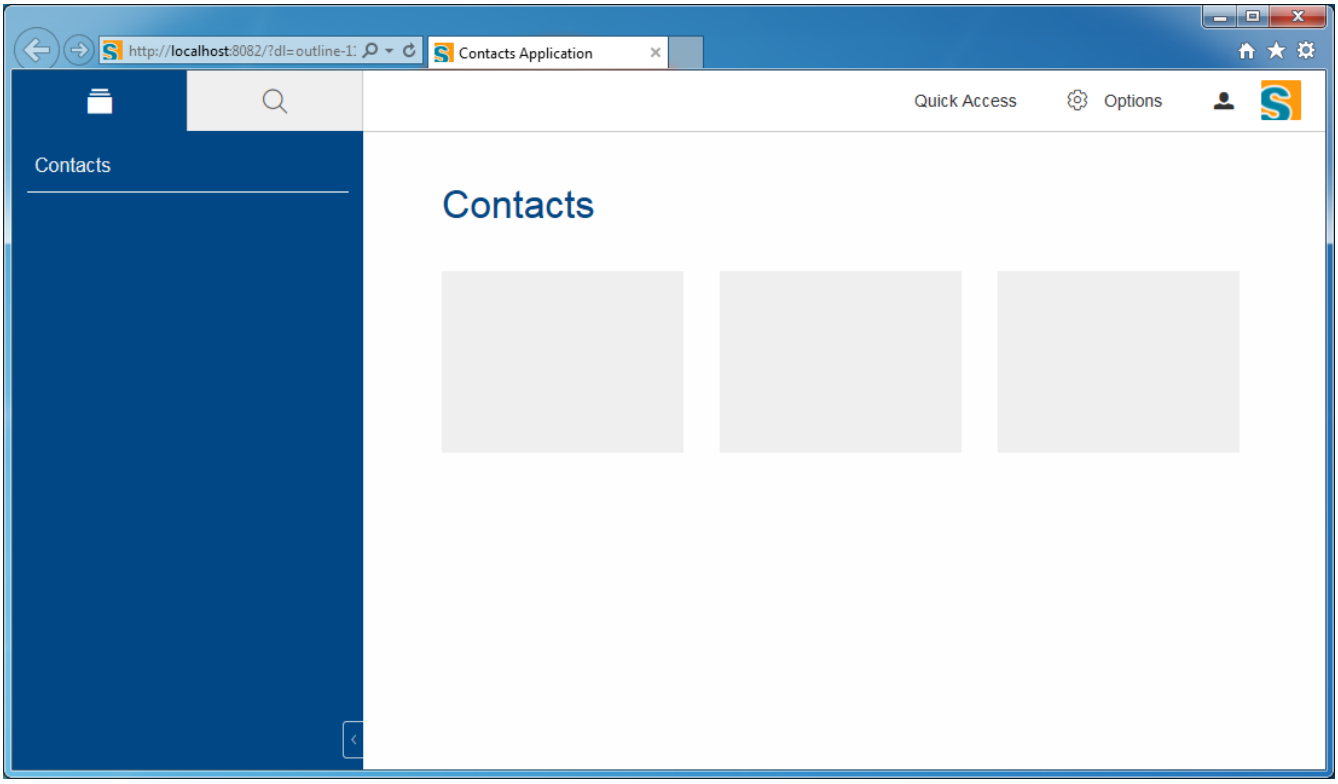


Figure 32. The "Contacts" application at the end of tutorial step 1.

From the coding perspective we now have all necessary maven Modules for "Contacts" application including Java package and class names to match with the complete Scout "Contacts" demo application. This point is important as it simplifies the comparison of intermediate stages of the tutorial application with the Scout demo application. The same is true for the user perspective: The layout of the current state of the tutorial matches with the complete "Contacts" sample application.

4.4. Adding the Person and Organization Page

In the second step of the Scout tutorial the components to display persons and organizations are added to the "Contacts" outline of the user interface of the Scout application. Specifically, a "Persons" page and an "Organizations" page are created and added to the navigation tree of the "Contacts" outline.

Database access and populating the pages with actual data from the database is not part of this section but will be covered in Section 4.5 in the next tutorial step.

The addition of the "Persons" page is described in detail in the sections listed below.

- Creating additional Packages (Section 4.4.1)
- Creating the Country Lookup Call (Section 4.4.2)
- Creating the Person Page (Section 4.4.3)
- Adding Table Columns to the Page (Section 4.4.4)
- Link the Person Page to the Contacts Outline (Section 4.4.5)

The addition of the company page is described in Section 4.4.6. Finally, the state of the "Contacts" application is summarized in Section 4.4.7.

4.4.1. Creating additional Packages

A substantial part of the "Contacts" application deals with persons. In addition to the "Persons" page we will also add a Scout form to enter/edit persons in a later tutorial step. For the "Contacts" application we use this fact to justify the addition of a specific Java package that will hold all classes related to persons. This person package can be created with the following steps.

- Open the "Contacts" Maven module `contacts.client` in the Eclipse Package Explorer
- Select the Java package `org.eclipse.scout.contacts.client` in folder `src/main/java`
- Press `Ctrl+N`, enter "package" into the search field
- Select the *Package* wizard in the proposal box and click *Next*
- Enter `org.eclipse.scout.contacts.client.person` and click *Finish* as shown in Figure 33
- Make sure the newly created person package is selected in the Eclipse Package Explorer

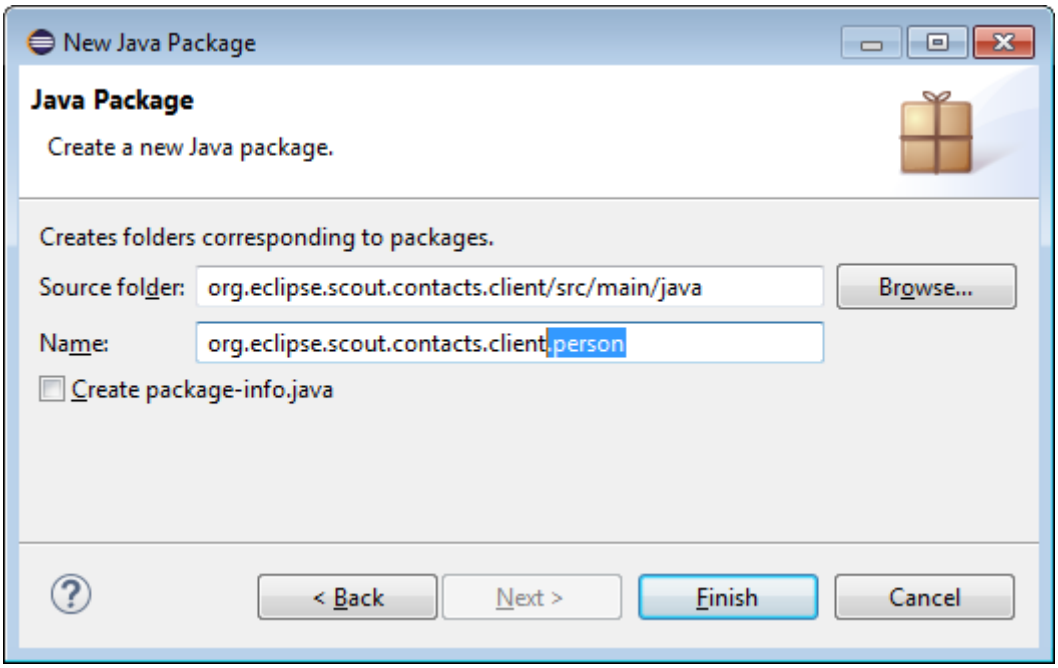


Figure 33. Add the person package to the "Contacts" application.

We will also need a separate package for organizations and some common elements.

- Add package `org.eclipse.scout.contacts.client.organization`
- Add package `org.eclipse.scout.contacts.client.common`

4.4.2. Creating the Country Lookup Call

The pages for the persons and the organizations will also display country information. To display country names we will be using a special column, that maps the country codes received from the backend application to translated country names. As the Java class `Locale` already contains both country codes and country names we can take advantage of this class and use it in a Scout local lookup call.

In package `org.eclipse.scout.contacts.client.common` create a new class `CountryLookupCall` according to the implementation provided in Listing 4.

Listing 4. The Scout lookup call for countries. This lookup call will be used for the address field.

```
public class CountryLookupCall extends LocalLookupCall<String> { ①

  private static final long serialVersionUID = 1L;

  @Override
  protected List<LookupRow<String>> execCreateLookupRows() { ②
    List<LookupRow<String>> rows = new ArrayList<>();

    for (String countryCode : Locale.getISOCountries()) {
      Locale country = new Locale("", countryCode);
      rows.add(new LookupRow<>(countryCode, country.getDisplayCountry())); ③
    }

    return rows;
  }
}
```

① Makes the `CountryLookupCall` to work with key type `String`

② Defines the set of lookup rows to be used

③ Add a row with the country code as key and the country name as display value

4.4.3. Creating the Person Page

In this section we create the Scout page that will be used to list all entered persons to the user of the "Contacts" application. Out-of-the box this page will support the sorting and filtering of all the persons. This "Persons" page is then added to the navigation tree below the "Contacts" outline.

We can now add the Scout person page as described below.

- Select the newly created package `org.eclipse.scout.contacts.client.person` in the Package Explorer
- Press `Ctrl`+`N`, enter "scout page" into the search field
- Select the *Scout Page* wizard in the proposal box and click *Next*
- Enter `PersonTablePage` as the class name and click *Finish* as shown in Figure 34

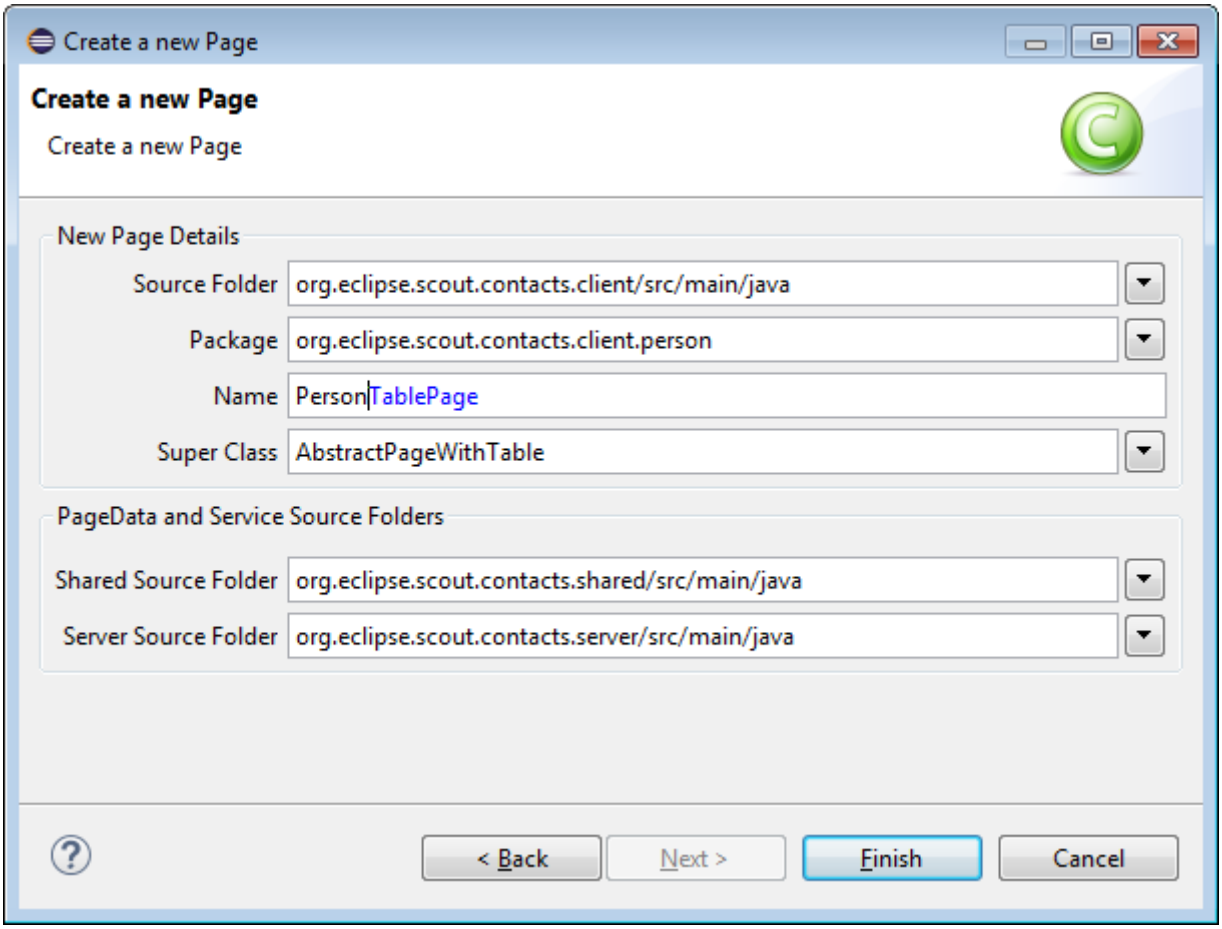


Figure 34. Add the person page to the "Contacts" application.

The Scout *New Page Wizard* then creates an initial implementation for the `PersonTablePage` class very similar to the listing provided in Listing 5 below.

Listing 5. Initial implementation of class PersonTablePage.

```
@PageData(PersonTablePageData.class)
public class PersonTablePage extends AbstractPageWithTable<Table> {

  @Override
  protected String getConfiguredTitle() {
    return TEXTS.get("Persons"); ①
  }

  @Override
  protected void execLoadData(SearchFilter filter) {
    importPageData(BEANS.get(IPersonService.class)
        .getPersonTableData(filter, getOrganizationId())); ②
  }

  @Override ③
  protected boolean getConfiguredLeaf() {
    return true;
  }

  public class Table extends AbstractTable {
    // container class to hold columns and other elements for this table page ④
  }
}
```

Before we start to add the columns to the table of the page we need to do some minor adaptations to Listing 5.

① Specify the title "Persons" for the page using the Scout NLS tooling (see Section 3.6.1)

② You don't need to update method `execLoadData` to match this listing for now

③ Add method `getConfiguredLeaf` to specify that the person page will not have any child pages

④ We will add the columns in the next section of this tutorial

We are now ready to populate the inner class `Table` of the person page with the columns to display various person attributes.

4.4.4. Adding Table Columns to the Page

Table pages are an important UI element of Scout applications as they frequently play a central role in the interactions of a user with the application. Out of the box table pages offer powerful options to sort, filter and re-arrange the data contained in the table. This functionality offers a good starting point to decide which columns to add to a table page.

To decide the columns to add the following criteria have been useful in practice.

- Unique identifier of an element
- Attributes that are most frequently used in searches

- Category attributes that are useful for filtering
- Fewer columns are better

As the visible data of all users is held in the memory of the frontend server it is good practice to keep the number of columns as low as possible. Not taking this advice into account can substantially increase the memory footprint of the frontend server in production.

For the person page of the "Contacts" application we will add the following columns.

- **PersonId**: Hidden attribute of type string to hold the person key. Class name: `PersonIdColumn`
- **First Name**: String column. Class name: `FirstNameColumn`
- **Last Name** String column. Class name: `LastNameColumn`
- **City**: String column. Class name: `CityColumn`
- **Country**: Smart column. Class name: `CountryColumn`
- **Phone**: String column, not visible per default. Class name: `PhoneColumn`
- **Mobile Phone**: String column, not visible per default. Class name: `MobileColumn`
- **Email**: String column, not visible per default. Class name: `EmailColumn`
- **Organization**: String column, not visible per default. Class name: `OrganizationColumn`

Use the column class names as indicated above. Working with different names is possible but requires additional work later in the tutorial when the data retrieved from the database is mapped to these column class names.

To add the first column `PersonIdColumn` we open class `PersonTablePage` in the Java editor and place the cursor inside of the body of the inner `Table` class. We then open the Scout content assist with `Ctrl`+`Space` and select the *Column* proposal as shown in Figure 35.

```
13 @Data(PersonTablePageData.class)
14 public class PersonTablePage extends AbstractPageWithTable<Table> {
15
16     @Override
17     protected String getConfiguredTitle() {
18         return TEXTS.get("Persons");
19     }
20
21     @Override
22     protected void execLoadData(SearchFilter filter) {
23         importPageData(BEANS.get(IPersonService.class).getPersonTableData(filter));
24     }
25
26     @Override
27     protected boolean getConfiguredLeaf() {
28         return true;
29     }
30
31     public class Table extends AbstractTable {
32
33     }
34 }
35
```

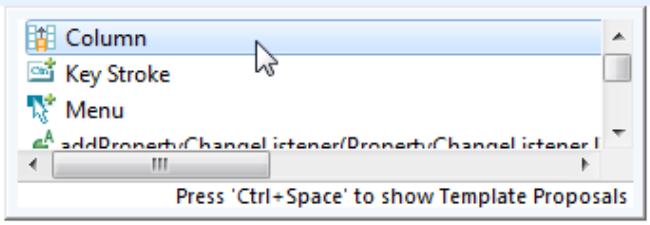


Figure 35. Adding a column to the person page table.

In the first edit box we type "PersonId" as shown in Figure 36 and press `Enter`.

```
33     public class Table extends AbstractTable {
34
35         public PersonIdColumn getPersonIdColumn() {
36             return getColumnSet().getColumnByClass(PersonIdColumn.class);
37         }
38
39         @Order(1000)
40         public class PersonIdColumn extends AbstractStringColumn {
41             @Override
42             protected String getConfiguredHeaderText() {
43                 return TEXTS.get("MyNlsKey");
44             }
45
46             @Override
47             protected int getConfiguredWidth() {
48                 return 100;
49             }
50         }
51
```

Figure 36. Adding a column to the person page table.

To configure this column as an invisible primary key we modify the newly created column class according to Listing 6.

Listing 6. Implementation of the person primary key column PersonIdColumn.

```
@Order(1)
public class PersonIdColumn extends AbstractStringColumn {

  @Override ①
  protected boolean getConfiguredDisplayable() {
    return false;
  }

  @Override ②
  protected boolean getConfiguredPrimaryKey() {
    return true;
  }
}
```

① Returning `false` here makes this column invisible. As this column will be excluded from the table control the user is not aware of the existence of this column.

② Returning `true` marks this attibute as a primary key (or part of a primary key)

We can now add the additional columns `FirstNameColumn`, `LastNameColumn`, `CityColumn` below. After entering the class name press `Tab` twice to move the cursor to the label text of the field. In the case of the first name enter "FirstName" and hit `Ctrl+Space` to open the wizard to add the translated text "First Name" as described in Section 3.6.1.

For these three columns the default implementation is fine and does not need any adaptations. Listing 7 below provides an example for this type of columns.

Listing 7. Implementation of the first name column.

```
@Order(2)
public class FirstNameColumn extends AbstractStringColumn {

  @Override
  protected String getConfiguredHeaderText() {
    return TEXTS.get("FirstName");
  }

  @Override
  protected int getConfiguredWidth() {
    return 120;
  }
}
```

For column `CountryColumn` we will use a smart column. We again use `Ctrl+Space` to open the wizard and enter "Country" for the class name box and press `Tab` once and select *AbstractSmartColumn* as column type. Next we press `Tab` again to enter "Country" as the translated text.

In the created class `CountryColumn` we need to update the class to extend `AbstractSmartColumn<String>` and add the method `getConfiguredLookupCall` according to Listing 8.

Listing 8. Implementation of the country smart column.

```
@Order(5)
public class CountryColumn extends AbstractSmartColumn<String> {

  @Override
  protected String getConfiguredHeaderText() {
    return TEXTS.get("Country");
  }

  @Override
  protected int getConfiguredWidth() {
    return 120;
  }

  @Override ①
  protected Class<? extends ILookupCall<String>> getConfiguredLookupCall() {
    return CountryLookupCall.class;
  }
}
```

① The configured lookup call is used to map country codes to the country names used in the user interface.

After the country column we add the three columns `PhoneColumn`, `MobileColumn`, `EmailColumn` and `OrganizationColumn` that are initially not visible in the user interface. As an example for such a column Listing 9 is provided below.

Listing 9. Implementation of the (initially invisible) phone column.

```
@Order(6)
public class PhoneColumn extends AbstractStringColumn {

  @Override
  protected String getConfiguredHeaderText() {
    return TEXTS.get("Phone");
  }

  @Override ①
  protected boolean getConfiguredVisible() {
    return false;
  }

  @Override
  protected int getConfiguredWidth() {
    return 120;
  }
}
```

① Returning `false` hides the column initially. Using the table control the user can then make this

column visible in the user interface.

Use the Eclipse content assist to efficiently add method `getConfiguredVisible`. Place the cursor after method `getConfiguredHeaderText`, type "getConVis" and hit `Ctrl+Space`. Then select the proposal *getConfiguredVisible* with `Enter` and the method is inserted for you.

We have now created a person page with corresponding table columns. However, this new UI component is not yet visible in the user interface. What is missing is the link from the application's contacts outline class to the newly created `PersonTablePage` class. This is what we will do in the following section.

4.4.5. Link the Person Page to the Contacts Outline

In this section we add the person page to the contacts outline created during the initial project setup of the first step of this tutorial. This will make the person page visible in the navigation area below the "Contacts" outline.

For this we have to add a single line of code to method `execCreateChildPages` of class `ContactOutline` according to Listing 10

Listing 10. Adding the PersonTable to the ContactOutline.

```
@Override
protected void execCreateChildPages(List<IPage<?>> pageList) {
  // pages to be shown in the navigation area of this outline
  pageList.add(new PersonTablePage()); ①
}
```

① A new instance of the `PersonTable` is added to this outline. This makes the person page visible in the navigation area below the contacts outline.

Before we can save the class `ContactOutline` we have to update its imports to include the import statement for class `PersonTablePage`. To update the imports you can either user the menu **Source › Organize Imports** or use the keyboard shortcut `Ctrl+Shift+O`.

The application is now in a state where we can restart the backend and the frontend server to verify our changes in the user interface.

4.4.6. Adding the Company Page

This section creates and adds a table page for organization to the "Contacts" outline. To create an organizations page the same steps are required as for the creation of the person page. The description is therefore kept on a higher level and in the text below only the main steps are described. Where appropriate, pointers are provided to the detailed descriptions for the creation of the person page.

- Add client package `org.eclipse.scout.contacts.client.organization`
- Add page `OrganizationTablePage` with title "Organizations" using the Scout new page wizard

Listing 11. Initial implementation of class OrganizationTablePage.

```
@PageData(OrganizationTablePageData.class)
public class OrganizationTablePage extends AbstractPageWithTable<Table> {

  @Override
  protected String getConfiguredTitle() {
    return TEXTS.get("Organizations"); ①
  }

  @Override
  protected void execLoadData(SearchFilter filter) {
    importPageData(BEANS.get(IOrganizationService.class).getOrganizationTableData
(filter));
  }

  public class Table extends AbstractTable {
    // container class to hold columns and other elements for this table page
  }
}
```

① Make sure to add a translated text entry for "Organizations" using the Scout NLS tooling

The implementation of class `OrganizationTablePage` using the Scout new page wizard then looks as shown in Listing 11.

As in the case of the person page you can now add the columns for the inner `Table` class. For the organization page add the columns according to the specification provided below.

- **OrganizationId**: Hidden attribute of type string to hold the organization key. Class name: `OrganizationIdColumn`
- **Name**: String column. Class name: `NameColumn`
- **City**: String column. Class name: `CityColumn`
- **Country**: Smart column. Class name: `CountryColumn`
- **Homepage**: String column, not visible per default. Class name: `HomepageColumn`

As in the case of the person page we have to add the newly created class `OrganizationTablePage` in method `execCreateChildPages` of the outline class `ContactOutline` as shown in Listing 12.

Listing 12. Adding the OrganizationTablePage to the ContactOutline.

```
  @Override
  protected void execCreateChildPages(List<IPage<?>> pageList) {
    // pages to be shown in the navigation area of this outline
    pageList.add(new PersonTablePage()); ①
    pageList.add(new OrganizationTablePage());
  }
```

① The pages will appear in the user interface according to the order in which they are added to the

outline.

4.4.7. What have we achieved?

In the second step of the "Contacts" tutorial we have created a person page and an organization page to display data of persons and organizations.

The "Contacts" application is in a clean state again and you can (re)start the backend and the frontend of the application and verify the user interface in your browser. The user interface should look like the screenshot provided in Figure 37.

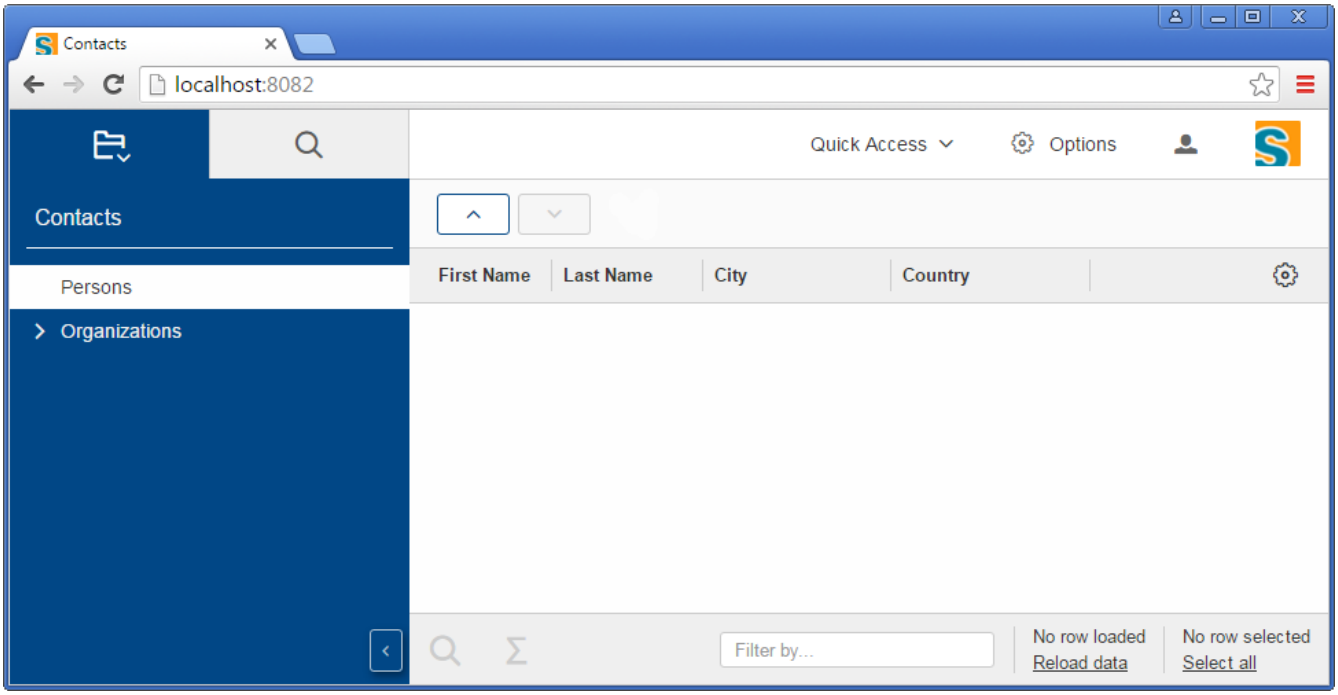


Figure 37. The "Contacts" application with the person and organization pages at the end of tutorial step 2.

When comparing the state of the "Contacts" tutorial application with the Scout demo application in Figure 24 the main difference is the missing person data. Adding access to a database is the focus of the next tutorial step.

4.5. Creating and Accessing the Database

This tutorial step shows how Scout applications can interact with databases via JDBC. Due to the clean layering implemented in the "Contacts" application only the Scout backend server connects to the database. We therefore focus on the Scout backend in this part of the tutorial.

For the "Contacts" application we will work with a Derby database. The choice of Derby is based on the fact that no additional installation is required and it is possible to work with in-memory databases.

We start this tutorial step with copying the classes that handle the database creation/access from the full "Contacts" demo application as described in Section 4.5.1. The setup is then explained in the following sections.

- Scout Config Properties (Section 4.5.2)

- The SQL Service and SQL Statements (Section 4.5.3)
- The Database Setup Service (Section 4.5.4)

With the basic infrastructure in place we review the existing "Contacts" backend to answer the question Section 4.5.5. In Section 4.5.6 we then add the missing pieces.

At the end of this tutorial step the "Contacts" backend server provides person and organization data to the frontend server as summarized in Section 4.5.7.

4.5.1. Adding the Infrastructure

This section describes the installation of the necessary components and classes that handle the database creation/access of the "Contacts" application.

To add the support for the Scout JDBC components and the Derby database we first need to declare the corresponding dependencies in the pom.xml file of the Maven server module. This can be done using the following steps.

- Expanding the Maven module `contacts.server` in the Eclipse Package Explorer
- Open the `pom.xml` file (use a double click on the file in the package explorer) and switch to the "pom.xml" tab in the Maven POM Editor.
- Add the database related dependencies according to Listing 13

Listing 13. The additional dependencies needed in the server pom.xml to use the derby database

```
<project xmlns="http://maven.apache.org/POM/4.0.0" xmlns:xsi=
"http://www.w3.org/2001/XMLSchema-instance" xsi:schemaLocation=
"http://maven.apache.org/POM/4.0.0 http://maven.apache.org/xsd/maven-4.0.0.xsd">
  <modelVersion>4.0.0</modelVersion>

  <parent>
    <groupId>org.eclipse.scout.contacts</groupId>
    <artifactId>org.eclipse.scout.contacts</artifactId>
    <version>9.0.0-SNAPSHOT</version>
    <relativePath>../org.eclipse.scout.contacts</relativePath>
  </parent>

  <artifactId>org.eclipse.scout.contacts.server</artifactId>

  <dependencies>
  <!-- database related dependencies --> ①
    <dependency>
      <groupId>org.eclipse.scout.rt</groupId>
      <artifactId>org.eclipse.scout.rt.server.jdbc</artifactId>
    </dependency>
    <dependency>
      <groupId>org.apache.derby</groupId>
      <artifactId>derby</artifactId>
      <version>10.14.2.0 </version>
    </dependency>
  </dependencies>
```

① Add the `derby` and the `org.eclipse.scout.rt.server.jdbc` dependencies to the pom.xml of your "Contacts" server module.

After adding the database dependencies to the server's pom.xml file we need to update all Maven server modules for the "Contacts" app. To do this, select the three modules `org.eclipse.scout.contacts.server.*` and hit `Alt+F5` as shown in Figure 38. Start the update with **[OK]**.

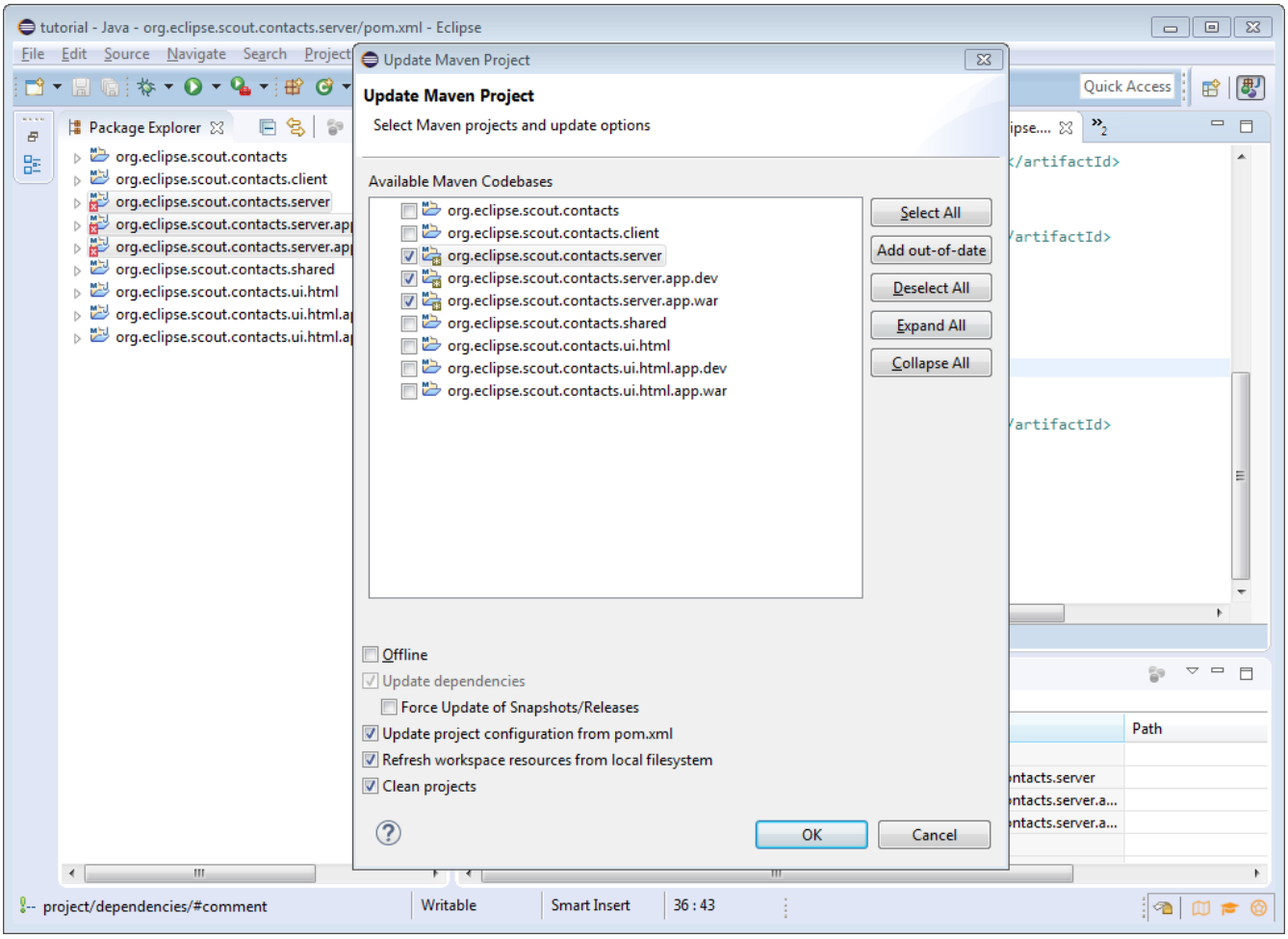


Figure 38. Update the Maven server modules for the "Contacts" application.

The next step is to create the `org.eclipse.scout.contacts.server.sql` package.

- Expand folder `src/main/java` of Maven module `contacts.server`
- Select the existing package `org.eclipse.scout.contacts.server` and hit `Ctrl+N`
- This opens the dialog to select a wizard. Enter "package" into the search field
- Select the *New Java Package* wizard with a double click on the Java *Package* proposal
- Enter `org.eclipse.scout.contacts.server.sql` into the *Name* field of the wizard and click **[Finish]**

We are now ready to copy the classes related to the database infrastructure from the "Contacts" demo application to our tutorial workspace.

The simplest way to do this is to open a second Eclipse IDE with the workspace where you have imported the Scout demo applications. If you have not done this yet go to the beginning of this tutorial Chapter 4 and catch up now.

In the demo application workspace navigate to the same package `org.eclipse.scout.contacts.server.sql` and copy over all its classes. After copying these classes make sure that the structure of your server Maven module looks as shown in Figure 39.

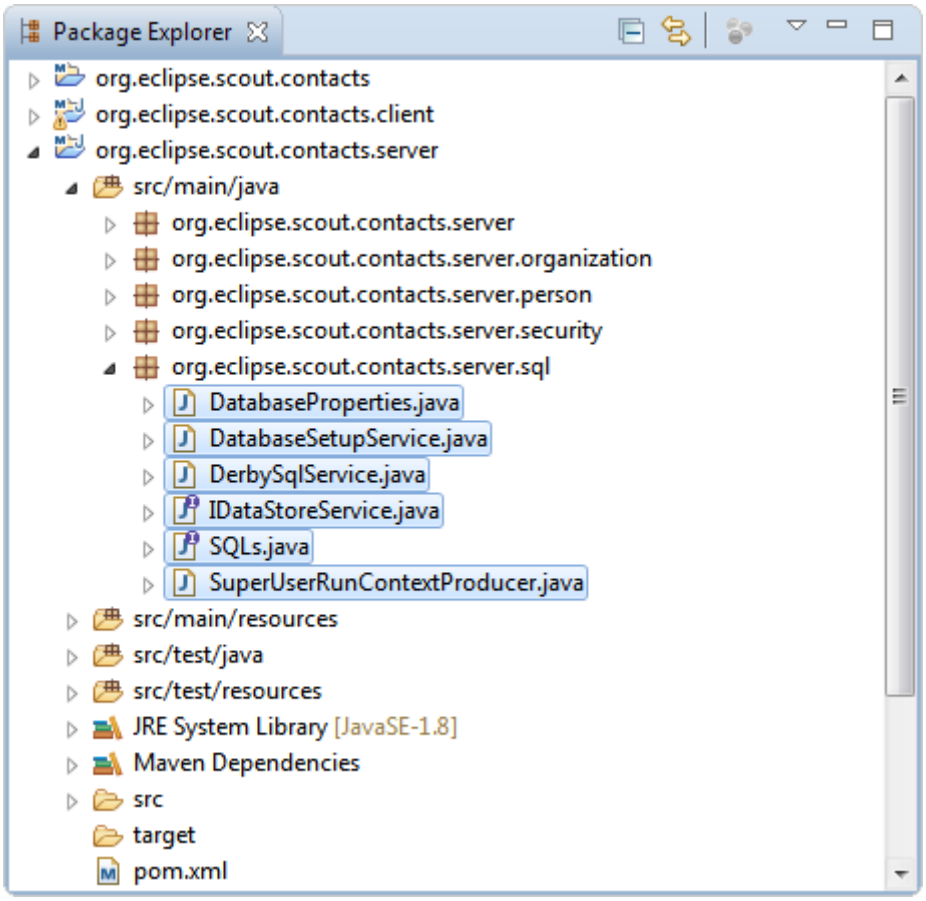


Figure 39. The copied database classes in the tutorial workspace.

The imported classes are described in the following sections. Additional information is provided where these classes are relying on Scout concepts that have not previously been introduced.

4.5.2. Scout Config Properties

Scout Config properties can greatly improve the flexibility of Scout applications. For the "Contacts" application this feature is used to keep its database setup configurable. Moving from a in-memory setup to a disk based database is then possible without any reprogramming.

The Scout backend (and frontent) applications initialize config properties from matching values found in file `config.properties`. For missing property values the default values defined in the config property classes are used.

In the case of the "Contacts" application the config property files are located in the subfolder `src/main/resources` of the Maven modules that specify the frontend and the backend application.

- Expand Maven module `contacts.server.app.dev`
- Expand subfolder `src/main/resources`
- Open file `config.properties` in the text editor
- Append all properties defined in Listing 14 to the file

Listing 14. Properties relevant for creating and accessing the database.

```
### Database
contacts.database.jdbc.mappingName=jdbc:derby:memory:contacts-database
contacts.database.autocreate=true
contacts.database.autopopulate=true

### Application specific
contacts.superuser=system
```

These added property values then match the config properties defined in the class `DatabaseProperties` provided in Listing 15. Remember that this is one of the database infrastructure classes we have copied before.

Listing 15. Typed properties for the "Contacts" application

```
public class DatabaseProperties {

  public static class DatabaseAutoCreateProperty extends AbstractBooleanConfigProperty
{
    // defines default value and key

    @Override
    public Boolean getDefaultValue() {
      return Boolean.TRUE; ①
    }

    @Override
    public String getKey() {
      return "contacts.database.autocreate"; ②
    }

    @Override
    public String description() {
      return "Specifies if the contacts database should automatically be created if it
does not exist yet. The default value is true.";
    }
  }

  public static class DatabaseAutoPopulateProperty extends
AbstractBooleanConfigProperty {
    // defines default value and key
  }

  public static class JdbcMappingNameProperty extends AbstractStringConfigProperty {
    // defines default value and key
  }

  public static class SuperUserSubjectProperty extends AbstractSubjectConfigProperty {
    // defines default value and key
  }
}
```

① Defines the default value of the property that is used if the property is not defined in file config.properties

② Defines the key to be used in file config.properties

In the Scout framework config properties are always typed and need to implement interface `IConfigProperty`. For commonly used types Scout already provides classes. A boolean property may be created by extending Scout class `AbstractBooleanConfigProperty`.

Accessing the actual property values in the code is demonstrated in the next section.

4.5.3. The SQL Service and SQL Statements

Accessing databases with the Scout framework is implemented with SQL services that extend base class `AbstractSqlService`. As the "Contacts" application will be working with a Derby database we also need a Derby specific SQL service.

This is why we have copied over class `DerbySqlService`. The only project specific method is `getConfiguredJdbcMappingName` as implemented in Listing 16.

Listing 16. The Derby SQL service to connect to the database

```
public class DerbySqlService extends AbstractDerbySqlService {

  @Override
  protected String getConfiguredJdbcMappingName() {
    String mappingName = CONFIG.getPropertyValue(JdbcMappingNameProperty.class);

    // add create attribute if we need to autocreate the db
    if (CONFIG.getPropertyValue(DatabaseAutoCreateProperty.class)) {
      return mappingName + ";create=true"; ①
    }

    return mappingName;
  }
}
```

① Check the Derby documentation for additional attributes.

This listing also demonstrates how to use the config properties in the code. With the property values defined in the previous section the "Contacts" application is working with an in-memory database.

To change the setup to a disk based version, we would have to change the value for the property `contacts.database.jdbc.mappingName` from `jdbc:derby:memory:contacts-database` to `jdbc:derby:<path-to-dir>`. For a Windows box a concrete example could look like this: `jdbc:derby:c:\\derby\\contacts-database`.

Now we look at how the actual SQL statements of the "Contacts" application work. For our application all statements are collected into a single class. While there are many more options how to organize SQL and Java code this setup has its own advantages.

- Efficient maintenance as all SQL statements are located in a single place
- Code completion support in the Eclipse IDE when using the statements
- The setup is easy to explain

The SQL statements related to the database structure are provided in Listing 17. The statements (or building blocks of statements) in class `SQLs` are plain SQL in many cases. In the other cases the statement texts include Scout specific syntax extensions with `:` as a prefix character. Examples are `:<identifier>` and `:{<identifier>.<attribute>}`.

Listing 17. Interface SQLs with the SQL commands for the creation of the database tables.

```
public interface SQLs {

  String SELECT_TABLE_NAMES = ""
      + "SELECT   UPPER(tablename) "
      + "FROM     sys.systables "
      + "INTO     :result"; ①

  String ORGANIZATION_CREATE_TABLE = ""
      + "CREATE   TABLE ORGANIZATION "
      + "         (organization_id VARCHAR(64) NOT NULL CONSTRAINT ORGANIZATION_PK
PRIMARY KEY,"
      + "          name VARCHAR(64), "
      + "          logo_url VARCHAR(512), "
      + "          url VARCHAR(64), "
      + "          street VARCHAR(64), "
      + "          city VARCHAR(64), "
      + "          country VARCHAR(2), "
      + "          phone VARCHAR(20), "
      + "          email VARCHAR(64), "
      + "          notes VARCHAR(1024)"
      + "         )";

  String PERSON_CREATE_TABLE = ""
      + "CREATE   TABLE PERSON "
      + "         (person_id VARCHAR(64) NOT NULL CONSTRAINT PERSON_PK PRIMARY KEY, "
      + "          first_name VARCHAR(64), "
      + "          last_name VARCHAR(64), "
      + "          picture_url VARCHAR(512), "
      + "          date_of_birth DATE, "
      + "          gender VARCHAR(1), "
      + "          street VARCHAR(64), "
      + "          city VARCHAR(64), "
      + "          country VARCHAR(2), "
      + "          phone VARCHAR(20), "
      + "          mobile VARCHAR(20), "
      + "          email VARCHAR(64), "
      + "          organization_id VARCHAR(64), "
      + "          position VARCHAR(512), "
      + "          phone_work VARCHAR(20), "
      + "          email_work VARCHAR(64), "
      + "          notes VARCHAR(1024), "
      + "          CONSTRAINT ORGANIZATION_FK FOREIGN KEY (organization_id) REFERENCES
ORGANIZATION (organization_id)"
      + "         )";
}
```

① The syntax ':identifier' adds convenience and is supported by the Scout framework

The next section discusses how the components introduced above are used by the "Contacts"

appliction to create an initial "Contacts" database during the startup phase of the application.

4.5.4. The Database Setup Service

The database setup service is responsible to create the "Contacts" database during the startup of the application. In order to implement such a service, a number of Scout concepts are combined into class `DatabaseSetupService`.

- Access config properties using class `CONFIG`
- Executing SQL statements via class `SQL`
- Logging via class `LOG`
- Scout platform with the annotations `@ApplicationScoped`, `@CreateImmediately` and `@PostConstruct`

How these elements are used in class `DatabaseSetupService` is shown in Listing 18. The actual creation of the "Contacts" database is performed by method `autoCreateDatabase`.

At the time of the database creation no user is yet logged into the application. This is why we use a run context associated with the super user. The context is then used to execute the runnable that creates the organization and person tables.

Listing 18. Class DatabaseSetupService to create the database tables for the "Contacts" application.

```
@ApplicationScoped
@CreateImmediately
public class DatabaseSetupService implements IDataStoreService {
  private static final Logger LOG = LoggerFactory.getLogger(DatabaseSetupService.
class);

  @PostConstruct
  public void autoCreateDatabase() {
    if (CONFIG.getPropertyValue(DatabaseAutoCreateProperty.class)) {
      try {
        RunContext context = BEANS.get(SuperUserRunContextProducer.class).produce();
        IRunnable runnable = () -> {
          createOrganizationTable();
          createPersonTable();
        };

        context.run(runnable);
      }
      catch (RuntimeException e) {
        BEANS.get(ExceptionHandler.class).handle(e);
      }
    }
  }

  public void createOrganizationTable() {
    if (!getExistingTables().contains("ORGANIZATION")) {
      SQL.insert(SQLs.ORGANIZATION_CREATE_TABLE);
      LOG.info("Database table 'ORGANIZATION' created");
```

```
      if (CONFIG.getPropertyValue(DatabaseAutoPopulateProperty.class)) {
        SQL.insert(SQLs.ORGANIZATION_INSERT_SAMPLE + SQLs.ORGANIZATION_VALUES_01);
        SQL.insert(SQLs.ORGANIZATION_INSERT_SAMPLE + SQLs.ORGANIZATION_VALUES_02);
        LOG.info("Database table 'ORGANIZATION' populated with sample data");
      }
    }
  }

  public void createPersonTable() {
    if (!getExistingTables().contains("PERSON")) {
      SQL.insert(SQLs.PERSON_CREATE_TABLE);
      LOG.info("Database table 'PERSON' created");

      if (CONFIG.getPropertyValue(DatabaseAutoPopulateProperty.class)) {
        SQL.insert(SQLs.PERSON_INSERT_SAMPLE + SQLs.PERSON_VALUES_01);
        SQL.insert(SQLs.PERSON_INSERT_SAMPLE + SQLs.PERSON_VALUES_02);
        LOG.info("Database table 'PERSON' populated with sample data");
      }
    }
  }

  private Set<String> getExistingTables() {
    StringArrayHolder tables = new StringArrayHolder();
    SQL.selectInto(SQLs.SELECT_TABLE_NAMES, new NVPair("result", tables)); ①
    return CollectionUtility.hashSet(tables.getValue());
  }
}
```

① The existing tables are stored in the `StringArrayHolder` object named "result".

The usage of `CONFIG` is already covered by the previous section. Introductions for `SQL`, `LOG` and the Scout platform annotations are provided below.

Logging

Scout uses the SLF4J framework for logging. For the actual implementation of the loggers Scout uses Logback per default. To use logging a local logger is first created using the SLF4J `LoggerFactory` class. Additional information regarding the logging configuration is provided below.

Executing SQL Statements

For the execution of SQL statements Scout provides the convenience class `SQL`. The various methods can be used with a simple SQL command as in `SQL.insert(mySqlCommand)` or using additional named objects as in `SQL.insertInto(mySqlCommand, myHolder)`. The Scout class `NVPair` is frequently used to create such named objects. Make sure that the identifiers (using the Scout `:` syntax) provided in the SQL commands always match with the names associated with the named objects.

Scout Platform

The Scout platform provides the basic infrastructure and a number of services to a Scout

application. Services are represented by Scout beans that are registered at startup with the platform and created once they are needed. For class `DatabaseSetupService` we can use the Scout annotation `@ApplicationScoped` to register the service and to make sure that there will only be a single instance of this class. To force the creation of a bean `DatabaseSetupService` at startup time we also add Scout annotation `@CreateImmediately`. Finally, the annotation `@PostConstruct` executes our method `autoCreateDatabase` as soon as the `DatabaseSetupService` bean is created.

Changing the basic log level of an application is a frequently used scenario. As Scout is using Logback per default we can adapt the log level in the `logback.xml` configuration files as shown in Listing 19. For the "Contacts" application these configuration files are located in folder `src/main/resources` of the Maven modules that define the frontend and the backend applications. More information regarding these configuration files is provided in the Logback manual.

Listing 19. Setting the log level in the logback.xml configuration file.

```
<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
<configuration>
  <root level="INFO"> ①
    <appender-ref ref="STDOUT" />
    <appender-ref ref="STDERR" />
  </root>
</configuration>
```

① The `level` attribute of the `<root>` element is used as the basic log level. Try "DEBUG" or "WARN" as alternative values.

4.5.5. What is missing?

This section reviews the backend infrastructure that has been created so far and identifies the pieces that are missing to fetch person and organization data to send it to the frontend server of the "Contacts" application.

During the creation of the person page and the organization page the Scout wizards created more than just Scout pages that are visible in the user interface. It also added corresponding classes in the shared module and the server module of the "Contacts" application.

The new page wizard basically added the complete round trip from the client (frontend server) to the server (backend server) and back. Using the organization page as an example, the setup created by the page wizard involves the following classes.

- Class `OrganizationTablePage` with method `execLoadData` in the client module
- The service interface `IOrganizationService` and class `OrganizationTablePageData` in the shared module
- Class `OrganizationService` with the method stub `getOrganizationTableData` in the server module

On the client side the server roundtrip is implemented in method `execLoadData` as shown in Listing 20.

Listing 20. Accessing the "Contacts" backend server to fetch organization data.

```
  @Override
  protected void execLoadData(SearchFilter filter) {
    importPageData(BEANS.get(IOrganizationService.class).getOrganizationTableData
(filter));
  }
```

This roundtrip between class `OrganizationTablePage` and `OrganizationService` works through the following steps.

1. `BEANS.get(IOrganizationService.class)` returns a reference to a client proxy service
2. Method `getOrganizationTableData(filter)` is executed on the corresponding server service
3. This method returns the organization data in the form of an `OrganizationTablePageData` object
4. Method `importPageData` transfers the data from the page data into the table of the user interface

On the server side fetching the data from the database will be implemented in class `OrganizationService` according to Listing 21.

Listing 21. Method getTableData to access the database and map the data into a pageData object.

```
public class OrganizationService implements IOrganizationService {

  @Override
  public OrganizationTablePageData getOrganizationTableData(SearchFilter filter) {
    OrganizationTablePageData pageData = new OrganizationTablePageData();
    return pageData;
  }
}
```

In the next section we will implement the database access logic in the `getOrganizationTableData` methods of the server classes `OrganizationService` and `PersonService`.

4.5.6. Fetching Organization and Person Data

We are now ready to fetch data from the Derby database using the available infrastructure and the SQL statements prepared in class `SQLs`. For the implementation of method `getOrganizationTableData` in class `OrganizationService` we will use the two SQL snippet provided in Listing 22.

Listing 22. Interface SQLs with the SQL to fetch the list of organizations with their attributes.

```
public interface SQLs {
  String ORGANIZATION_PAGE_SELECT = ""
      + "SELECT   organization_id, "
      + "         name, "
      + "         city, "
      + "         country, "
      + "         url "
      + "FROM     ORGANIZATION ";

  String ORGANIZATION_PAGE_DATA_SELECT_INTO = ""
      + "INTO     :{page.organizationId}, " ①
      + "         :{page.name}, "
      + "         :{page.city}, "
      + "         :{page.country}, "
      + "         :{page.homepage}";
}
```

① The syntax ':{identifier.attribute}' adds convenience to map SQL result sets to Scout page data objects.

Taking advantage of the SQL convenience offered by the Scout framework, we can add the missing functionality with two lines of code. See Listing 23 for the full listing of method `getOrganizationTableData`. After adding the two additional lines, we update the imports of the classes with pressing `Ctrl+Shift+O`.

Listing 23. Method getTableData to access the database and map the data into a pageData object.

```
public class OrganizationService implements IOrganizationService {

  @Override
  public OrganizationTablePageData getOrganizationTableData(SearchFilter filter) {
    OrganizationTablePageData pageData = new OrganizationTablePageData();

    String sql = SQLs.ORGANIZATION_PAGE_SELECT + SQLs
.ORGANIZATION_PAGE_DATA_SELECT_INTO; ①
    SQL.selectInto(sql, new NVPair("page", pageData)); ②

    return pageData;
  }
}
```

① Added line 1: Assembling of the SQL statement

② Added line 2: Fetching the data from the database and storing the result in `pageData`

Note that the identifier "page" in the NVPair object will be mapped to the same identifier used in the `ORGANIZATION_PAGE_DATA_SELECT_INTO` statement.

Finally, we have to also implement the loading of the person data in class `PersonService`. The

implementation of method `getPersonTableData` is provided in Listing 24.

Listing 24. Method getPersonTableData to access the database and map the data into a page data object.

```
public class PersonService implements IPersonService {

  @Override
  public PersonTablePageData getPersonTableData(SearchFilter filter) {
    PersonTablePageData pageData = new PersonTablePageData();

    String sql = SQLs.PERSON_PAGE_SELECT + SQLs.PERSON_PAGE_DATA_SELECT_INTO;
      SQL.selectInto(sql, new NVPair("page", pageData));

      return pageData;
  }
}
```

4.5.7. What have we achieved?

In the third step of the "Contacts" tutorial we have added the infrastructure to work with a Derby database. The infrastructure is used to create and populate the initial database. In addition person and organization data is now fetched from the database on the "Contacts" backend server and handed to the "Contacts" frontend server via a page data object.

The "Contacts" application is in a clean state again and you can (re)start the backend and the frontend of the application and verify the result in your browser. Person and company data is now visible in the user interface as shown in Figure 40.

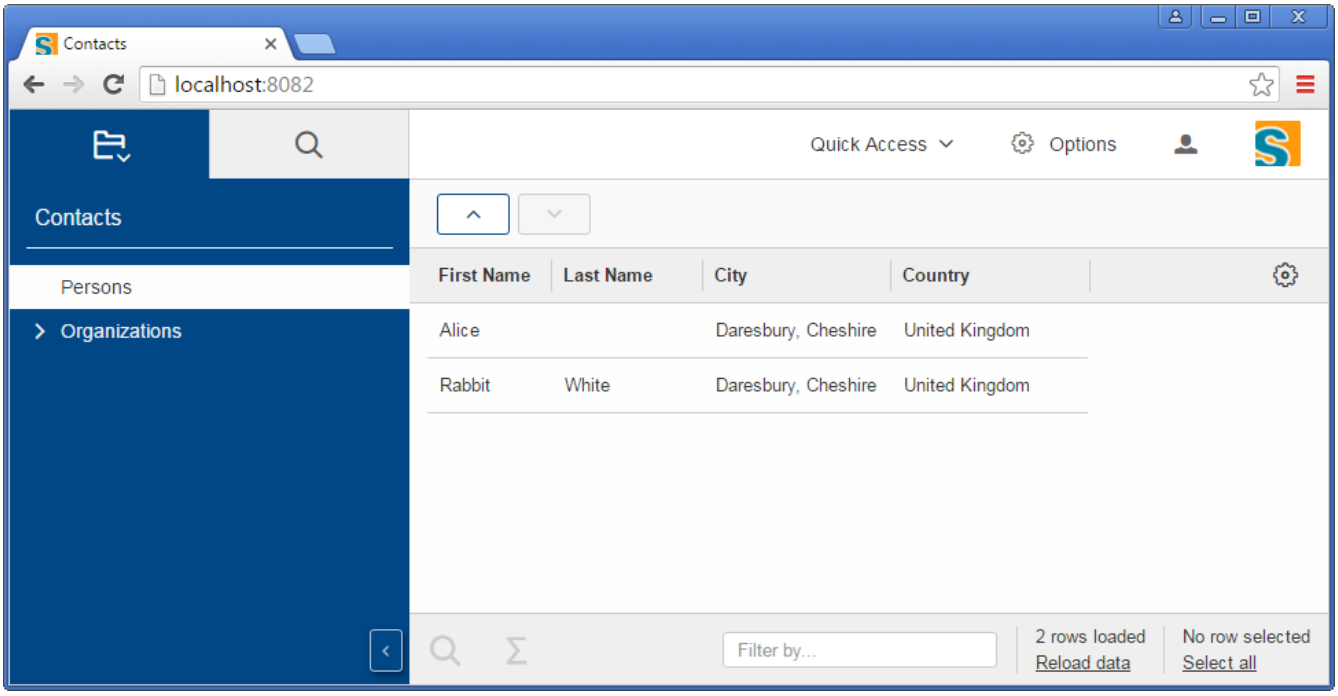


Figure 40. The "Contacts" application displaying person data at the end of tutorial step 3.

4.6. Adding a Form to Create/Edit Persons

In this tutorial step we add the Scout forms that are used to create and edit persons and organizations in the user interface. This tutorial step also provides an introduction into the design and implementation complex form layouts with the Scout framework.

Before we start with the actual implementation of the form Section 4.6.1 provides an introduction to the layouting concepts of the Scout framework. Based on this information we design a hierarchical form layout for the person form and can then dive into the creation of the person form.

- Implementing the Form (Section 4.6.2)
- Adding a Gender Code Type (Section 4.6.3)
- Adding Form Fields (Section 4.6.4)
- Person Form Handler and Person Service (Section 4.6.5)

The tutorial step concludes with a summary in Section 4.6.6.

4.6.1. Designing the Person Form

We start with the sketch of the form layout as shown in Figure 41.

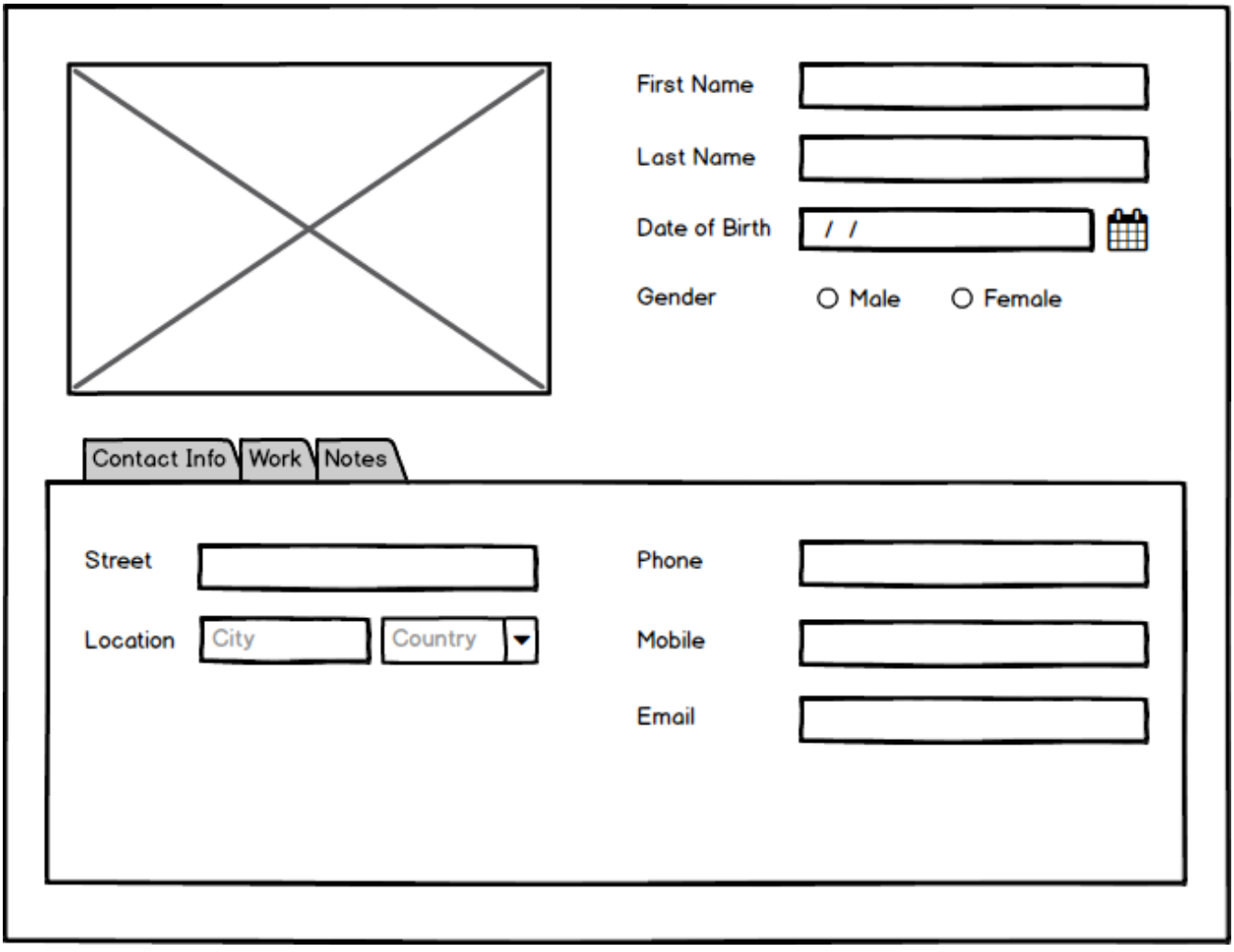


Figure 41. A sketch of the target layout for the person form.

The upper half of the form shows a picture of the person and contains some primary attributes such as first name and the gender of the person.

The lower half of the form contains tab boxes. A "Contact Info" tab provides contact details of the person and adding notes for the person in the form of free text is possible in the "Notes" tab.

Figure 42 below shows how the sketched form can fit with the logical grid layout of the Scout framework. Scout containers have two columns (indicated in red) per default and as many rows (indicated in yellow) as needed.

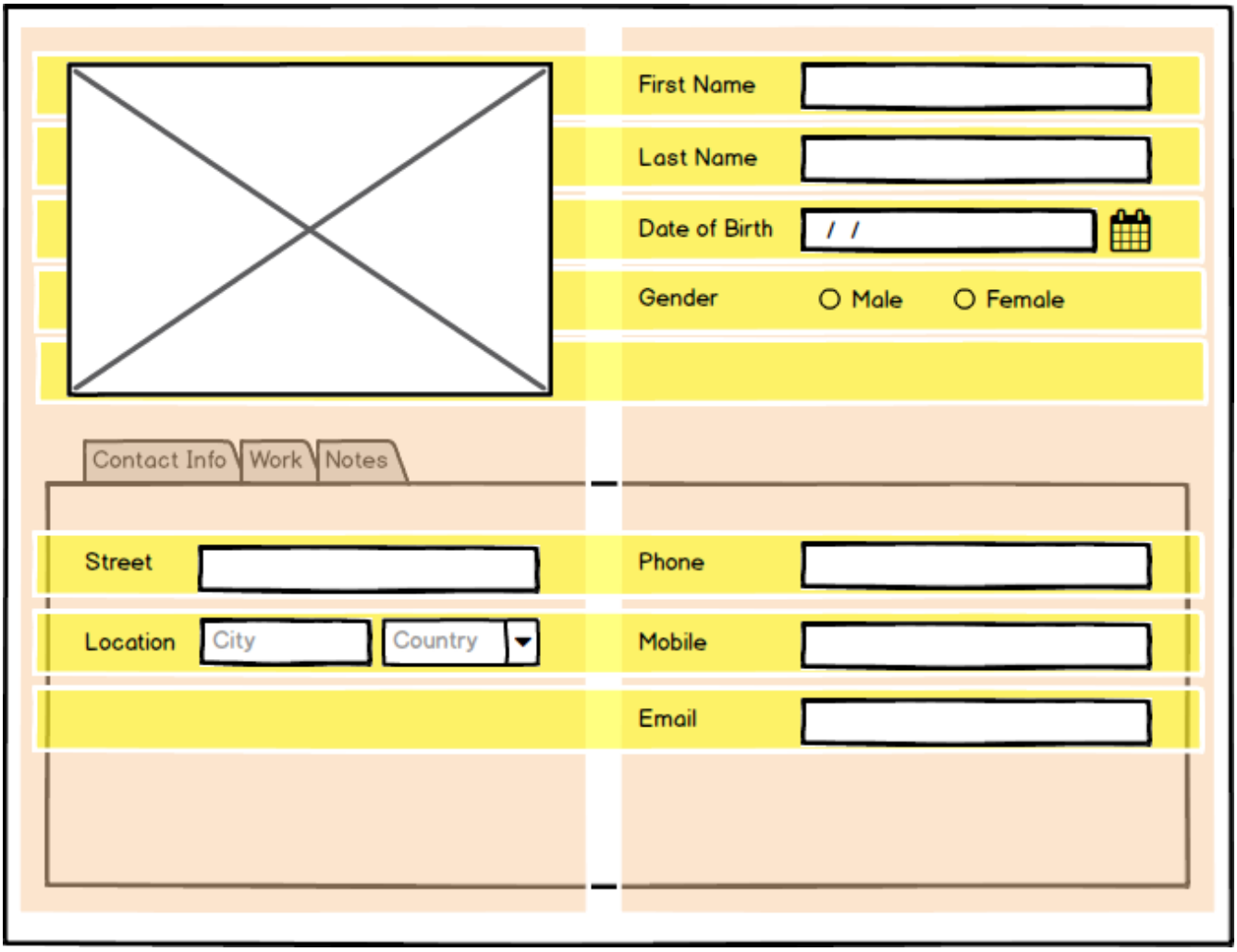


Figure 42. Logical columns and rows of the Scout form layout. Scout containers have two columns per default.

Individual form fields consist of a label part and a field part and occupy a single cell in the logical grid. Examples for fields using the default configuration are the first name field or the email field. When needed, fields can be configured to occupy several columns or rows. An example for this case is the image field that will hold the picture of the person. This field is configured to occupy 5 logical rows.

With Scout's container widgets such as group boxes, tab boxes and sequence boxes complex layouts can be achieved. Containers provide a lot of flexibility as these widgets can be nested hierarchically as shown in Figure 43

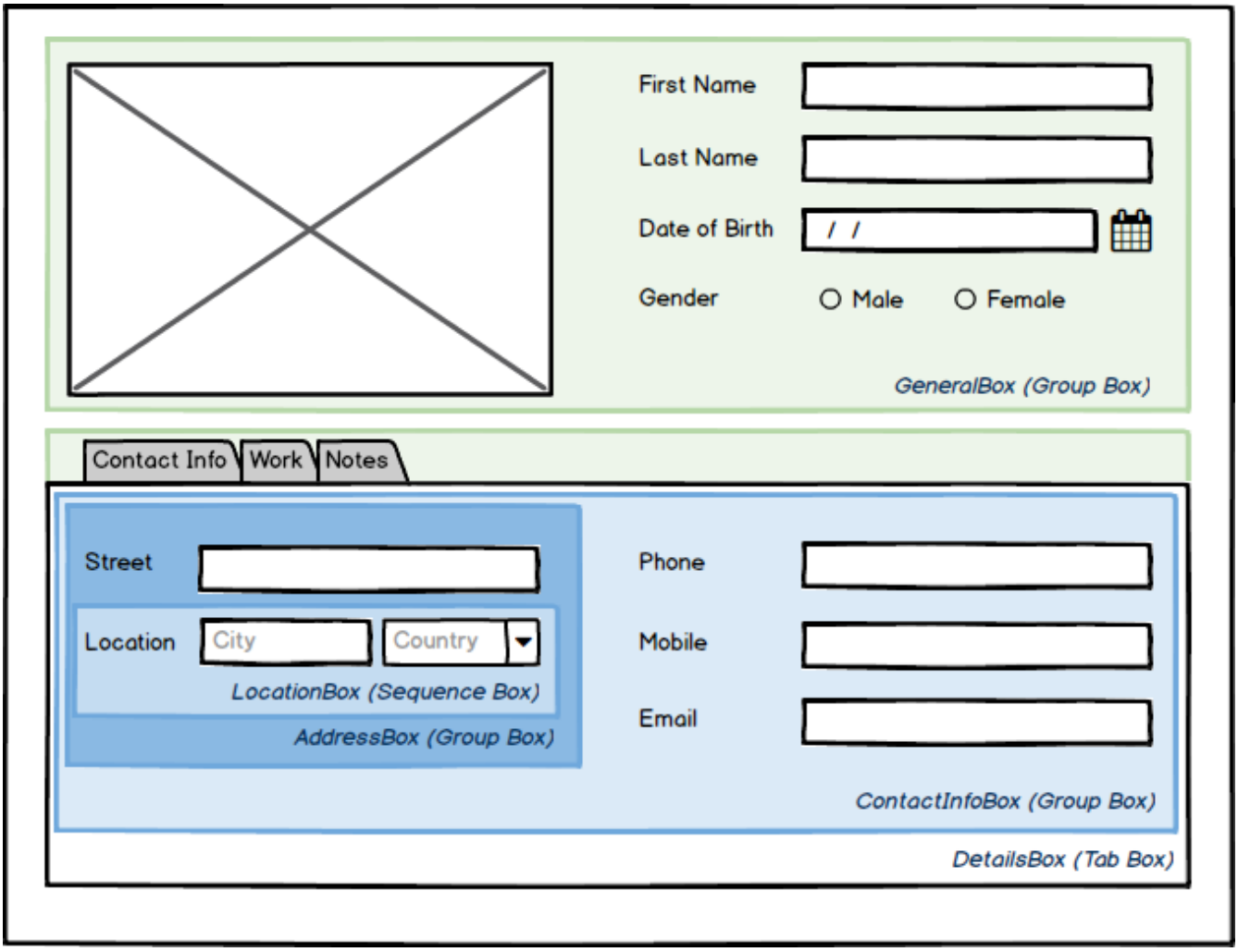


Figure 43. The hierarchical organization of the form including Scout group boxes, tab boxes and a sequence box.

The sketch above details the organization of the container components to match the desired layout for the person form. The different container widgets can all be used with their default settings except for the address box.

For the address box we will have to modify its size and its inner organization. As group boxes occupy two columns per default we will need to reduce the width of the address box to a single column. The second change is to the inner layout of the address box. To force the location box to come below the street field we have to change the inner layout of the group box to a single column as well. Otherwise, the location box would be shown next to the street field.

In the next section we will start to implement the person form with the layout described above.

4.6.2. Implementing the Form

In this section we implement the person form with its container widgets as described in the previous section. To be able to use the form to create and edit persons we will add "New" and "Edit" context menus to the table in the person page. Finally we will also add a "Create Person" entry to the the "Quick Access" top level menu of the application.

Start the form creation with the Scout new form wizard following the steps listed below.

1. Expand the Maven module `contacts.client` in the Eclipse package explorer

2. Select package `org.eclipse.scout.contacts.client.person` in folder `src/main/java`
3. Press `Ctrl+N` and enter "form" into the search field of the wizard selection dialog
4. Select the *Scout Form* proposal and click the **[Next]** button
5. Enter "Person" into the *Name* and verify that the field contents match Figure 44
6. Click **[Finish]** to start the creation of the form and its related components

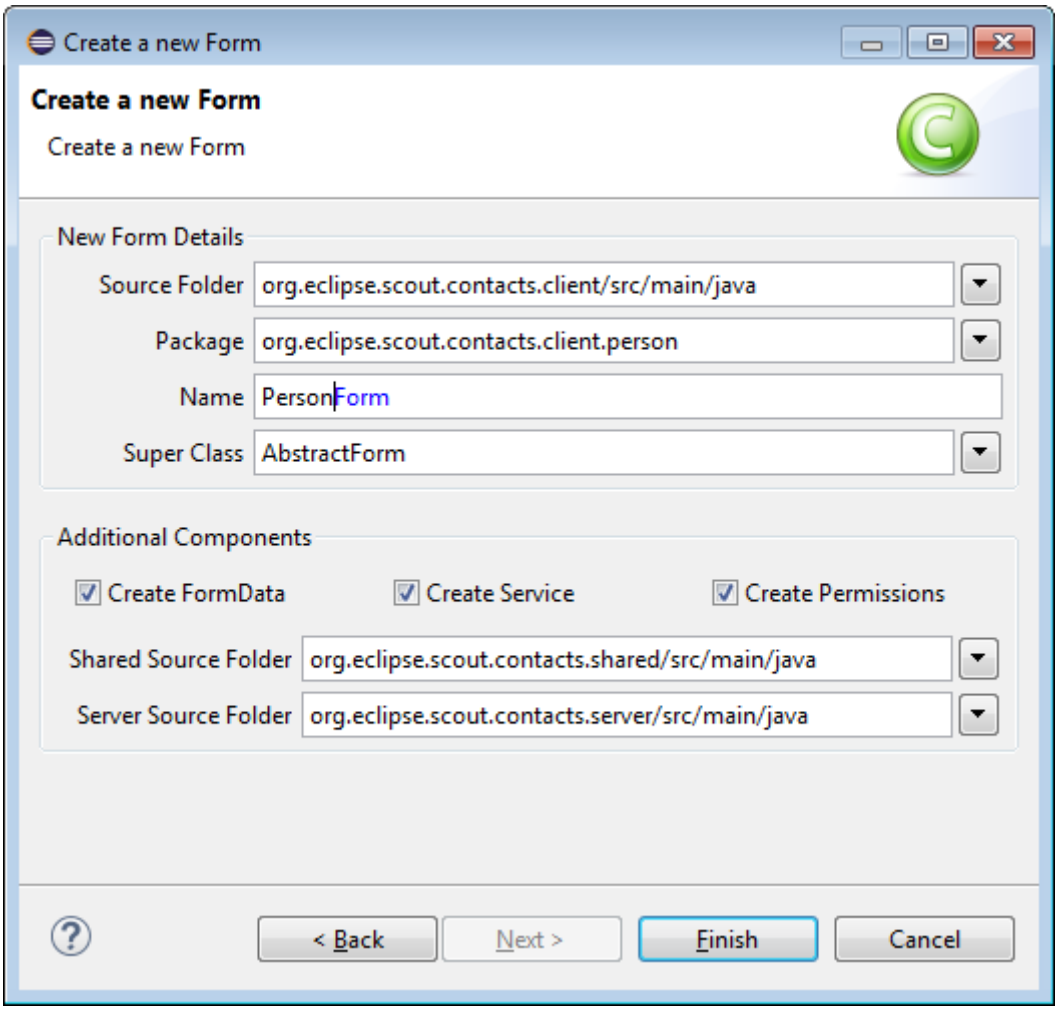


Figure 44. Use the New Scout Form to create the person form.

Now open the newly created class `PersonForm` in the Java editor and perform the changes listed below as shown in Listing 25.

- Add property `personId` with the corresponding getter and setter methods
- Add method `computeExclusiveKey`
- Add method `getConfiguredDisplayHint`
- Verify the translated text entry in method `getConfiguredTitle`

Listing 25. Add getConfiguredDisplayHint and the methods related to the person's primary key.

```
@FormData(value = PersonFormData.class, sdkCommand = SdkCommand.CREATE) ①
public class PersonForm extends AbstractForm {

  // represents the person's primary key
  private String personId;

  @FormData ②
  public String getPersonId() {
    return personId;
  }

  @FormData ②
  public void setPersonId(String personId) {
    this.personId = personId;
  }

  @Override
  public Object computeExclusiveKey() { ③
    return getPersonId();
  }

  @Override
  protected int getConfiguredDisplayHint() { ④
    return IForm.DISPLAY_HINT_VIEW;
  }

  @Override
  protected String getConfiguredTitle() {
    return TEXTS.get("Person");
  }
}
```

① Links the form with its form data class `PersonFormData`.

② The annotation `@FormData` on the getter and setter method define the `personId` as a property that will be included in the form data.

③ The object returned by this method is used by the framework to verify if a specific entity is already opened in some other form.

④ Configure this form to be opened in the view mode. Views are opened in the bench area of the user interface.

We are now going to add the layout containers according to Listing 26. First add class `GeneralBox` using the Scout content assist selecting the *Group Box* proposal. Delete method `getConfiguredLabel`, as we are only using this group box to organize fields.

After the general box add a tab box container class by choosing the *Tab Box* proposal in the Scout content assist. Inside of class `DetailsBox` create the individual tab containers "Contact Info", "Work" and "Notes" as inner classes of the details box according to Listing 26.

Listing 26. The layouting structure of the person form using Scout container widgets.

```
public class PersonForm extends AbstractForm {

  @Order(10)
  public class MainBox extends AbstractGroupBox { ①

    @Order(10)
    public class GeneralBox extends AbstractGroupBox { ②
    }

    @Order(20)
    public class DetailsBox extends AbstractTabBox { ③

      @Order(10)
      public class ContactInfoBox extends AbstractGroupBox { ④

        @Order(10)
        public class AddressBox extends AbstractGroupBox {
        }
      }

      @Order(20)
      public class WorkBox extends AbstractGroupBox {
      }

      @Order(30)
      public class NotesBox extends AbstractGroupBox {
      }
    }

    @Order(30)
    public class OkButton extends AbstractOkButton {
    }

    @Order(40)
    public class CancelButton extends AbstractCancelButton {
    }
  }
}
```

① Every Scout form has a class `MainBox`. It contains all visible UI components.

② The `GeneralBox` will hold the picture field, first name and last names, the date of birth and the gender.

③ The `DetailsBox` tab box will contain the various tabs implemented in inner group boxes.

④ The containers `ContactInfoBox`, `WorkBox` and `Notes` represent the three tabs of the tab box.

To actually open the person form the form needs to be integrated in the user interface. In Scout application forms are typically opened by first selecting a specific row in a page and then using a

context menu. For the "Contacts" application we will follow this pattern too.

Open class `PersonTablePage` in the Java editor and create the context menus "New" and "Edit" in the inner class `Table` according to Listing 27.

Listing 27. The page context menus to open the person form.

```
@PageData(PersonTablePageData.class)
public class PersonTablePage extends AbstractPageWithTable<Table> {

  public class Table extends AbstractTable {

    @Override
    protected Class<? extends IMenu> getConfiguredDefaultMenu() { ①
      return EditMenu.class;
    }

    @Order(10)
    public class EditMenu extends AbstractMenu {
      @Override
      protected String getConfiguredText() {
        return TEXTS.get("Edit");
      }

      @Override
      protected void execAction() {
        PersonForm form = new PersonForm();
        form.setPersonId(getPersonIdColumn().getSelectedValue()); ②
        form.addFormListener(new PersonFormListener());
        // start the form using its modify handler
        form.startModify();
      }
    }

    @Order(20)
    public class NewMenu extends AbstractMenu {

      @Override
      protected String getConfiguredText() {
        return TEXTS.get("New");
      }

      @Override
      protected Set<? extends IMenuType> getConfiguredMenuTypes() { ③
        return CollectionUtility.<IMenuType> hashSet(
            TableMenuType.EmptySpace, TableMenuType.SingleSelection);
      }

      @Override
      protected void execAction() {
        PersonForm form = new PersonForm();
```

```
        form.addFormListener(new PersonFormListener());
        // start the form using its new handler
        form.startNew();
      }
    }

    private class PersonFormListener implements FormListener {

      @Override
      public void formChanged(FormEvent e) {
        // reload page to reflect new/changed data after saving any changes
        if (FormEvent.TYPE_CLOSED == e.getType() && e.getForm().isFormStored()) {
          reloadPage();
        }
      }
    }
  }
}
```

① This action gets executed when the user presses `Enter` on a table row or double clicks on a table row.

② Transfer the primary key of the selected person row to the person form.

③ Including `TableMenuType.EmptySpace` in the return value activates the "New" menu even when no row is selected.

In addition to the context menus defined for the person page we also add a "Create new person" menu on the desktop under the "Quick Access" top level menu. To do this open class `Desktop` in the Java editor and navigate to the inner class `QuickAccessMenu`. We can then add a `NewPersonMenu` using the Scout content assist and selecting the *Menu* proposal entry. The final implementation for the "Create new person" menu is provided in Listing 28.

Listing 28. The "Create new person" menu on the desktop.

```
public class Desktop extends AbstractDesktop {

  @Order(10)
  public class QuickAccessMenu extends AbstractMenu {

    @Override
    protected String getConfiguredText() {
      return TEXTS.get("QuickAccess");
    }

    @Order(10)
    public class NewPersonMenu extends AbstractMenu {

      @Override
      protected String getConfiguredText() {
        return TEXTS.get("NewPersonMenu");
      }

      @Override
      protected void execAction() {
        new PersonForm().startNew();
      }
    }

  }
}
```

We have now created the initial implementation of the person form including context menus to open the form from the person page and the "Quick Access" top level menu of the "Contacts" application. At this point it is already possible to verify that the person form can be opened on the user interface via the context menus. A screenshot of the current state is shown in Figure 45.

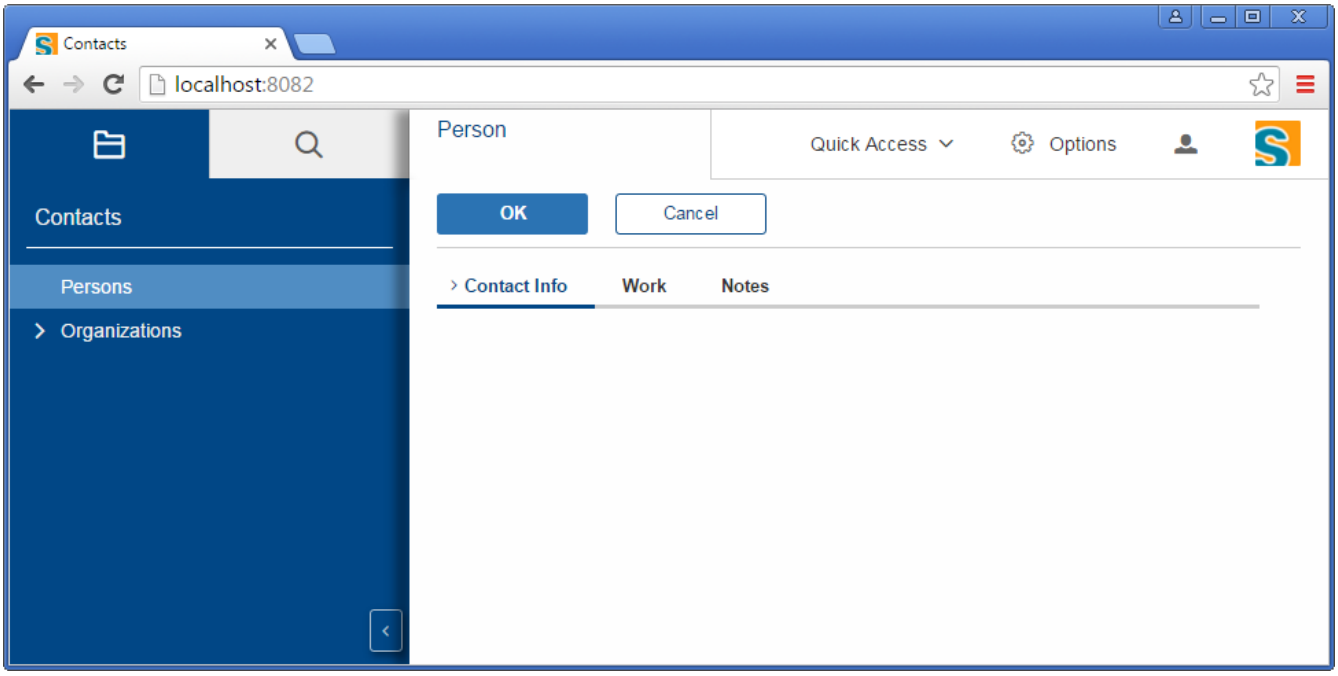


Figure 45. The initial person form and the top level menu "Create new person".

This initial implementation of the person form is also ready to add the individual form fields into the container boxes. For the fields of the person form we can directly extend the abstract form field classes offered by the Scout framework. Only for the implementation of the gender field we need a Scout code type that represents the possible values for the radio buttons.

4.6.3. Adding a Gender Code Type

In this section we will add a gender code type for the "Contacts" application. As code types can be used for the specification of the options of a radio button group, we will be able to implement the gender field by providing a reference to the code type. To keep things simple, the gender code type will contain a "Male" code and a "Female" code.

Code types are frequently used in both the frontend and the backend of an application. This implies that code type classes need to be implemented in the application's shared module. As the gender code type is related to persons we will implement this class in the person package.

Follow the steps described below to create the gender code type.

1. Expand the Maven module `contacts.shared` in the Eclipse package explorer
2. Select package `org.eclipse.scout.contacts.shared.person` in folder `src/main/java`
3. Press `Ctrl+N` and enter "code" into the search field of the wizard selection dialog
4. Select the *Scout CodeType* proposal and click the **[Next]** button
5. Enter "Gender" into the *Name* field and use the type `String` for the first and second type argument according to Figure 46

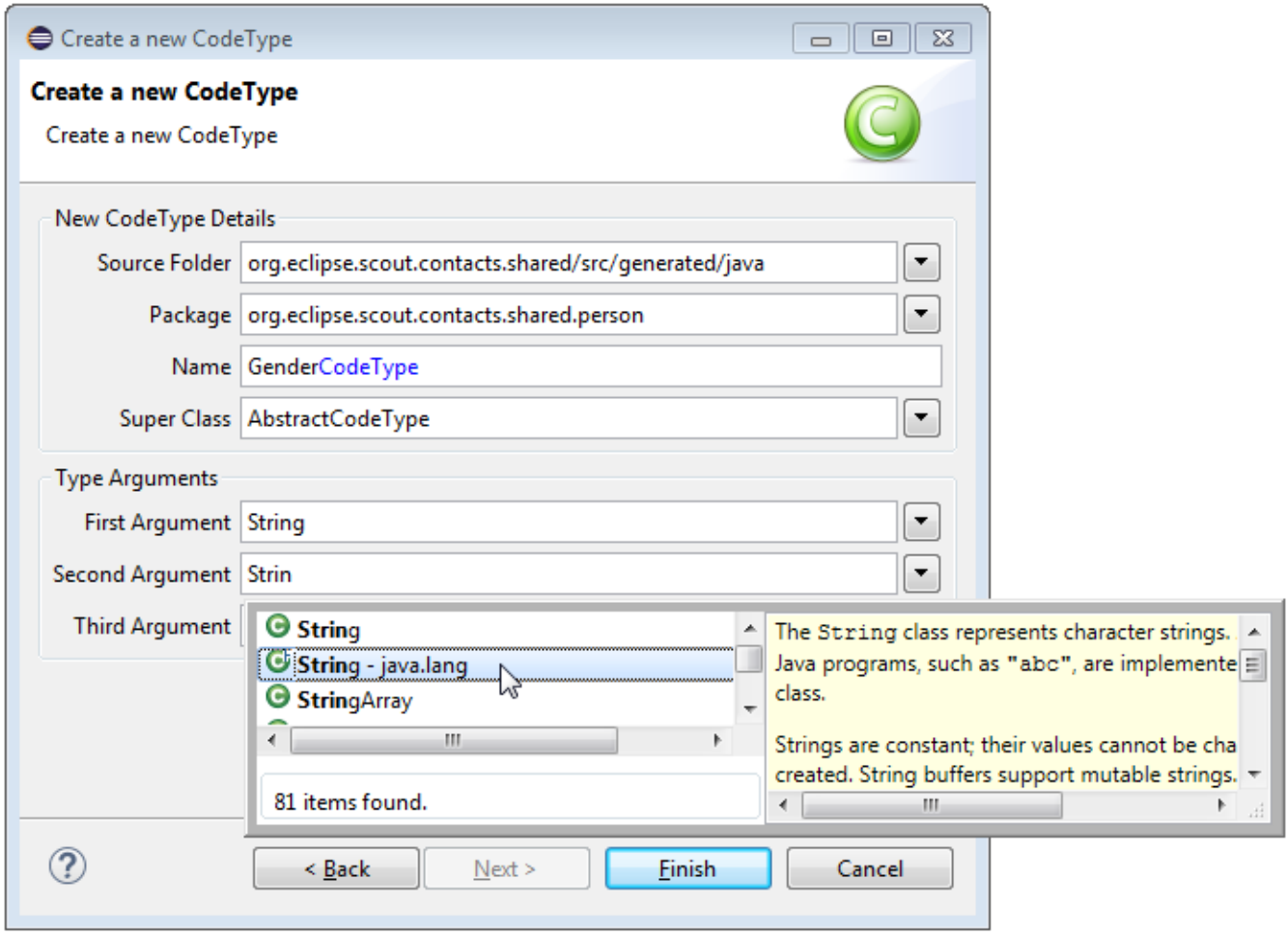


Figure 46. Create the gender code using the Scout new code wizard.

Now click button **[Finish]** to start the wizard. Then, open the newly created class `GenderCodeType` in the Java editor and set the `ID` constant to "Gender". The created class will then look like Listing 29 except for the missing inner code classes. We will add these inner codes as the next step.

Listing 29. The Scout code type to represent the gender of a person. This code type will be used for the gender field.

```
public class GenderCodeType extends AbstractCodeType<String, String> {

  private static final long serialVersionUID = 1L;
  public static final String ID = "Gender";

  @Override
  public String getId() {
    return ID;
  }

  @Order(1000)
  public static class MaleCode extends AbstractCode<String> {

    private static final long serialVersionUID = 1L;
    public static final String ID = "M";

    @Override
    protected String getConfiguredText() {
      return TEXTS.get("Male");
    }

    @Override
    public String getId() {
      return ID;
    }
  }

  @Order(2000)
  public static class FemaleCode extends AbstractCode<String> {

    private static final long serialVersionUID = 1L;
    public static final String ID = "F";

    @Override
    protected String getConfiguredText() {
      return TEXTS.get("Female");
    }

    @Override
    public String getId() {
      return ID;
    }
  }
}
```

To add an inner class `MaleCode` code to the gender code type perform the steps below.

1. Press `Ctrl+Space` and select the *Code* proposal with a double click
2. Enter "Male" into the first box to be used in the `MaleCode` class name
3. Tab to the value for the `ID` constant and set it to "M"
4. Tab to the value in `TEXTS.get` and add "Male" and its translated text
5. Hit `Enter` to finish

Then repeat the steps above for the female code.

4.6.4. Adding Form Fields

In this section we will add the form fields to the layout containers of the person form. We will start with filling the general box with the picture field, followed by the other fields in the upper part of the person form. Finally, we fill the individual tab boxes into the details box in the lower part of the person form.

As the first field we add the field that will show the picture of the person to the `GeneralBox` container.

1. Open class `PersonForm` in the Java editor
2. Place the curson in the body of the inner class `GeneralBox`.
3. Copy the code provided in Listing 30 into the general box.
4. Add for each field a getter method above the MainBox (where all other getters are). Alternatively you could use the SDK to create both fields (including getters) and add the code from Listing 30.
5. Hit `Ctrl+Shift+O` and fix the necessary imports.

Listing 30. The picture field for the person form.

```
@Order(10)
public class PictureUrlField extends AbstractStringField {

  @Override ①
  protected boolean getConfiguredVisible() {
    return false;
  }
}

@Order(20)
public class PictureField extends AbstractImageField {

  @Override ②
  protected Class<PictureUrlField> getConfiguredMasterField() {
    return PictureUrlField.class;
  }

  @Override ③
  protected void execChangedMasterValue(Object newMasterValue) {
```

```
      updateImage((String) newMasterValue);
    }

    @Override
    protected boolean getConfiguredLabelVisible() {
      return false;
    }

    @Override
    protected int getConfiguredGridH() {
      return 5;
    }

    protected void updateImage(String url) {
      clearErrorStatus(); ④

      if (url == null) {
        setImage(null);
      }
      else {
        try {
          setImage(IOUtility.readFromUrl(new URL((String) url)));
          setAutoFit(true);
        }
        catch (Exception e) { ⑤
          String message = TEXTS.get("FailedToAccessImageFromUrl");
          addErrorStatus(new Status(message, IStatus.WARNING));
        }
      }
    }
  }
```

① Sets the field invisible. An invisible field does not need space in the user interface.

② Declares `PictureUrlField` as the master field of the picture field.

③ This method will be called when the value of the master field has changed.

④ Clears any field error status.

⑤ Sets the field error status in case of an exception during the loading of the image.

Using the combination of the `PictureField` and `PictureUrlField` as its master field has two benefits. First, having a field that contains the the URL makes sure that this information is also stored in the form data and second, the method `execChangedMasterValue` can then be used to trigger the refresh of the actual picture when the picture URL is changed.

The remaining fields for the general box can then be added using the Scout content assist or by copying Listing 31 into the code below the picture field, again not forgetting the getters above the MainBox.

Listing 31. The other fields in the general box.

```
    @Order(30)
    public class FirstNameField extends AbstractStringField {

      @Override
      protected String getConfiguredLabel() {
        return TEXTS.get("FirstName");
      }
    }

    @Order(40)
    public class LastNameField extends AbstractStringField {

      @Override
      protected String getConfiguredLabel() {
        return TEXTS.get("LastName");
      }
    }

    @Order(50)
    public class DateOfBirthField extends AbstractDateField {

      @Override
      protected String getConfiguredLabel() {
        return TEXTS.get("DateOfBirth");
      }
    }

    @Order(60)
    public class GenderGroup extends AbstractRadioButtonGroup<String> {

      @Override
      protected String getConfiguredLabel() {
        return TEXTS.get("Gender");
      }

      @Override ①
      protected Class<? extends ICodeType<?, String>> getConfiguredCodeType() {
        return GenderCodeType.class;
      }
    }
```

① The codes defined in `GenderCodeType` will be used to determine the actual radio buttons to add to the gender field.

Whenever we add several fields to a Scout container field the individual fields will be displayed according to their order specified by the `@Order` annotation in the source code. Using the default two column layout, the Scout layouting engine uses the first fields to fill up the first column before the remaining fields are assigned to the second column. In general the Scout layouting engine tries to

balance the number of fields over all available columns. For the general box this rule has the effect that the picture field (this is the first field according to its order value) is assigned to the left column and all other fields are assigned to the right column.

After having added all the fields to the general box of the person form we can now fill the individual tabs of the `DetailsBox` container. We start with adding the content to the tabs "Work" and "Notes" as described below.

Now add the string fields listed below to the "Work" tab as inner classes of the container field `WorkBox`. Use the Scout content assist to add the fields and select *String Field* as the type of each field.

- Class `PositionField`, using label "Position"
- Class `OrganizationField`, using label "Organization"
- Class `PhoneWorkField`, using label "Phone"
- Class `EmailWorkField`, using label "E-Mail"

The "Notes" tab represented by the container field `NotesBox` only contains a single string field. This field will not need a label, span 4 rows of the logical grid and hold a multi line text according to Listing 32.

Listing 32. The notes tab box with its multi line text field.

```
    @Order(30)
    public class NotesBox extends AbstractGroupBox {

      @Override
      protected String getConfiguredLabel() {
        return TEXTS.get("Notes");
      }

      @Order(10)
      public class NotesField extends AbstractStringField {

        @Override
        protected int getConfiguredGridH() {
          return 4;
        }

        @Override
        protected boolean getConfiguredLabelVisible() {
          return false;
        }

        @Override
        protected boolean getConfiguredMultilineText() {
          return true;
        }
      }
    }
  }
```

Next is the implementation of the address box in the "Contact Info" tab. The address box is realized as a single column group box that holds a street field, a city field and a country field. According to the form layout defined in Section 4.6.1 the city field and the country field will be located on the same logical row and in the same cell of the logical grid.

In the Scout default layout each form field uses up a single cell of the logical grid. Whenever we like to be more economical with the space occupied by several fields, we can work with a Scout sequence box. Inner fields of a sequence box will be arranged on a single row from left to right and the spacing between the inner fields will be minimal.

Taking advantage of these properties we implement the location box as a sequence field according to Listing 33. To further optimize screen real estate we also switch to on-field labels for the city field and the country field.

Listing 33. The content of the address box.

```
    @Order(10)
    public class AddressBox extends AbstractGroupBox {
```

```
        @Override
        protected boolean getConfiguredBorderVisible() {
          return false;
        }

        @Override
        protected int getConfiguredGridH() { ①
          return 3;
        }

        @Override
        protected int getConfiguredGridW() { ①
          return 1;
        }

        @Override
        protected int getConfiguredGridColumnCount() { ②
          return 1;
        }
        @Order(10)
        public class StreetField extends AbstractStringField {

          @Override
          protected String getConfiguredLabel() {
            return TEXTS.get("Street");
          }
        }

        // use a sequence box for horizontal layout ③
        @Order(20)
        public class LocationBox extends AbstractSequenceBox {

          @Override
          protected String getConfiguredLabel() {
            return TEXTS.get("Location");
          }

          @Override
          protected boolean getConfiguredAutoCheckFromTo() { ④
            return false;
          }

          @Order(10)
          public class CityField extends AbstractStringField {

            @Override
            protected String getConfiguredLabel() {
              return TEXTS.get("City");
            }

            @Override
```

```
              protected byte getConfiguredLabelPosition() {
                return LABEL_POSITION_ON_FIELD; ⑤
              }
            }

            @Order(20)
            public class CountryField extends AbstractSmartField<String> {

              @Override
              protected String getConfiguredLabel() {
                return TEXTS.get("Country");
              }

              @Override
              protected byte getConfiguredLabelPosition() {
                return LABEL_POSITION_ON_FIELD;
              }

              @Override
              protected Class<? extends ILookupCall<String>> getConfiguredLookupCall()
{
                return CountryLookupCall.class;
              }
            }
          }
        }
```

① Makes the address box to occupy 1 column and 3 rows.

② The content in the address box will use a single column layout.

③ Extending a Scout sequence box will place the inner fields of the `LocationBox` on a single row.

④ Disables the default check if the value of the first field in the sequence box is less than the value in the second field.

⑤ On field labels do not take any additional space and are shown in the field itself.

While string fields are used for the street field and the city field, the country field is implemented as a smart field. Scout smart fields can be viewed as a powerful drop down lists with search-as-you-type support. In the case of the country field the smart field is backed by the lookup class `CountryLookupCall` that we already used for the country smart column in the person page.

After the address box the "Contact Info" box contains the three fields mentioned below. Use the Scout content assist to add the fields and select *String Field* as the type of each field.

- Class `PhoneField`, using label "Phone"
- Class `MobileField`, using label "Mobile"
- Class `EmailField`, using label "E-Mail"

We have now completed the implementation of the form layout and added all form fields of the person form. The application is now in a state where we can verify the layout of the person form

and check the handling of the different input fields. (Re)start the application and enter some values into the various fields of the person form.

To view and enter person data with the form we have yet to add the interaction with the database in the backend of the "Contacts" application. This is the topic of the next section.

4.6.5. Person Form Handler and Person Service

This section shows how we can integrate the person form created in the previous sections with the "Contacts" backend application to load and store person data with the database.

Most of the necessary infrastructure such as the transfer objects between the frontend and the backend application has already been created by the Scout form wizard. In the text below we will first discuss the setup created by the new form wizard and then add the missing code snippets to interact with the database.

On the frontend side, the Scout new form wizard has also created the two form handler classes `ModifyHandler` and `NewHandler`. By convention a `ModifyHandler` is used to change existing data and a `NewHandler` implements the creation of new data.

Form handler classes provide a number of callback methods that are invoked at various stages during the life cycle of the form. The implementation created by the Scout wizard includes the methods `execLoad` and `execStore` for each form handler. In these methods the form fetches data from the Scout backend application and/or sends new data to the backend server.

Adapt the default implementation of the form handlers according to Listing 34.

Listing 34. The new handler and modify handler for the person form.

```
public class PersonForm extends AbstractForm {

  public class ModifyHandler extends AbstractFormHandler {

    @Override
    protected void execLoad() {
      IPersonService service = BEANS.get(IPersonService.class); ①
      PersonFormData formData = new PersonFormData();
      exportFormData(formData); ②
      formData = service.load(formData); ③
      importFormData(formData); ④

      getForm().setSubTitle(calculateSubTitle()); ⑤
    }

    @Override
    protected void execStore() {
      IPersonService service = BEANS.get(IPersonService.class);
      PersonFormData formData = new PersonFormData();
      exportFormData(formData);
      service.store(formData); ⑥
    }
  }

  public class NewHandler extends AbstractFormHandler {

    @Override
    protected void execStore() {
      IPersonService service = BEANS.get(IPersonService.class);
      PersonFormData formData = new PersonFormData();
      exportFormData(formData);
      formData = service.create(formData); ⑦
      importFormData(formData);
    }
  }

  private String calculateSubTitle() {
    return StringUtility.join(" ", getFirstNameField().getValue(),
        getLastNameField().getValue());
  }
}
```

① Obtains a reference to the person service located on the Scout backend application.

② All form field values are transferred to the form data. In this case the person primary key property will be transferred to the form data. Remember that we have set this key in the "Edit" context menu.

③ The form data (including the person primary key) is sent to the `load` method. The load method returns the person data from the backend.

④ The field values in the form data are loaded into the form fields of the person form.

⑤ The sub title on the view tab of the form is updated to reflect the name of the person.

⑥ Calls the `store` method of the person service providing the updated person data.

⑦ Calls the `create` method of the person service providing the new person data.

With the implementation provided in Listing 34 the classes `ModifyHandler` and `NewHandler` orchestrate the complete roundtrip between the frontend and the backend of the "Contacts" application.

The only part that is now missing is the implementation of the form service methods `create`, `load` and `store` on the backend of the "Contacts" application. For these methods we can again rely on the default implementations created by the Scout new form wizard.

Modify the person service methods according to Listing 35.

Listing 35. The PersonService methods to load, create and update person data.

```
public class PersonService implements IPersonService {

  @Override
  public PersonFormData create(PersonFormData formData) {
    if (!ACCESS.check(new CreatePersonPermission())) {
      throw new VetoException(TEXTS.get("InsufficientPrivileges"));
    }

    // add a unique person id if necessary
    if (StringUtility.isNullOrEmpty(formData.getPersonId())) {
      formData.setPersonId(UUID.randomUUID().toString());
    }

    SQL.insert(SQLs.PERSON_INSERT, formData); ①

    return store(formData); ②
  }

  @Override
  public PersonFormData load(PersonFormData formData) {
    if (!ACCESS.check(new ReadPersonPermission())) {
      throw new VetoException(TEXTS.get("InsufficientPrivileges"));
    }

    SQL.selectInto(SQLs.PERSON_SELECT, formData); ③

    return formData;
  }

  @Override
  public PersonFormData store(PersonFormData formData) {
    if (!ACCESS.check(new UpdatePersonPermission())) {
      throw new VetoException(TEXTS.get("InsufficientPrivileges"));
    }

    SQL.update(SQLs.PERSON_UPDATE, formData); ④

    return formData;
  }
}
```

① The SQL insert statement adds a new person entry in the database. Only the primary key is used to create this entry.

② To save all other person attributes provided in the form data, the `store` method is reused.

③ The SQL select into transfers the person data from the database into the form data.

④ The SQL update statement transfers all person attributes provided in the form data to the person table.

4.6.6. What have we achieved?

In the fourth step of the "Contacts" tutorial we have added the person form to add, view and change persons. Using the person form as an example we have learned how to implement complex form layouts using the Scout layouting mechanism, Scout container fields and individual form field properties.

We have also seen how we can use context menus to integrate the forms in the user interface of the application and have implemented the interaction of the frontend with the backend application including the persistance of person data in the database.

The "Contacts" application is in a clean state again and you can (re)start the backend and the frontend of the application and verify the result in your browser. We can now verify the creation of new person entries and the modification of existing person data in the current state of the "Contacts" application. The created person form is shown in Figure 47.

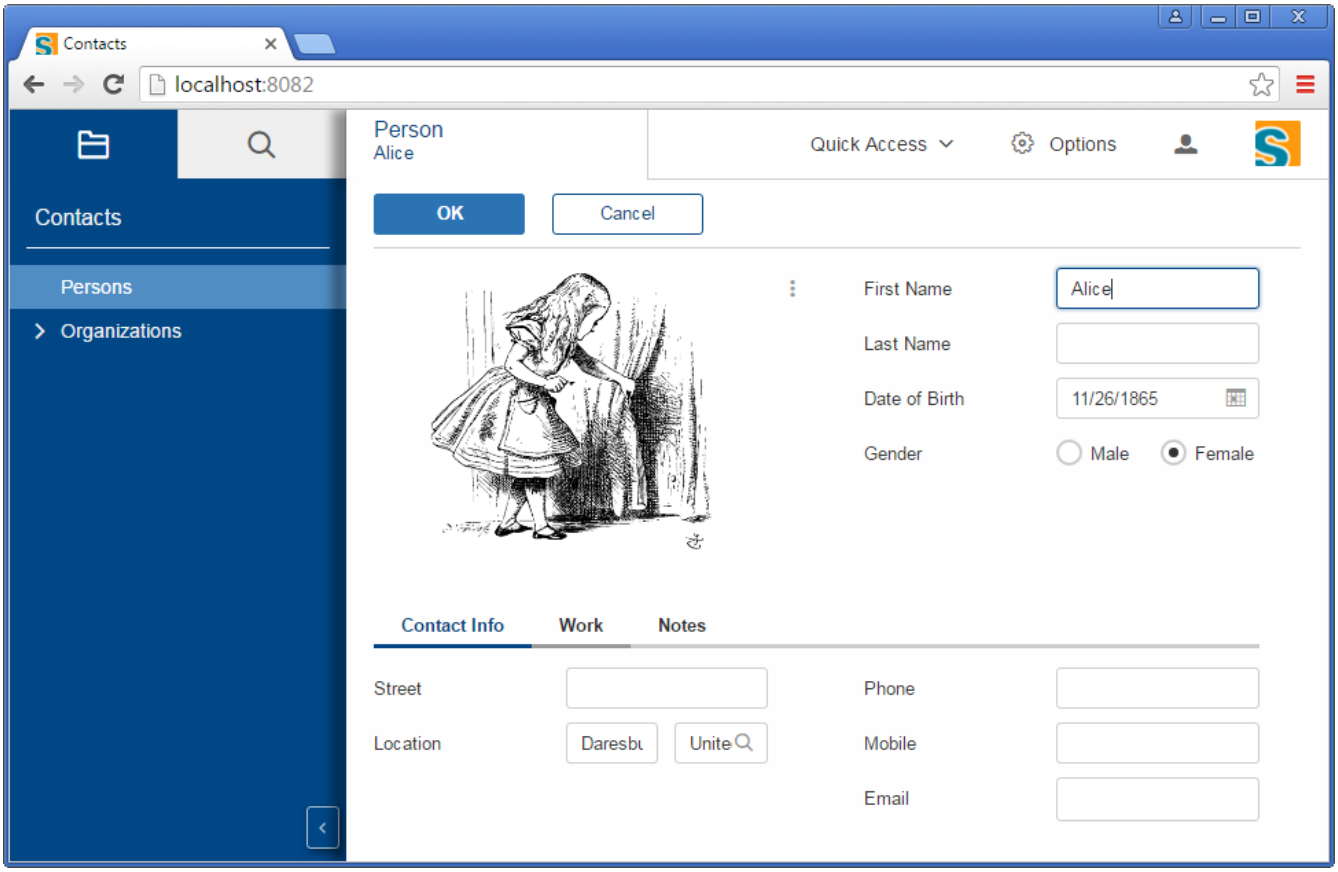


Figure 47. The "Contacts" application with the person form at the end of tutorial step 4.

4.7. Form Field Validation and Template Fields

This tutorial step introduces two additional concepts that are used in most Scout applications. Form field validation and template fields. Form field validation helps to keep data quality high and template fields are used to increase the code quality of Scout application.

In addition to just retrieving and storing new data, a business application should also help the user to maintain the quality of the entered data. To validate user input, the Scout framework offers form field validation. Simple input validation is possible on the level of individual fields as shown in Section 4.7.1. Scout also offers mechanisms to validate field values on the level of container fields or

on the level of a form as shown in Section 4.7.2. In the text below we add a number of form field validations that implement this approach for the person form.

In Section 4.7.3 we refactor the picture field code into a template field that can later be re-used for the organization form. To edit the image URL we add a simple edit form to the refactored picture field in Section 4.7.4.

In Section 4.7.5 we outline the creation of additional template fields and provide a summary of this tutorial step in Section 4.7.6.

4.7.1. Simple Form Field Validation

This section explains the form field validation on the level of a single field. As an example we will use the email address field defined in the "Contact Info" tab. The validation implemented in Listing 36 checks the length and the format of the entered email address.

Listing 36. The validation of the email field

```
@Order(40)
public class EmailField extends AbstractStringField {

  private static final String EMAIL_PATTERN = ①
      "^[_A-Za-z0-9-\\+]+(\\.[_A-Za-z0-9-]+)*@" +
          "[A-Za-z0-9-]+(\\.[A-Za-z0-9]+)*(\\.[A-Za-z]{2,})$";

  @Override
  protected String getConfiguredLabel() {
    return TEXTS.get("Email");
  }

  @Override ②
  protected int getConfiguredMaxLength() {
    return 64;
  }

  @Override ③
  protected String execValidateValue(String rawValue) {
    if (rawValue != null && !Pattern.matches(EMAIL_PATTERN, rawValue)) {
      throw new VetoException(TEXTS.get("BadEmailAddress")); ④
    }

    return rawValue; ⑤
  }
}
```

① Email verification is performed against a simple regular expression.

② This prevents the field from accepting more than 64 characters. The return value should match the size of the corresponding table column.

③ Method `execValidateValue` is called during validation of the new field value.

④ If the value violates any business rules, a `VetoException` should be thrown.

⑤ If the new value passes all business rules the method returns the value.

In the next section we use the address box to demonstrate the joint validation of several fields.

4.7.2. Complex Form Field Validation

Often the values of several fields have to be considered jointly to evaluate if the entered data is actually valid. As an example we will add a more complex form field validation on the level of the `AddressBox` group box widget that takes into account the data entered into the street, city, and country fields.

The implemented validation for the address box example should enforce the following set of business rules.

- Only valid countries should be allowed
- If a city is provided a country must also be provided
- If street information is provided, both a city and a country must be provided
- The address may be empty

The simplest rule is about entering only valid countries. This rule is already implemented as the country smart field only allows the user to select a single entry of the list of valid countries. A possible implementation to enforce the other rules is provided in Listing 37.

Listing 37. The validation of the fields in the address box

```
@Order(10)
public class AddressBox extends AbstractGroupBox {

  @Order(10)
  public class StreetField extends AbstractStringField {

    @Override ①
    protected void execChangedValue() {
      validateAddressFields(); ②
    }
  }

  @Order(20)
  public class LocationBox extends AbstractSequenceBox {

    @Order(10)
    public class CityField extends AbstractStringField {

      @Override
      protected void execChangedValue() {
        validateAddressFields(); ②
      }
    }

    @Order(20)
    public class CountryField extends AbstractSmartField<String> {

      @Override
      protected void execChangedValue() {
        validateAddressFields(); ②
      }
    }
  }

  protected void validateAddressFields() {
    boolean hasStreet = StringUtility.hasText(getStreetField().getValue());
    boolean hasCity = StringUtility.hasText(getCityField().getValue());

    getCityField().setMandatory(hasStreet); ③
    getCountryField().setMandatory(hasStreet || hasCity);
  }
}
```

① This method is called after the value of this field has been changed.

② After changing the street, the city or the country recompute which address fields are mandatory.

③ The city becomes mandatory if the street field is not empty. The country is mandatory if the street or the city is not empty.

Whenever the content of the street field, the city field, or the country field is changed the mechanism implemented above triggers a re-evaluation of the mandatory status of the city field and the country field. As the Scout default form validation ensures that every mandatory field receives some content the application prevents the user from entering address data that does not satisfy the business rules mentioned above.

The verification of user input can also be triggered before the form is closed. This behavior can be implemented by overriding method `execValidate` on the form level. As an example we use this mechanism to make sure that a user can only enter persons that have at least some name information.

Now add this validation to the person form using the implementation provided in Listing 38.

Listing 38. The validation of the first and last names on the form level

```
public class PersonForm extends AbstractForm {

  @Override ①
  protected boolean execValidate() {
    boolean noFirstName = StringUtility.isNullOrEmpty(getFirstNameField().getValue());
    boolean noLastName = StringUtility.isNullOrEmpty(getLastNameField().getValue());

    getGeneralBox().clearErrorStatus(); ②

    if (noFirstName && noLastName) {
      getGeneralBox().addErrorStatus(TEXTS.get("MissingName")); ③
      getFirstNameField().requestFocus();

      throw new VetoException(TEXTS.get("MissingName")); ④
    }

    return true; ⑤
  }
}
```

① This method is called during the form validation and before the form is stored/closed.

② In case both the first name and the last name fields are empty add an error status to the parent container widget.

③ Place the focus on the first name field.

④ The return value indicates if the validation has passed successfully or not.

As we have now implemented a number of form field validations we are now ready to test the result in the running application. Re-start the "Contacts" application and try to trigger the different validation rules. Figure 48 shows the response of the user interface when trying to save invalid person data.

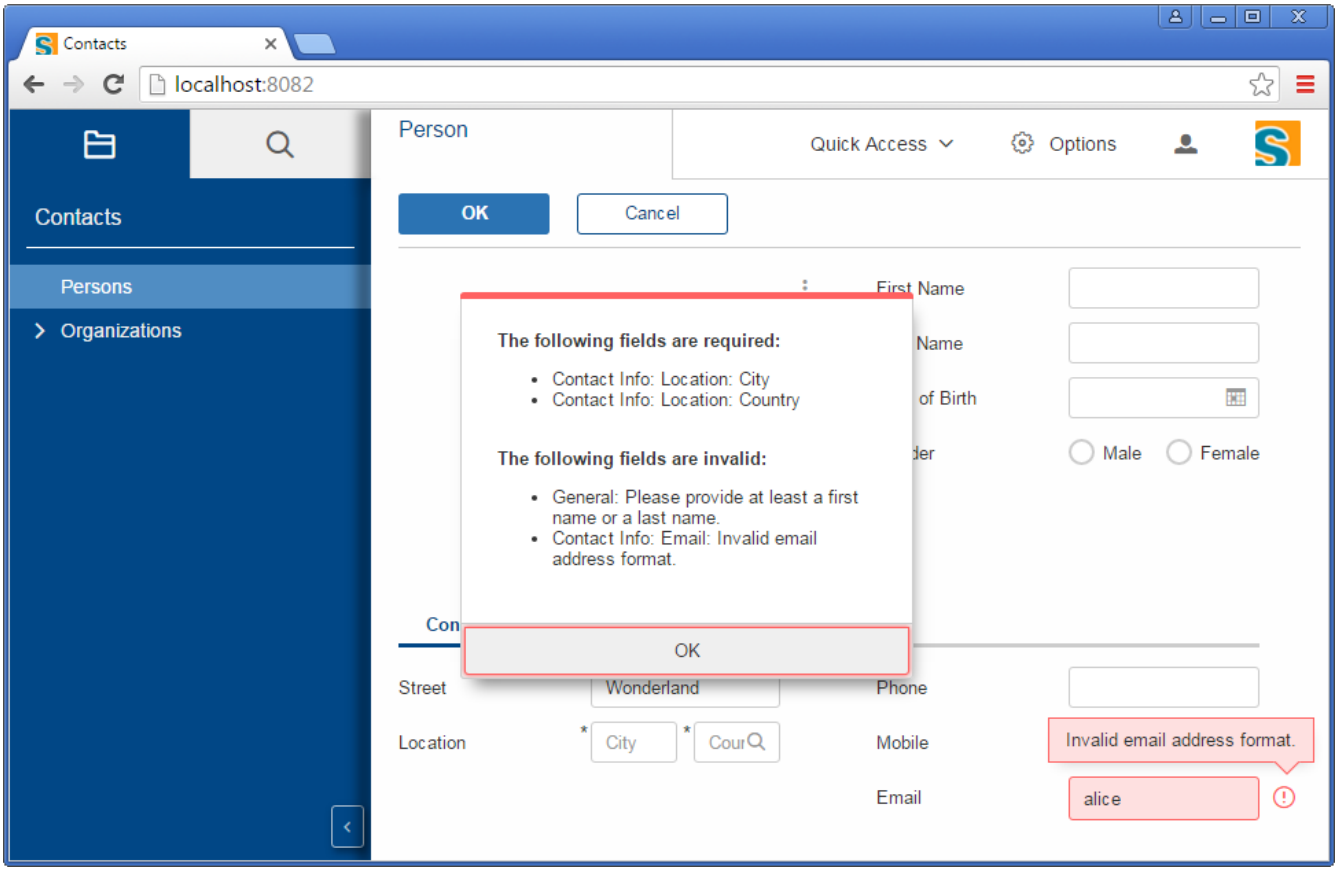


Figure 48. The form field validation implemented for the person form.

4.7.3. Creating Template Fields

In this section we show how to refactor a group of fields into a Scout template field that is ready for reuse. As an example we refactor the picture field into a template field. Later in tutorial step Section 4.8 we can then reuse this field in the company form to show the company's logo.

The generic approach to refactor a form field into a template field is listed below.

1. Create an empty field data class in the shared module
2. Create the template field class in the client module
3. Copy the existing field code to the template field
4. Let the original field extend the new template field and fix imports

For refactoring the picture field we can exactly follow these steps. To create the empty field data class perform the following steps.

1. Expand the shared module of the "Contacts" application
2. Navigate into folder `src/generated/java`
3. Add a new package `org.eclipse.scout.contacts.shared.common`
4. Create class `AbstractUrlImageFieldData` in this package as shown in Listing 39

Listing 39. The empty form data class for the picture template field.

```
package org.eclipse.scout.contacts.shared.common;

public class AbstractUrlImageFieldData {
}
```

We are now ready to implement the template field class according to the following steps.

1. Navigate to the client module of the "Contacts" application
2. Select package `org.eclipse.scout.contacts.client.common` in folder `src/main/java`
3. Create class `AbstractUrlImageField` using `Ctrl+N`
4. Update the implementation according to Listing 40
5. Fix the imports using `Ctrl+Shift+O`

Listing 40. The refactored picture field.

```
@FormData(value = AbstractUrlImageFieldData.class, ①
    sdkCommand = SdkCommand.CREATE,
    defaultSubtypeSdkCommand = DefaultSubtypeSdkCommand.CREATE)
public class AbstractUrlImageField extends AbstractImageField {

  private String url; ②

  @FormData ②
  public String getUrl() {
    return url;
  }

  @FormData ②
  public void setUrl(String url) {
    this.url = url;
    updateImage();
  }

  @Override
  protected boolean getConfiguredLabelVisible() {
    return false;
  }

  @Override
  protected int getConfiguredGridH() {
    return 5;
  }

  protected void updateImage() {
    clearErrorStatus();

    if (url == null) {
      setImage(null);
    }
    else {
      try {
        setImage(IOUtility.readFromUrl(new URL((String) url)));
        setAutoFit(true);
      }
      catch (Exception e) {
        addErrorStatus(new Status(TEXTS.get("FailedToAccessImageFromUrl"), IStatus
.WARNING));
      }
    }

    getForm().touch();
  }
}
```

① The link to the corresponding field data class.

② Field `PictureUrlField` is refactored into the property `url` value. To transfer the content of this property to the field data object we need to add annotation `@FormData` to its getter and setter methods.

The next step is to replace the original code of the picture field with the newly created template field. As the functionality of the template field exactly matches with the original code, class `PictureField` only needs to extend the newly created template field as shown in Listing 41.

Listing 41. The refactored picture field.

```
@Order(10)
public class MainBox extends AbstractGroupBox {

  @Order(10)
  public class GeneralBox extends AbstractGroupBox {

    @Order(10)
    public class PictureField extends AbstractUrlImageField { ①
    }

    // additional form field

  }
}
```

① The implementation of the picture field is now provided by the template field `AbstractUrlImageField`.

As the last step we need to slightly modify the SQL statement that loads and stores the picture URL information. The reason for the change is the replacement of the picture url field by an url property defined as a member of the picture field. For this change perform the steps listed below.

1. Open class `SQLs` in the Java editor.
2. In string `PERSON_SELECT` change the token ':pictureUrl' with ':picture.url'
3. In string `PERSON_UPDATE` change the token ':pictureUrl' with ':picture.url'

Based on the picture field example we have now walked through the complete process to turn normal fields into template fields. This process remains the same for refactoring container fields into template fields.

4.7.4. Adding a simple URL Input Form to the Picture Field

Using the refactored picture template field we want the user to be able to enter and update the URL of the shown picture. For this we add a simple form with a single field and a context menu to the picture template field using the Scout new form wizard as shown in Figure 49.

- Verify that you use the correct source folder and package name.
- In the *Name* field enter "PictureUrl".

- In section *Additional Components* deselect all checkboxes.
- Click **[Finish]** to let the wizard implement the form.

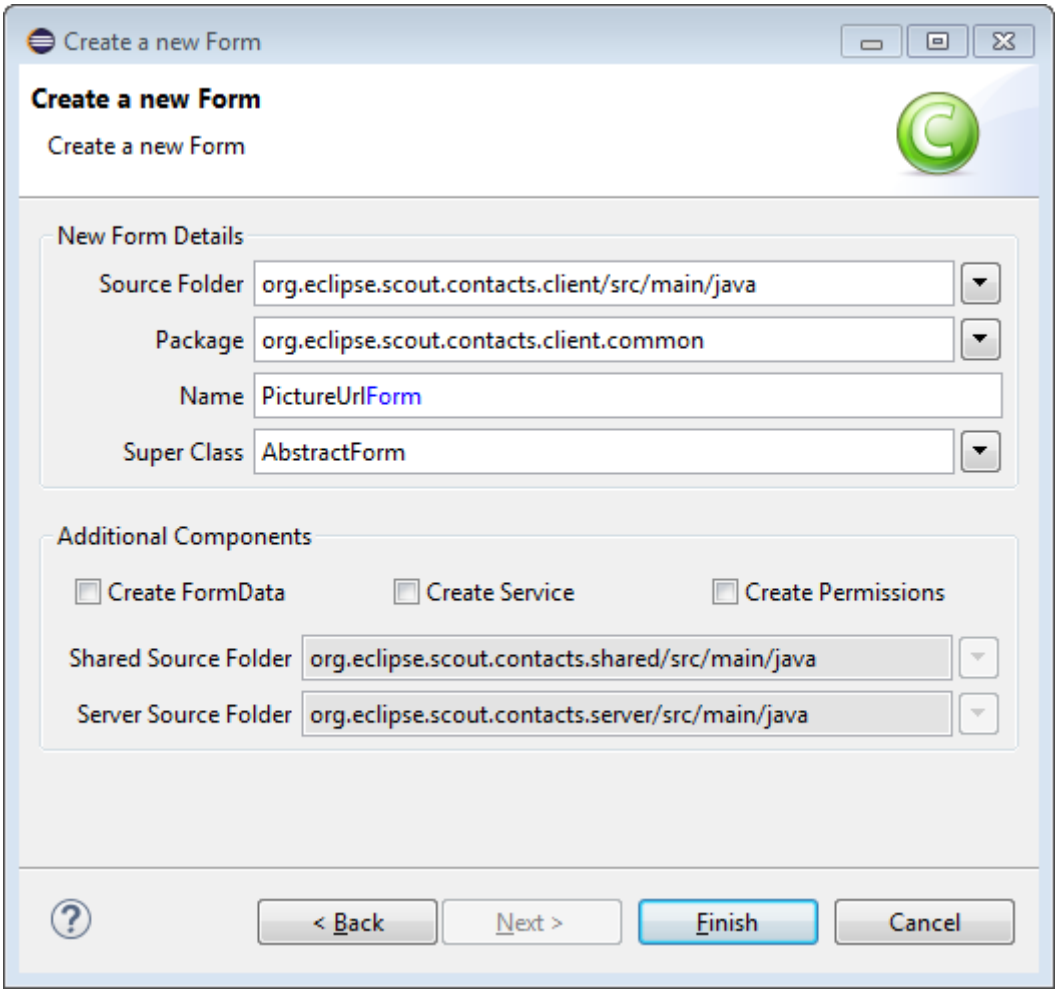


Figure 49. Creating the picture URL form with the new form wizard.

Now adapt the content of the URL form according to Listing 42. As you can see, there is no roundtrip to a backend server and the form only contains a single editable field.

Listing 42. The form to edit the picture URL

```
public class PictureUrlForm extends AbstractForm {

  @Override
  protected String getConfiguredTitle() {
    return TEXTS.get("PictureURL");
  }

  public void startModify() {
    startInternal(new ModifyHandler());
  }

  public UrlField getUrlField() {
    return getFieldByClass(UrlField.class);
  }

  @Order(10)
  public class MainBox extends AbstractGroupBox {

    @Order(10)
    public class UrlBox extends AbstractGroupBox {

      @Order(10)
      public class UrlField extends AbstractStringField {

        @Override
        protected boolean getConfiguredLabelVisible() { ①
          return false;
        }
      }
    }

    @Order(20)
    public class OkButton extends AbstractOkButton {
    }

    @Order(30)
    public class CancelButton extends AbstractCancelButton {
    }
  }

  public class ModifyHandler extends AbstractFormHandler { ②
  }
}
```

① No label is needed as the name of the field is already provided by the title of the form.

② As no round trip to the backend is required the modify handler can remain empty.

We can now add an "Edit URL" menu to the picture template field. The implementation of the edit

context menu is provided in Listing 43.

Listing 43. The "Edit URL" menu for the refactored picture field

```
public class AbstractUrlImageField extends AbstractImageField {

  @Order(10)
  public class EditURLMenu extends AbstractMenu {

    @Override
    protected String getConfiguredText() {
      return TEXTS.get("EditURL");
    }

    @Override
    protected Set<? extends IMenuType> getConfiguredMenuTypes() {
      return CollectionUtility.<IMenuType> hashSet(
          ImageFieldMenuType.Image,
          ImageFieldMenuType.Null);
    }

    @Override
    protected void execAction() {
      PictureUrlForm form = new PictureUrlForm();
      String oldUrl = getUrl();

      if (StringUtility.hasText(oldUrl)) { ①
        form.getUrlField().setValue(oldUrl);
      }

      form.startModify();
      form.waitFor(); ②

      if (form.isFormStored()) { ③
        setUrl(form.getUrlField().getValue());
      }
    }
  }
}
```

① If we already have an URL for the picture prefill the url field in the form with its value.

② Method `waitFor` makes the application wait until the user has closed the form.

③ Only store the new URL if the user has saved a new value. Storing the value will refresh the picture in the user interface.

Based on the example with the picture field we have now walked through the complete process to turn normal fields into template fields. This process remains the same for refactoring container fields into template fields.

4.7.5. More Template Fields

To reduce the amount of copy & paste for the implementation of the company form in the next tutorial step, we recommend that you refactor the following fields into templates.

- Email field
- Address group box field
- Notes group box field

You can follow the steps described in the previous section for the picture field. To be able to copy & paste the code in the following tutorial step you may use the following class names.

- `AbstractEmailField` for the email template field
- `AbstractAddressBox` for the address group template field
- `AbstractNotesBox` for the notes tab template field

Replacing the concrete fields with the template fields in the person form will result in a number of compile errors in the field getter methods of the person form. In the case of the "Contacts" application these getter methods are not needed and can simply be deleted.

Moving from concrete fields to template fields also implies some minor changes as we have seen with the picture template field. Therefore make sure to modify the SQL statements in class `SQLs` accordingly.

- Replace token ':street' by ':addressBox.street'
- Replace token ':city' by ':addressBox.city'
- Replace token ':country' by ':addressBox.country'
- Replace token ':notes' by ':notesBox.notes'

4.7.6. What have we achieved?

In this step of the "Contacts" tutorial we have covered two important concepts for implementing business applications.

- Validation of user input on the level of fields, components and the complete form
- Creation and usage of template fields to minimize copy & paste where possible

The "Contacts" application is in a clean state again and you can (re)start the backend and the frontend of the application and verify the result in your browser. Using the created picture template field we can now update the image in the picture form as shown in Figure 50.

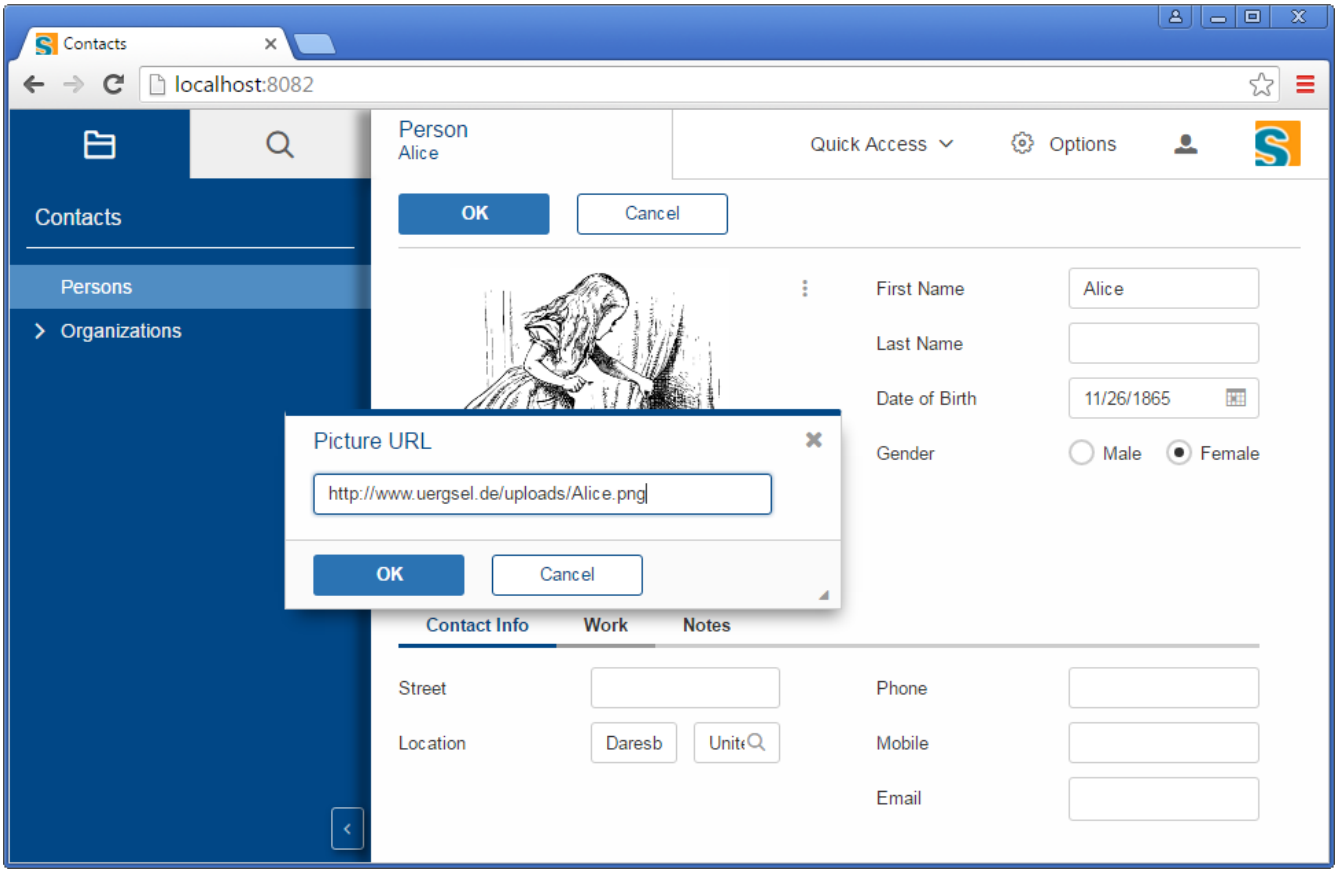


Figure 50. The person form with the refactored picture template field including a menu (red square) and a URL edit form.

In the next tutorial step we are going to implement the company form to enter and edit company information. For the creation of this form we can then reuse the template fields that we have created.

4.8. Adding the Company Form

This section describes the implementation of the organization form. For the implementation of the organization form we can apply many of the concepts we have learned in the previous sections. As a result, the descriptions of this section can be kept on a much higher level.

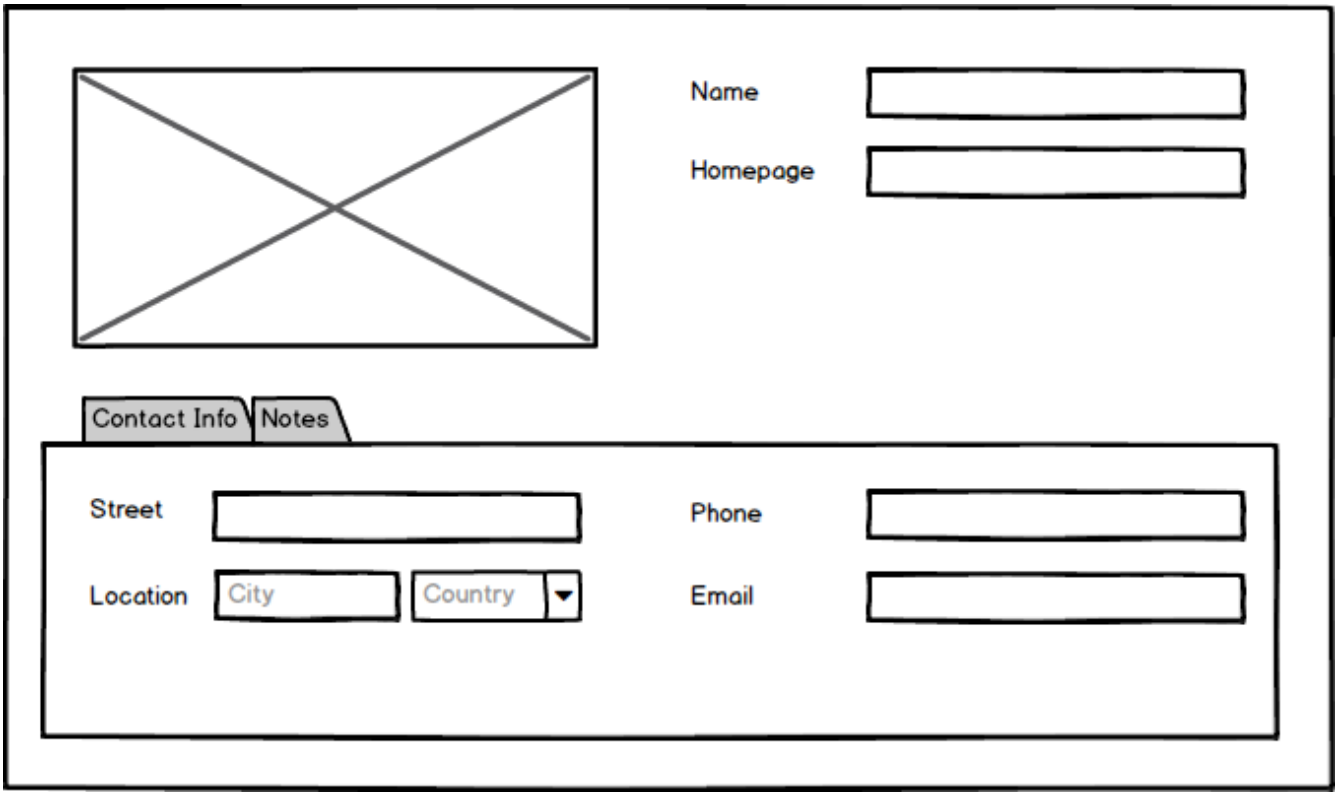


Figure 51. The sketch of the organization form layout.

Considering the layout sketch for the organization form shown in Figure 51 we can already see how we can reuse the following fields / templates.

- The picture field
- The address box with street, city and country including its validation
- The email field with its validation
- The complete "Notes" tab

For the remaining fields "Name", "Homepage" and "Phone" we will use simple string fields with matching label texts.

We can now implement the company form according to the following steps.

1. Expand folder `src/main/java` in the client module in the package explorer
2. Select package `org.eclipse.scout.contacts.client.organization` and hit `Ctrl`+`N`
3. Enter "form" into the search field of the wizard selection and double click on proposal *Scout Form*
4. Use "OrganizationForm" as class name and make sure to select all check boxes in the lower part of the wizard
5. Click **[Finish]** to start the Scout form wizard.

After creating the initial form class using Scout's new form wizard the form layout can be implemented according to Listing 44.

Listing 44. The layout implementation of the organization form

```
public class OrganizationForm extends AbstractForm {

  private String organizationId;

  @FormData
  public String getOrganizationId() {
    return organizationId;
  }

  @FormData
  public void setOrganizationId(String organizationId) {
    this.organizationId = organizationId;
  }

  @Override
  public Object computeExclusiveKey() {
    return getOrganizationId();
  }

  @Override
  protected String getConfiguredTitle() {
    return TEXTS.get("Organization");
  }

  @Override
  protected int getConfiguredDisplayHint() {
    return IForm.DISPLAY_HINT_VIEW;
  }

  @Order(10)
  public class MainBox extends AbstractGroupBox {

    @Order(10)
    public class GeneralBox extends AbstractGroupBox {

      @Order(10)
      public class PictureField extends AbstractUrlImageField { ①

        @Override
        protected int getConfiguredGridH() { ②
          return 4;
        }

        @Override
        protected double getConfiguredGridWeightY() { ③
          return 0;
        }
      }

      @Order(20)
      public class NameField extends AbstractStringField {
```

```
      @Override
      protected String getConfiguredLabel() {
        return TEXTS.get("Name");
      }

      @Override
      protected boolean getConfiguredMandatory() { ④
        return true;
      }
    }

    @Order(30)
    public class HomepageField extends AbstractStringField {

      @Override
      protected String getConfiguredLabel() {
        return TEXTS.get("Homepage");
      }
    }
  }

  @Order(20)
  public class DetailsBox extends AbstractTabBox {

    @Order(10)
    public class ContactInfoBox extends AbstractGroupBox {

      @Override
      protected String getConfiguredLabel() {
        return TEXTS.get("ContactInfo");
      }

      @Order(10)
      public class AddressBox extends AbstractAddressBox { ⑤
      }

      @Order(20)
      public class PhoneField extends AbstractStringField {

        @Override
        protected String getConfiguredLabel() {
          return TEXTS.get("Phone");
        }
      }

      @Order(30)
      public class EmailField extends AbstractEmailField { ⑥
      }
    }
```

```
      @Order(20)
      public class NotesBox extends AbstractNotesBox { ⑦
      }
    }

    @Order(30)
    public class OkButton extends AbstractOkButton {
    }

    @Order(40)
    public class CancelButton extends AbstractCancelButton {
    }
  }
}
```

① We reuse the picture template field to display the company logo.

② We reduce the number of rows for the company logo compared to the person picture.

③ We do not allow the general box to grow or shrink vertically

④ We configure the company name field to be mandatory for an organization.

⑤ As-is reuse of the address template box.

⑥ As-is reuse of the email template field.

⑦ As-is reuse of the notes tab box.

To be able to open the organization form we need to link the form to the user interface. Following the pattern for the person form we define the context menus "Edit" and "New" for the organization table and a menu "Create new organization" under the "Quick access" top level menu.

The implementation of the organization form is completed by providing the logic to interact with the database in the organization service according to Listing 45. The technical setup exactly follows the implementation of the person service.

Listing 45. The OrganizationService methods to load, create and update organization data.

```
public class OrganizationService implements IOrganizationService {

  @Override
  public OrganizationFormData create(OrganizationFormData formData) {
    if (!ACCESS.check(new CreateOrganizationPermission())) {
      throw new VetoException(TEXTS.get("InsufficientPrivileges"));
    }

    if (StringUtility.isNullOrEmpty(formData.getOrganizationId())) {
      formData.setOrganizationId(UUID.randomUUID().toString());
    }

    SQL.insert(SQLs.ORGANIZATION_INSERT, formData);

    return store(formData);
  }

  @Override
  public OrganizationFormData load(OrganizationFormData formData) {
    if (!ACCESS.check(new ReadOrganizationPermission())) {
      throw new VetoException(TEXTS.get("InsufficientPrivileges"));
    }

    SQL.selectInto(SQLs.ORGANIZATION_SELECT, formData);

    return formData;
  }

  @Override
  public OrganizationFormData store(OrganizationFormData formData) {
    if (!ACCESS.check(new UpdateOrganizationPermission())) {
      throw new VetoException(TEXTS.get("InsufficientPrivileges"));
    }

    SQL.update(SQLs.ORGANIZATION_UPDATE, formData);

    return formData;
  }
}
```

Method `prepareCreate` is not needed for the creation of a new organization and we can remove it from `OrganizationService` and `IOrganizationService`. Therefore, the implementation of the method `execLoad` in the new handler of the organization form can also be removed.

With these implementations of the organization form and organization service the "Contacts" application can now also be used to maintain a list of organizations.

4.8.1. What have we achieved?

In the sixth step of the "Contacts" tutorial we have added the Scout form to edit and create organizations. The focus of this part of the tutorial was on re-using previous work and applying the concepts that have been introduced in previous tutorial steps.

The "Contacts" application is in a clean state again and you can (re)start the backend and the frontend of the application and verify the result in your browser. As shown in Figure 52 company data can now be viewed and entered in the user interface.

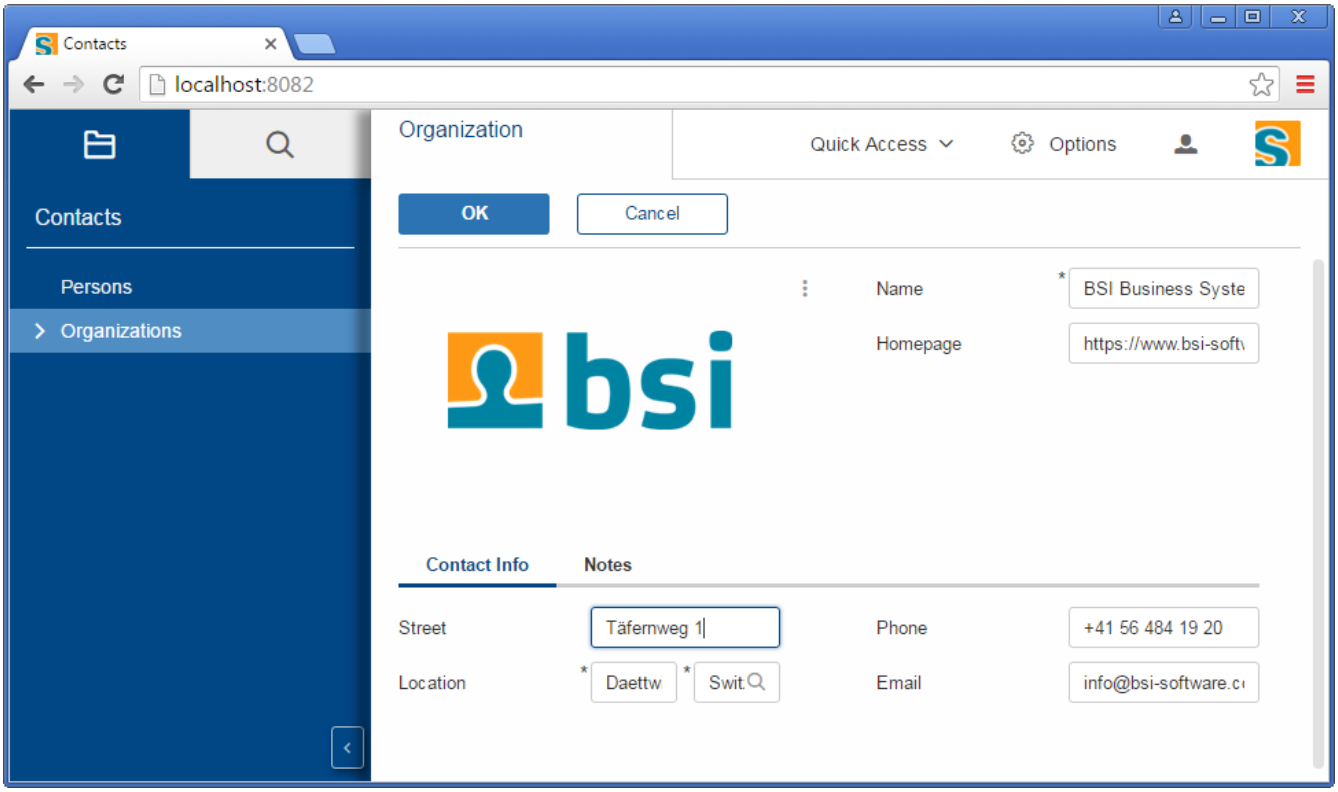


Figure 52. The "Contacts" application with the newly created organization form.

4.9. Linking Organizations and Persons

In this step we modify the user interface to represent the 1:n relationship between organizations and persons. For the implementation of this 1:n relation we follow the Scout standard pattern.

In the "Contacts" application any person can be assigned to a single organization. This fact is represented in the database schema created using the statement `SQLs.PERSON_CREATE_TABLE`.

We will therefore need to be able to assign a person to an existing organization by selecting an existing organization in the field. For this we modify the organization field on the person to a smart field. To display the assigned organizations we will also modify the person page accordingly.

In addition we would like to be able to easily access all persons assigned to a specific organization. Using the existing organization page we will add a child page that will then show all associated persons. This will result in a drill-down functionality for the organization page.

The implementation of the features described above can be achieved by the the following steps.

- Creating an Organization Lookup Call (Section 4.9.1)
- Using the Lookup Call in the Person Form and the Person Table (Section 4.9.2)
- Link the Person Page to Organizations (Section 4.9.3)

This last tutorial step ends with a short review in Section 4.9.4

4.9.1. Creating an Organization Lookup Call

Before we can change the organization field on the person form from a string field to a smart field we need a organization lookup call that provides the necessary data to the smartfield. We have been using this approach for the country field already. The difference to the lookup call for countries lies in the fact that we no longer have a static list of entries but need to fetch possible the organizations dynamically. We will therefore need to access the database to provide the data to the lookup call.

As this is a common requirement the Scout framework comes with the base class `AbstractSqlLookupService` and a default mechanism to route lookup calls from the frontend sever to database calls on the backend server. The necessary infrastructure can be created using the Scout lookup wizard according to the steps described below.

1. Expand folder `src/main/java` in the client module in the package explorer
2. Select package `org.eclipse.scout.contacts.shared.organization` and hit `Ctrl`+`N`
3. Enter "lookup" into the search field of the wizard selection and double click on proposal *Scout LookupCall*
4. Use "OrganizationLookupCall" as class name
5. Enter "String" as the key class and use service super class "AbstractSqlLookupService" in the wizard
6. Verify that the fields in the wizard match the values provided in Figure 53
7. Click **[Finish]** to start the Scout lookup call wizard.

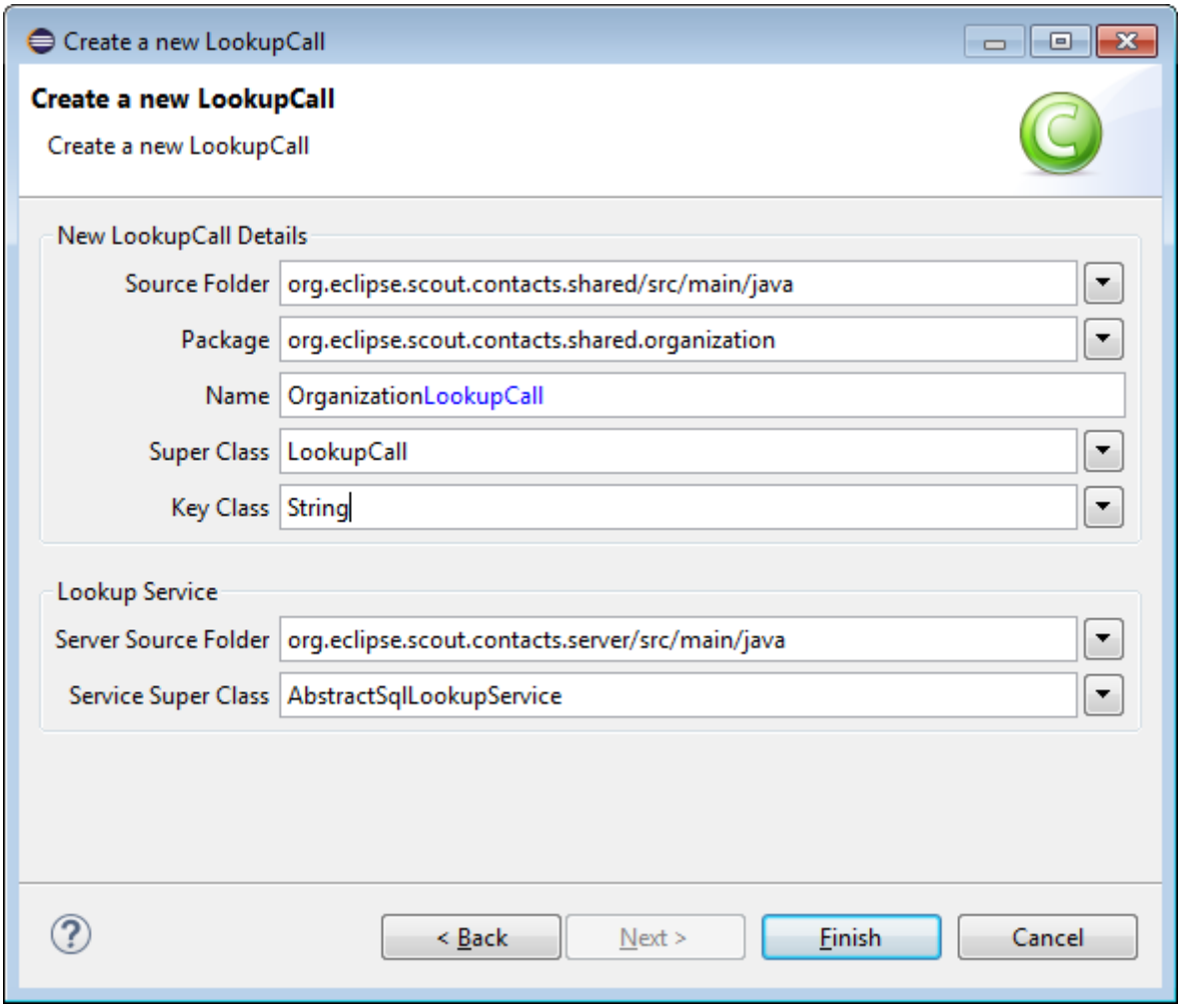


Figure 53. Using the Scout lookup call wizard for creating class OrganizationLookupCall.

The Scout wizard will then create the lookup class `OrganizationLookupCall` and the corresponding lookup service with the interface `IOrganizationLookupService` and its initial implementation `OrganizationLookupService`. We will only need to provide some implementation for the lookup service. The service interface and the lookup call class can be used as provided by the Scout wizard. Listing 46 shows the code generated for the lookup call

Listing 46. The OrganizationLookupCall implemented by the Scout wizard.

```
public class OrganizationLookupCall extends LookupCall<String> {

  private static final long serialVersionUID = 1L;

  @Override
  protected Class<? extends ILookupService<String>> getConfiguredService() {
    return IOrganizationLookupService.class;
  }
}
```

We are now ready to implement method `getConfiguredSqlSelect` of the organization lookup service. Open class `OrganizationLookupService` in the Java editor and change the implementation according to Listing 47.

Listing 47. The OrganizationService methods to load, create and update organization data.

```
public class OrganizationLookupService
    extends AbstractSqlLookupService<String>
    implements IOrganizationLookupService {

  @Override
  protected String getConfiguredSqlSelect() {
    return SQLs.ORGANIZATION_LOOKUP; ①
  }
}
```

① We only need to return a single SQL statement for lookup services that extend `AbstractSqlLookupService`

The SQL statement that backs the lookup service is provided in Listing 48. Lookup services can provide data for three different use cases. The most straightforward case is the mapping of a key to a specific lookup row. Next is the case where the lookup service returns a number of lookup rows that match a provided substring and finally the case where the lookup service simply returns all available rows.

Listing 48. The SQL statement to provide the data for the organization lookup service.

```
  String ORGANIZATION_LOOKUP = ""
      + "SELECT   organization_id, "
      + "         name "
      + "FROM     ORGANIZATION "
      + "WHERE    1 = 1 "
      + "<key>    AND organization_id = :key</key> " ①
      + "<text>   AND UPPER(name) LIKE UPPER(:text||'%') </text> " ②
      + "<all></all>"; ③
```

① The where clause to be used for a search for a specific key

② The where clause to be used when some search text is provided

③ The where clause that defines the full set of lookup rows

4.9.2. Using the Lookup Call in the Person Form and the Person Table

Now we can use the organization lookup call to transform the organization field in the "Work" tab of the person form into a smart field. To do this we open class `PersonForm` in the Java editor and navigate to its inner class `WorkBox`. Then, update the implementation of the OrganizationField according to Listing 49

Listing 49. The organization smart field in the "Work" tab backed by the OrganizationLookupCall.

```
@Order(20)
public class WorkBox extends AbstractGroupBox {

  @Order(20)
  public class OrganizationField extends AbstractSmartField<String> { ①

    @Override
    protected String getConfiguredLabel() {
      return TEXTS.get("Organization");
    }

    @Override ②
    protected Class<? extends ILookupCall<String>> getConfiguredLookupCall() {
      return OrganizationLookupCall.class;
    }
  }
}
```

① The OrganizationField now extends a Scout smart field

② The smart field is backed by the newly created organization lookup call

This change has the effect, that now we can assign an organization in the person form by typing a substring of the organizations name into the organization field. The conversion of the field into a smart field has the additional benefit that only valid organizations can be selected that respect the referential integrity defined by the database.

As a next step we also modify the organization column of the person page. For this open class `PersonTablePage` in the Java editor and navigate to its inner class `Table`. Then, change the implementation of `OrganizationColumn` according to Listing 50.

Listing 50. The organization smart column in the person page.

```
public class Table extends AbstractTable {

  @Order(9)
  public class OrganizationColumn extends AbstractSmartColumn<String> {

    @Override
    protected String getConfiguredHeaderText() {
      return TEXTS.get("Organization");
    }

    @Override
    protected Class<? extends ILookupCall<String>> getConfiguredLookupCall() {
      return OrganizationLookupCall.class;
    }
  }
}
```

Using the created organization lookup calls we have now completed the modifications on the person form and also used the lookup call to display the a person's organization in the person page. The next section will focus on the necessary modifications and new components to re-use the person page as a sub page of the organization page.

4.9.3. Link the Person Page to Organizations

In this section we will implement a drill-down functionality on the organization page. The goal is to let the user of the application expand a row in the organization page to provide access to the persons of the organization.

Scout node pages are useful when we want to display different entities that are related to a specific entry in a parent page. In the "Contacts" demo application this mechanism is used to link both persons and events to an organization as shown in Figure 54. The coloring of the application has been modified to indicate that this is a screenshot of the "Contacts" demo application, not the tutorial application that we are building here.

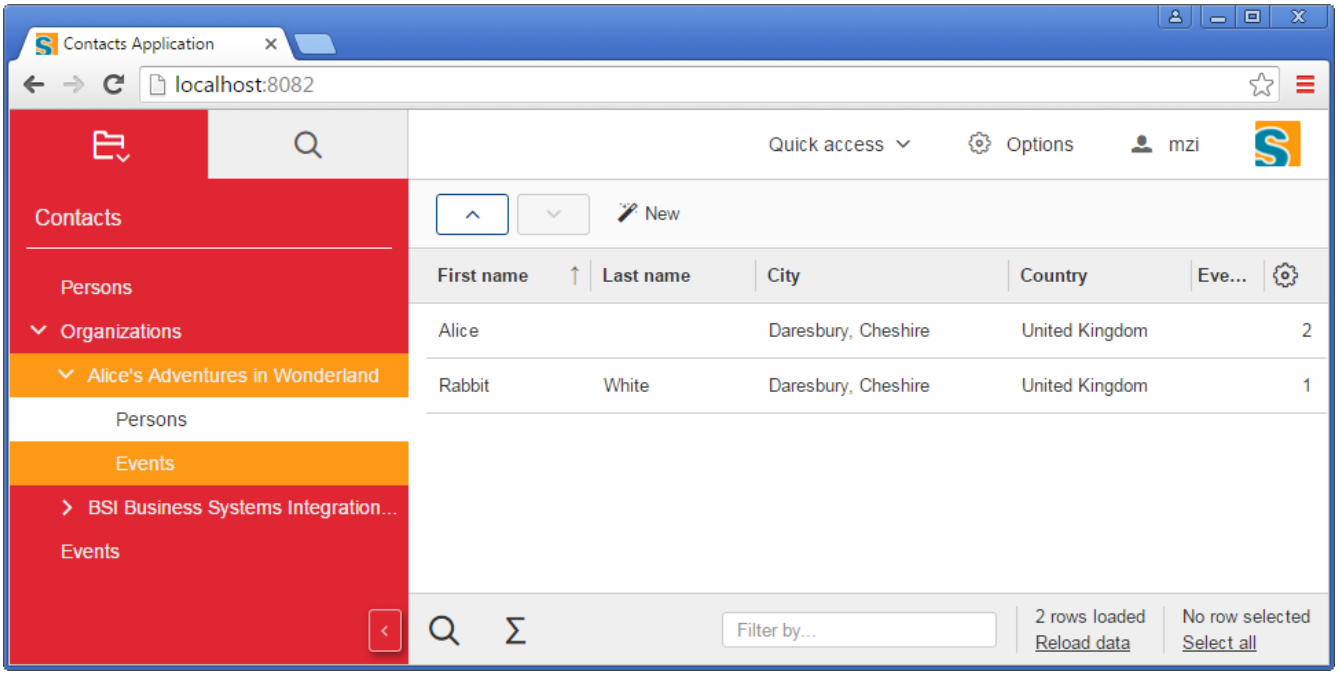


Figure 54. A drill-down on an organization in the "Contacts" demo application provides access to related persons and events.

In the "Contacts" demo application this hierarchical page structure is implemented as follows.

- Organization page implemented in class `OrganizationTablePage`
  - A node page implemented in class `OrganizationNodePage`
    - Person page implemented in class `OrganizationTablePage`
    - Event page implemented in class `EventTablePage`

For the "Contacts" tutorial application we will create the exact same structure but only add the person page as child page to the organization node page.

To implement this sequence of linked pages we will follow the dependencies of the linked classes. We start with adapting method `getPersonTableData` in the person service by adding an organization id parameter. Using this parameter we can then restrict the person search to the subset that is linked to the specified organization. For this change we first update the person service interface as shown in Listing 51.

Listing 51. The updated method `getPersonTableData` for the person service interface.

```
@ApplicationScoped
@TunnelToServer
public interface IPersonService {

  PersonTablePageData getPersonTableData(SearchFilter filter, String organizationId);
①

  PersonFormData create(PersonFormData formData);

  PersonFormData load(PersonFormData formData);

  PersonFormData store(PersonFormData formData);
}
```

① Add parameter `organizationId`

We now adapt the method implementation in the person service according to Listing 52.

Listing 52. Method getPersonTableData to access the database and map the data into a page data object.

```
public class PersonService implements IPersonService {

    @Override
    public PersonTablePageData getPersonTableData(SearchFilter filter, String
organizationId) {
        PersonTablePageData pageData = new PersonTablePageData();
        StringBuilder sql = new StringBuilder(SQLs.PERSON_PAGE_SELECT);

        // if an organization is defined, restrict result set to persons that are
linked to it
        if (StringUtility.hasText(organizationId)) {
            sql.append(String.format("WHERE LOWER(organization_id) LIKE LOWER('%s') ",
                    organizationId));
        }

        sql.append(SQLs.PERSON_PAGE_DATA_SELECT_INTO);
        SQL.selectInto(sql.toString(), new NVPair("page", pageData));

        return pageData;
    }
}
```

Having modified the person service we add a organization id property to the person page. We can then populate this property when the person page is attached to the company node page. Finally we can use in method `execLoadData` according to Listing 53.

Listing 53. Add the possibility to restrict the list of persons to those assigned to a specific organization.

```
@PageData(PersonTablePageData.class)
public class PersonTablePage extends AbstractPageWithTable<Table> {

  private String organizationId; ①

  public String getOrganizationId() {
    return organizationId;
  }

  public void setOrganizationId(String organizationId) {
    this.organizationId = organizationId;
  }

  @Override
  protected void execLoadData(SearchFilter filter) {
    importPageData(BEANS.get(IPersonService.class)
        .getPersonTableData(filter, getOrganizationId())); ②
  }

  public class Table extends AbstractTable {

    @Order(20)
    public class NewMenu extends AbstractMenu {

      @Override
      protected void execAction() {
        PersonForm form = new PersonForm();
        form.getOrganizationField().setValue(getOrganizationId()); ③
        form.addFormListener(new PersonFormListener());
        // start the form using its new handler
        form.startNew();
      }
    }
  }
}
```

① This property lets the person page remember an organization key

② Provides the organization key to the person search on the backend server

③ If the user creates a new person below an organization pre-fill the corresponding field

In the cases where the modified person page is shown as a child page of the organization page we can now improve the usability of the page's new menu. When creating a person under an existing organization we create the new person with a pre-filled organization id. See the modified `execAction` method in `NewMenu` of Listing 53.

The next step in the setup of the page hierarchy is the creation of the organization node page. Node pages allow to define a list of child pages that typically represent different entities. As mentioned before we will only have the person page as a child page in the "Contacts" tutorial application.

To create the company node page follow the steps listed below.

1. Expand folder `src/main/java` in the client module in the package explorer
2. Select package `org.eclipse.scout.contacts.client.organization` and hit `Ctrl+N`
3. Enter "scout page" into the search field of the wizard selection and double click on proposal *Scout Page*
4. Add "Organization" to the class name field
5. Switch the super class field to "AbstractPageWithNodes"
6. Verify that the fields in the wizard match the values provided in Figure 55
7. Click **[Finish]** to start the Scout page wizard

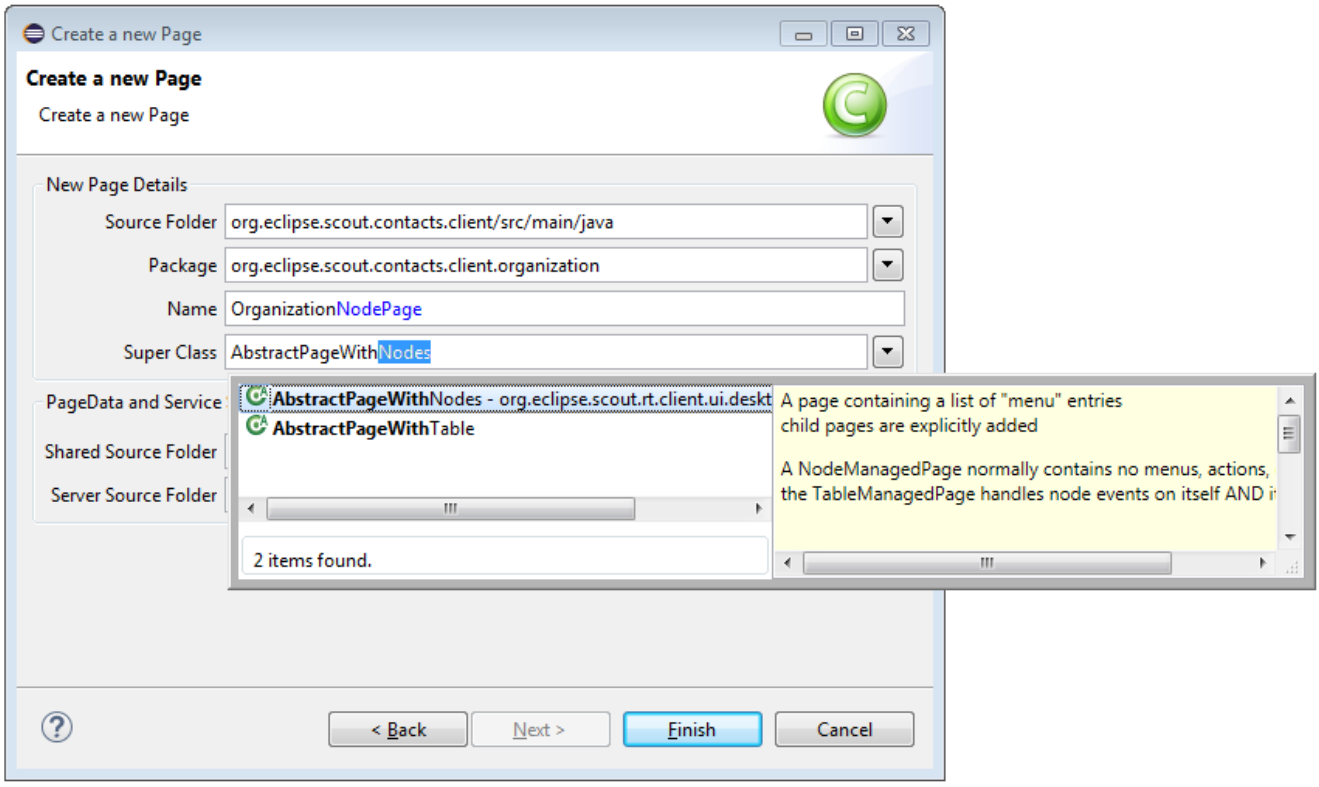


Figure 55. Creating the organization node page.

After the wizard has created the initial implementation of the node page open class `OrganizationNodePage` in the Java editor and adapt its implementation according to Listing 54.

Listing 54. The complete implementation of the class `OrganizationNodePage`.

```
public class OrganizationNodePage extends AbstractPageWithNodes {

  private String organizationId; ①

  public String getOrganizationId() {
    return organizationId;
  }

  public void setOrganizationId(String organizationId) {
    this.organizationId = organizationId;
  }

  @Override ②
  protected void execCreateChildPages(List<IPage<?>> pageList) {
    PersonTablePage personTablePage = new PersonTablePage();
    personTablePage.setOrganizationId(getOrganizationId()); ③
    pageList.add(personTablePage);
  }
}
```

① The organization id property that represents the selected organization in the parent page

② Method `execCreateChildPages` defines the list of child pages

③ Define the organization id property for the person child page

We have now created an organization node page that contains a person page as its child page. The only missing step to create the discussed page hierarchy is the link between the organization page with the organization node page. Create this missing link by adding method `execCreateChildPage` to the organization page as shown in Listing 55.

Listing 55. Add the organization node page as a child page to the organization page.

```
@PageData(OrganizationTablePageData.class)
public class OrganizationTablePage extends AbstractPageWithTable<Table> {

  @Override
  protected IPage<?> execCreateChildPage(ITableRow row) {
    OrganizationNodePage childPage = new OrganizationNodePage();
    childPage.setOrganizationId(getTable().getOrganizationIdColumn().getValue(row));
    return childPage;
  }
}
```

The difference between Scout table pages and node pages is also reflected in the different signatures of `AbstractPageWithTable.execCreateChildPage` and `AbstractPageWithNodes.execCreateChildPages`. Table pages can have a single child page while node pages may contain a list of child pages.

4.9.4. What have we achieved?

In the seventh step of the "Contacts" tutorial we have introduced a typical Scout user interface pattern for 1:n relationships. We have created a dynamic lookup call and used the lookup call to provide the data for a smart field and a smart column.

To implement a drill-down functionality for the organization table we have created a page hierarchy using the existing organization page and person page. To link the two table pages we have also created and integrated a Scout node page.

The "Contacts" application is in a clean state again and you can (re)start the backend and the frontend of the application and verify the result in your browser. As shown in Figure 56 the organization specific person data is now presented in a hierarchical form in the navigation area of the application.

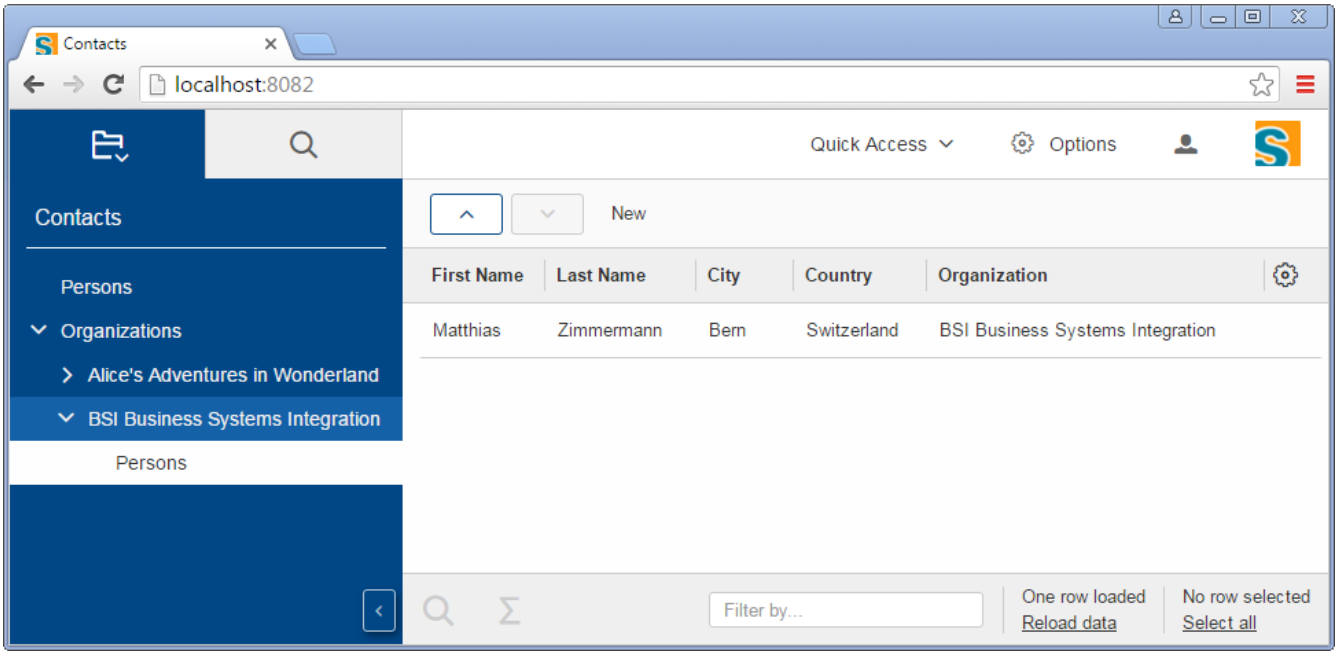


Figure 56. The linked person page only shows persons related to the parent organization page.

4.10. Additional Concepts and Features

This last part of the "Contacts" tutorial discusses the gap between the tutorial application and the complete "Contacts" demo application. In a number of aspects the full "Contacts" demo application comes with additional features and improvements over the functionality of its tutorial version.

The sections below highlight the following areas.

- Theming and Styling (Section 4.10.1)
- Modular Scout Applications (Section 4.10.2)
- Infrastructure (Section 4.10.3)

4.10.1. Theming and Styling

- theme switching form for top level options menu Figure 57

- project specific theme "dark"

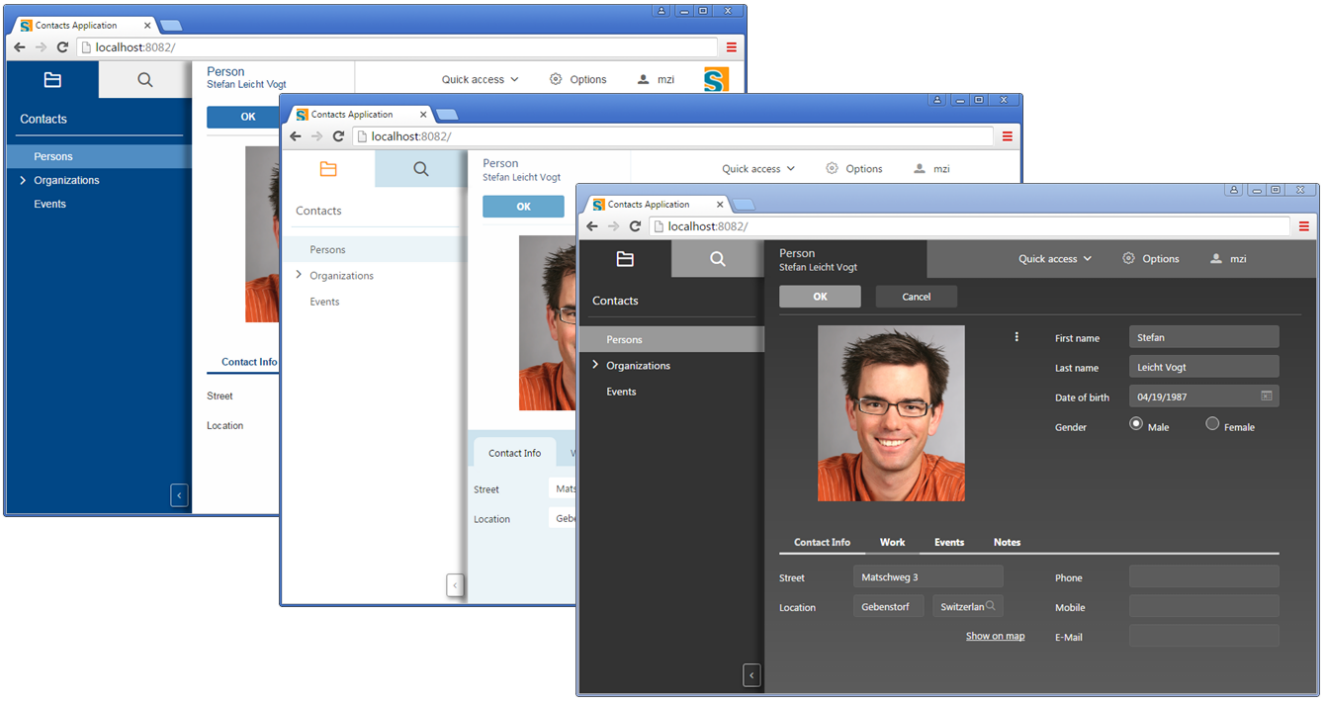


Figure 57. Scout application can change between different themes at runtime.

4.10.2. Modular Scout Applications

- separate entity "event"
- additional pattern for managing m:n relationships using table fields
- contributions to core:
  - menu to desktop
  - column to person page
  - tab to person form
  - event page as child page of organization page

4.10.3. Infrastructure

- maven module that combines frontend and backend into a single war file
- docker integration
  - docker-maven-plugin in pom.xml
  - Dockerfile

4.11. Git configuration

If you want to add the created application to a Git repository there might some configurations be helpful. If there are no plans to use Git, this chapter can be skipped.

E.g. it is best practice to exclude some files from adding to a Git repository. These exclusions can be configured by creating a file named `.gitignore` in the root folder of the repository (see the Git

Documentation for details). Here is a sample file that might be used as starting point:

```
# Git
*.orig

# Maven
target/
.surefire-*
.flattened-pom.xml

# Do not check in any log files
*.log
```

Appendix A: Licence and Copyright

This appendix first provides a summary of the Creative Commons (CC-BY) licence used for this book. The licence is followed by the complete list of the contributing individuals, and the full licence text.

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A.2. Contributing Individuals

In the text below, all contributing individuals are listed in alphabetical order by name. For

contributions in the form of GitHub pull requests, the name should match the one provided in the corresponding public profile.

Bresson Jeremie, Fihlon Marcus, Nick Matthias, Schroeder Alex, Zimmermann Matthias

A.3. Full Licence Text

The full licence text is available online at http://creativecommons.org/licenses/by/3.0/legalcode

Appendix B: Scout Installation

B.1. Overview

This chapter walks you through the installation of Eclipse Scout. The installation description (as well as the rest of this book) is written and tested for Eclipse Scout 9.0 which is delivered as integral part of the Eclipse Oxygen release train, 2017. Detailed information regarding the scheduling of this release train is provided in the Eclipse wiki. [5: Release plan: http://wiki.eclipse.org/Oxygen/Simultaneous_Release_Plan].

We assume that you have not installed any software relevant for the content of this book. This is why the Scout installation chapter starts with the installation of the Java Development Kit (JDK). Consequently, you will have to skip some of the sections depending on your existing setup.

In the text below, installation routines are described separately for Windows, Mac, and Linux.

B.2. Download and Install a JDK

The first step to install Scout is to have an existing and working installation of a JDK version 11. Please note that the Scout 9.0 Runtime does not officially support other Java versions. When downloading a Java 11 JDK it is recommended to choose version 11.0.1 or newer. Please note that only x64 hardware architectures are supported.

You can download the JDK archive matching your operating system from the Java homepage. [6: OpenJDK 11 download: https://jdk.java.net/11/] Afterwards extract the archive to a location of your choice.

To verify the installation you might want to go through this Java “Hello World!” tutorial. [7: Windows Java “Hello World!”: http://docs.oracle.com/javase/tutorial/getStarted/cupojava/win32.html].

B.3. Download and Install Scout

Before you can install Scout make sure that you have a working Java Development Kit (JDK) installation version 11.

You can check your installation on the command line as follows.

```
console-prompt>java -version
openjdk version "11.0.1" 2018-10-16
OpenJDK Runtime Environment 18.9 (build 11.0.1+13)
OpenJDK 64-Bit Server VM 18.9 (build 11.0.1+13, mixed mode)
```

To download the Eclipse Scout package visit the official Eclipse download page.

www.eclipse.org/downloads/packages

The download page lists all available Eclipse packages. Scroll to the package "Eclipse IDE for Scout Developers" and select the download for your preferred platform.

After the package selection, confirm the suggested download mirror as shown in Figure 58.

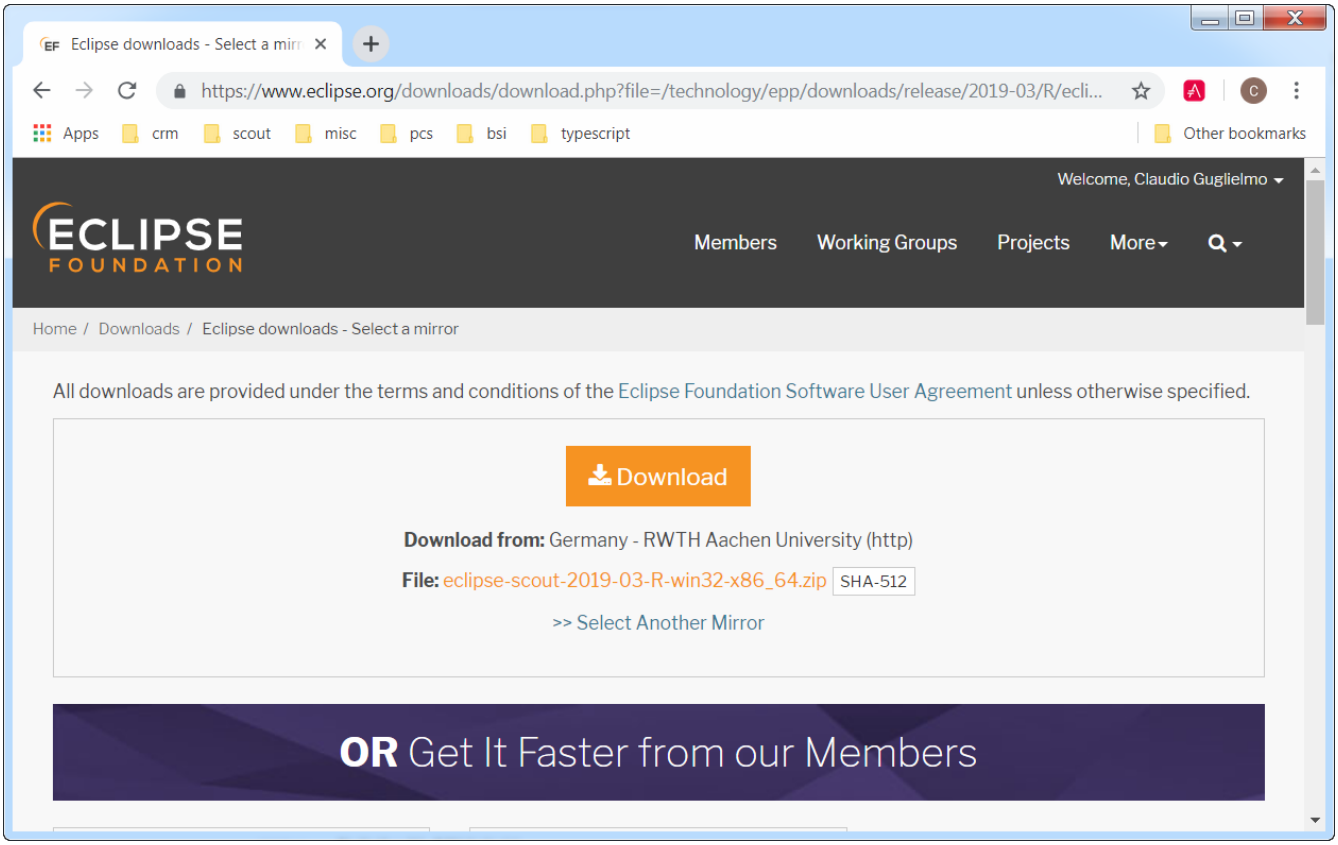

Figure 58. Downloading the Scout package from a mirror.

As the Scout package is a simple ZIP (or tar.gz) file, you may unpack its content to a folder of your choice. Inside the eclipse sub-folder, you will then find the Eclipse executable file, such as the `eclipse.exe` file on a Windows plattform. Starting the Eclipse executable brings up the workspace launcher as shown in Figure 59.

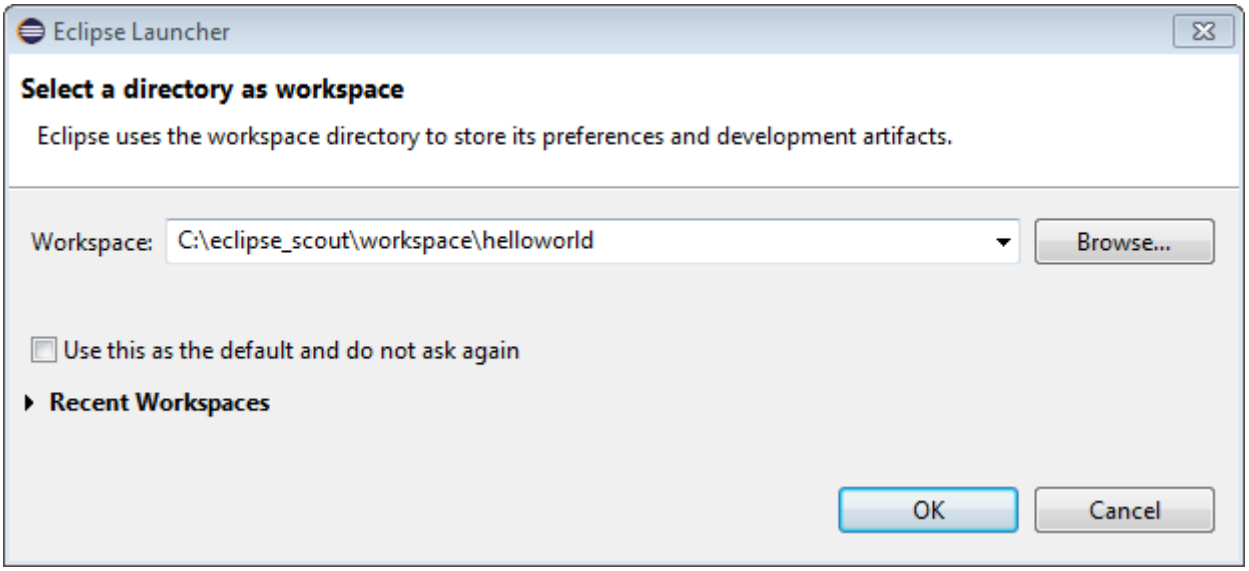

Figure 59. Starting the Eclipse Scout package and selecting an empty workspace.

Into the *Workspace* field you enter an empty target directory for your first Scout project. After

clicking the **[Ok]** button, the Eclipse IDE creates any directories that do not yet exist and opens the specified workspace. When opening a new workspace for the first time, Eclipse then displays the welcome screen shown in Figure 60.

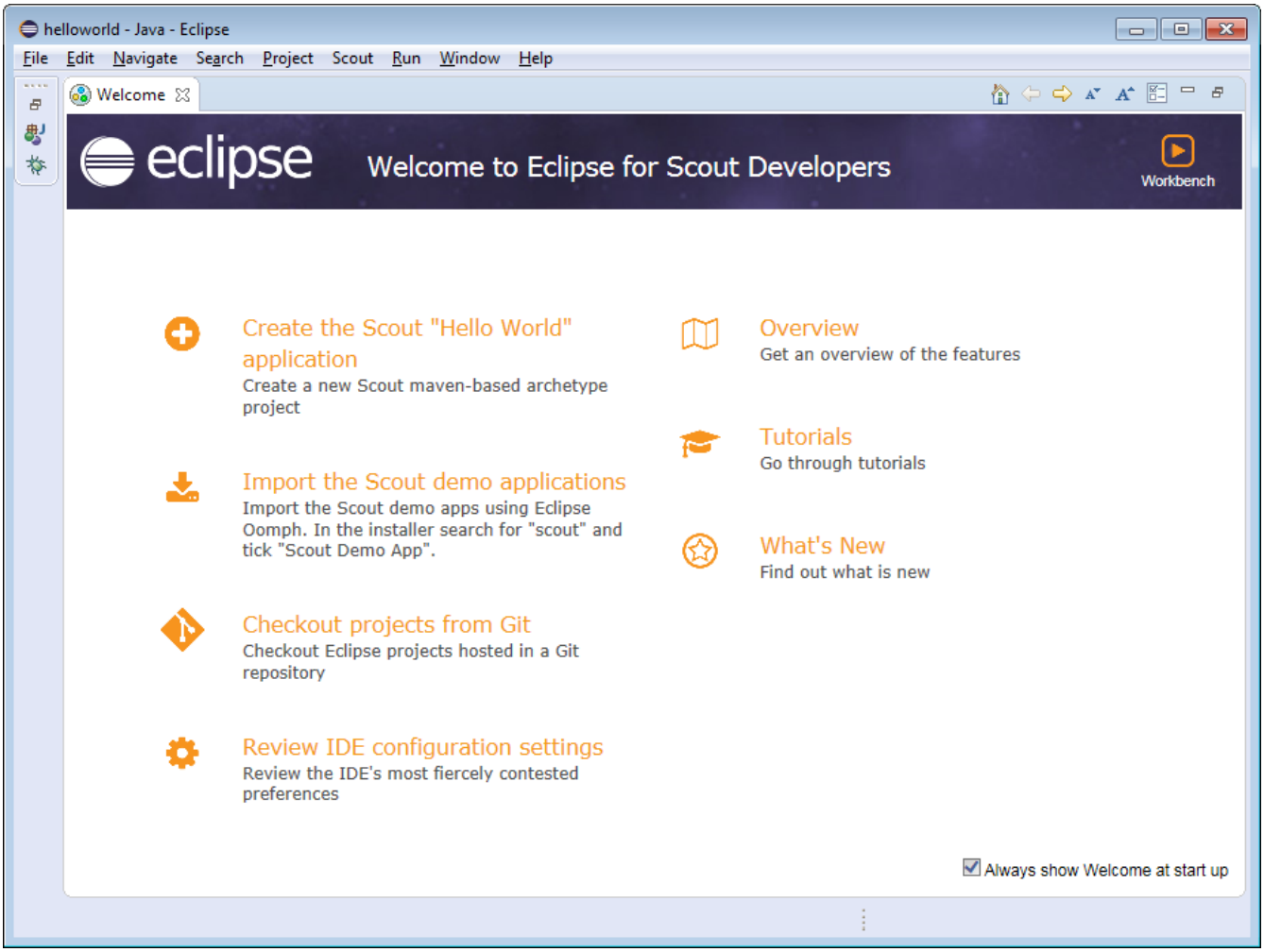

Figure 60. Eclipse Scout welcome screen.

To close the welcome page and open the Scout perspective in the Eclipse IDE click on the *Workbench* icon. As a result the empty Java perspective is displayed according to Figure 61.

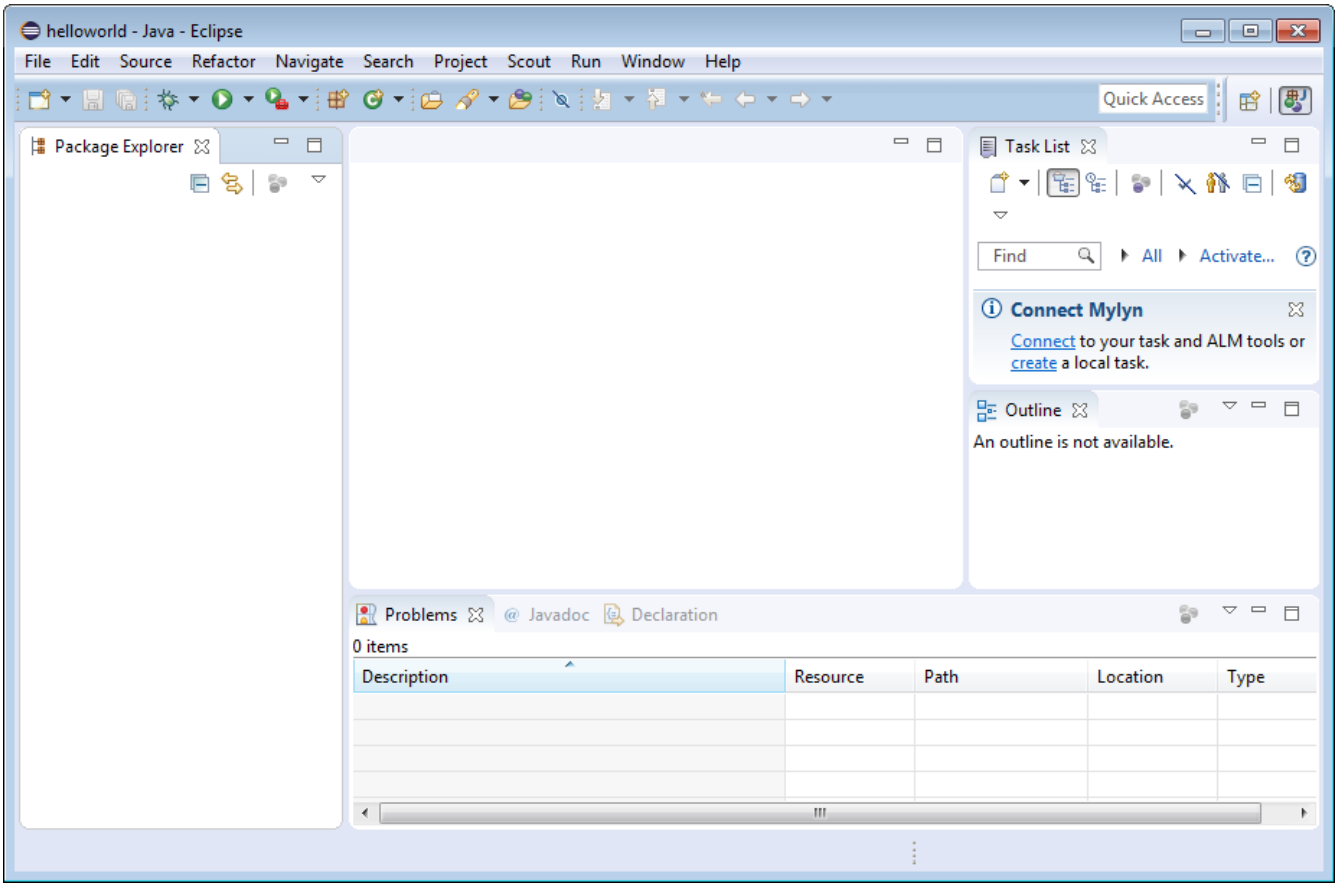

Figure 61. Eclipse Scout started in the Scout SDK perspective.

Congratulations, you just have successfully completed the Eclipse Scout installation!

If you have only installed a single JDK you will not need to change the default `eclipse.ini` file of your Eclipse installation. In case you have installed multiple JDKs coming with their individual Java Runtime Environments (JREs), you might want to explicitly specify which JRE to use. Open the file `eclipse.ini` in a editor of your choice and insert the following two lines at the top of the file:

```
-vm
C:\jdk-11.0.1\bin\server\jvm.dll
```

where the second line specifies the exact path to the JRE to be used to start your Eclipse Scout installation.

If you have explicitly specified the JRE to be used you verify this in the running Eclipse installation. First, select the **Help › About Eclipse** menu to open the about dialog. Then, click on the **[Installation Details]** button and switch to the *Configuration* tab. In the long list of system properties you will find lines similar to the ones shown below.

```
*** Date: Donnerstag, 19. Juni 2014 10:37:17 Normalzeit

*** Platform Details:

*** System properties:
...
-vm
C:\jdk-11.0.1\bin\server\jvm.dll
...
sun.java.command=... vm C:\java\jdk1.8.0_77_x64\jre\bin\server\jvm.dll -vmargs ...
```

You have now successfully completed the Eclipse Scout installation on your Windows environment. With this running Scout installation you may skip the following section on how to add Scout to an existing Eclipse installation.

B.4. Add Scout to your Eclipse Installation

This section describes the installation of Scout into an existing Eclipse installation. As the audience of this section is assumed to be familiar with Eclipse, we do not describe how you got your Eclipse installation in the first place. For the provided screenshots we start from the popular package *Eclipse IDE for Java EE Developers*.

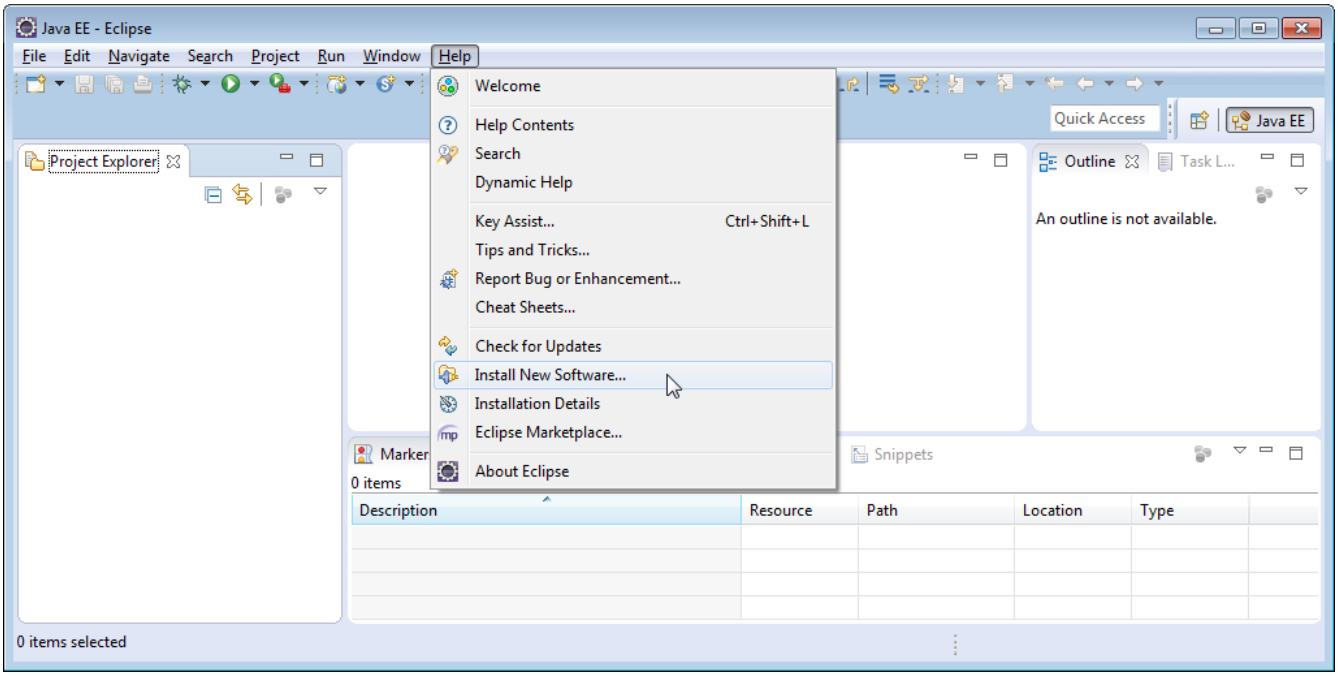

Figure 62. Eclipse menu to install additional software

To add Scout to your existing Eclipse installation, you need to start Eclipse. Then select the **Help › Install New Software...** menu as shown in Figure 62 to open the install dialog.

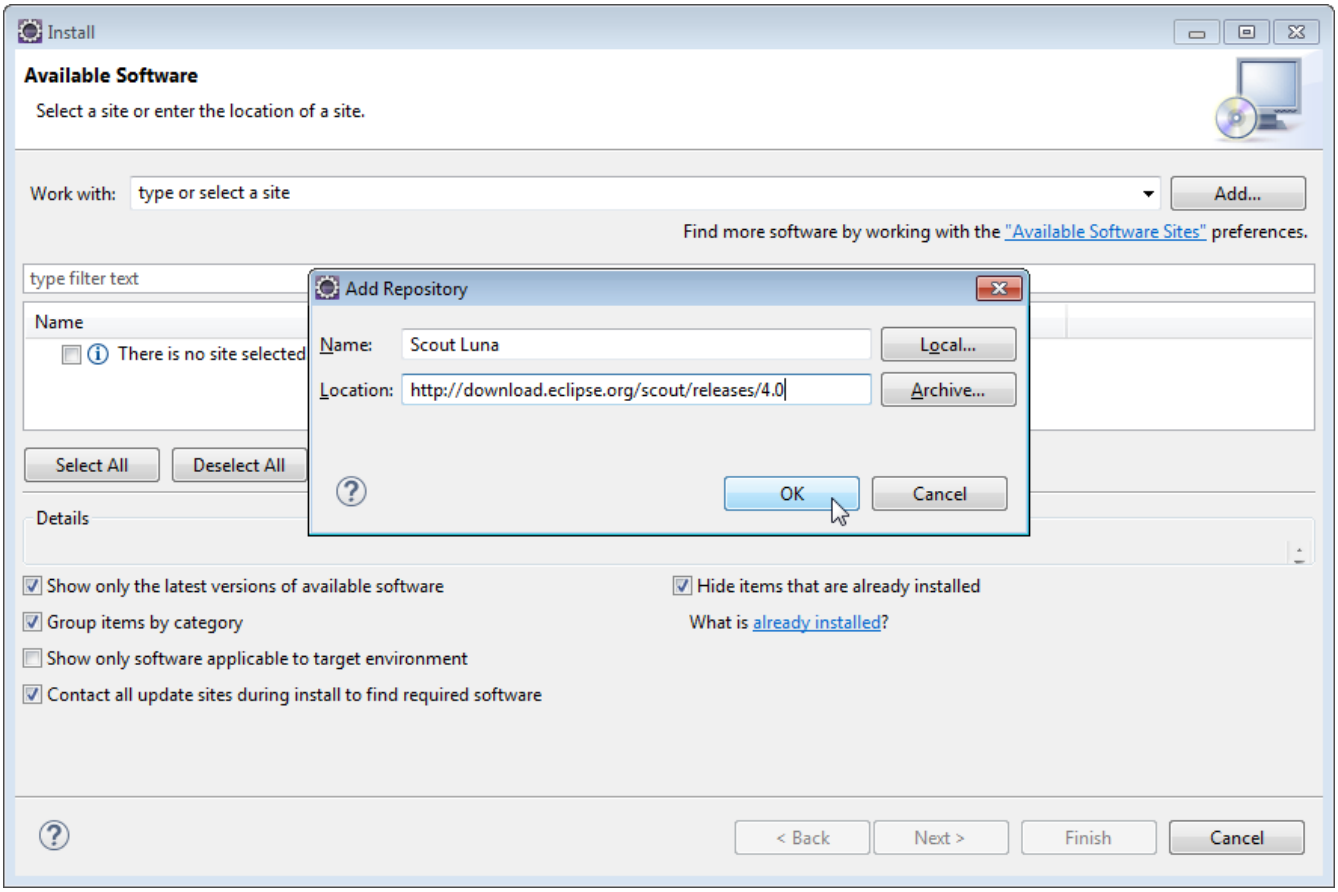

Figure 63. Add the current Scout repository

In the install dialog, click on the **[Add...]** button to enter the link to the Scout repository. This opens the popup dialog *Add Repository* As shown in Figure 63, you may use “Scout Oxygen” for the *Name* field. For the *Location* field enter the Scout release repository as specified below. http://download.eclipse.org/scout/releases/9.0.

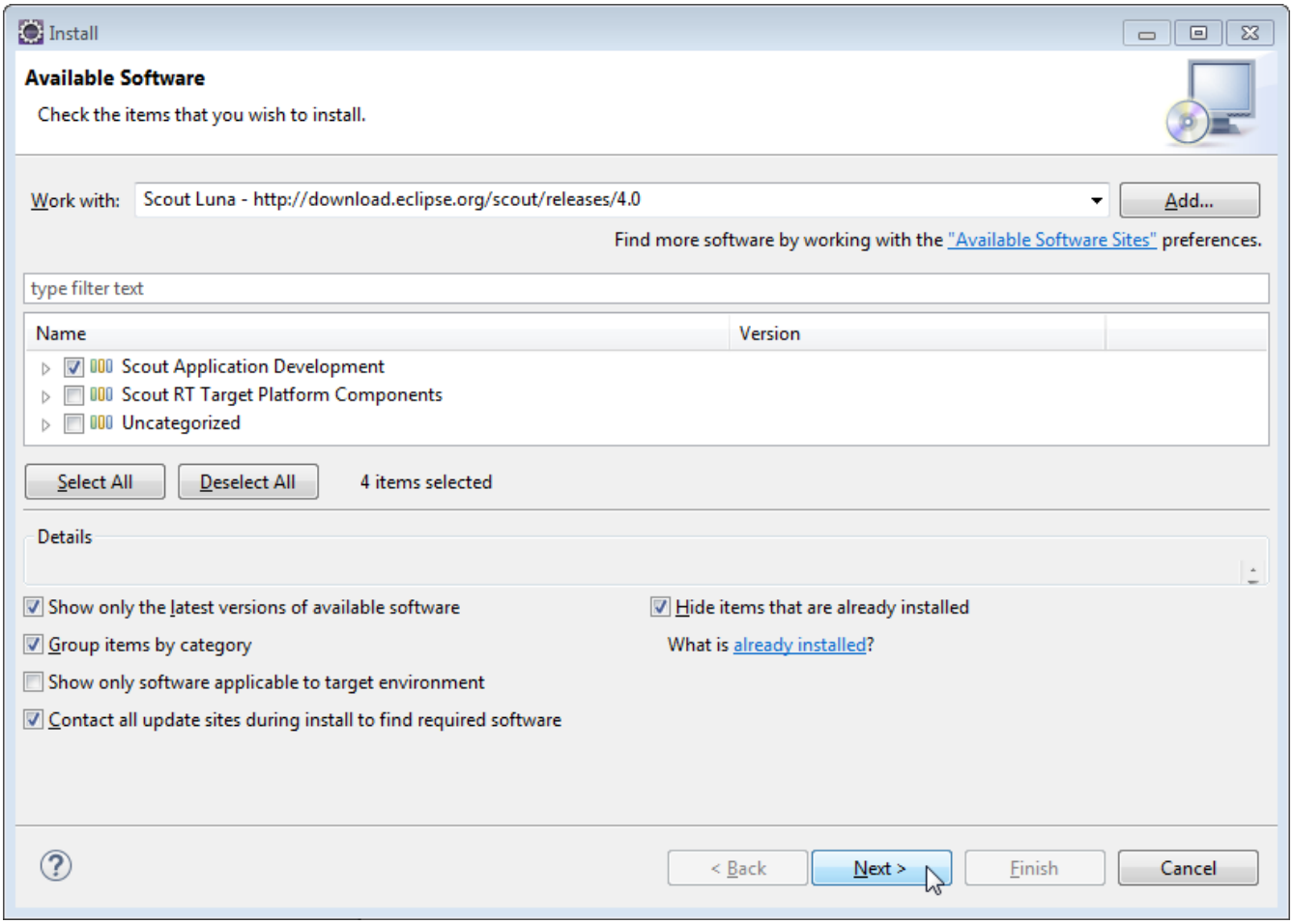

Figure 64. Select the Scout features to add to the Eclipse installation

After the Eclipse IDE has connected to the Scout repository, select the Scout feature *Scout Application Development* as shown in Figure 64. Then, move through the installation with the **[Next]** button. On the last installation step, accept the presented EPL terms by clicking on the appropriate radio button. To complete the installation, click the **[Finish]** button and accept the request for a restart of Eclipse. After the restart of the Eclipse IDE, you may add the Scout perspective using the **Window › Open Perspective › Other ...** menu and selecting the Scout perspective from the presented list. Clicking on the Scout perspective button should then result in a state very similar to Figure 61.

B.5. Verifying the Installation

After you can start your Eclipse Scout package you need to verify that Scout is working as intended. The simplest way to verify your Scout installation is to create a “Hello World” Scout project and run the corresponding Scout application as described in Chapter 2.

Appendix C: Apache Tomcat Installation

Apache Tomcat is an open source web server that is a widely used implementation of the Java Servlet Specification. Specifically, Tomcat works very well to run Scout applications. In case you are interested in getting some general context around Tomcat you could start with the Wikipedia article. [8: Apache Tomcat Wikipedia: http://en.wikipedia.org/wiki/Apache_Tomcat.]. Then get introduced to its core component "Tomcat Catalina". [9: Mulesoft's introduction to Tomcat Catalina: http://www.mulesoft.com/tomcat-catalina.] before you switch to the official Tomcat homepage. [10: Apache Tomcat Homepage: http://tomcat.apache.org/].

This section is not really a step by step download and installation guide. Rather, it points you to the proper places for downloading and installing Tomcat. We recommend to work with Tomcat version 9.0. Start your download from the official download site. [11: Tomcat 9 Downloads: http://tomcat.apache.org/download-90.cgi].

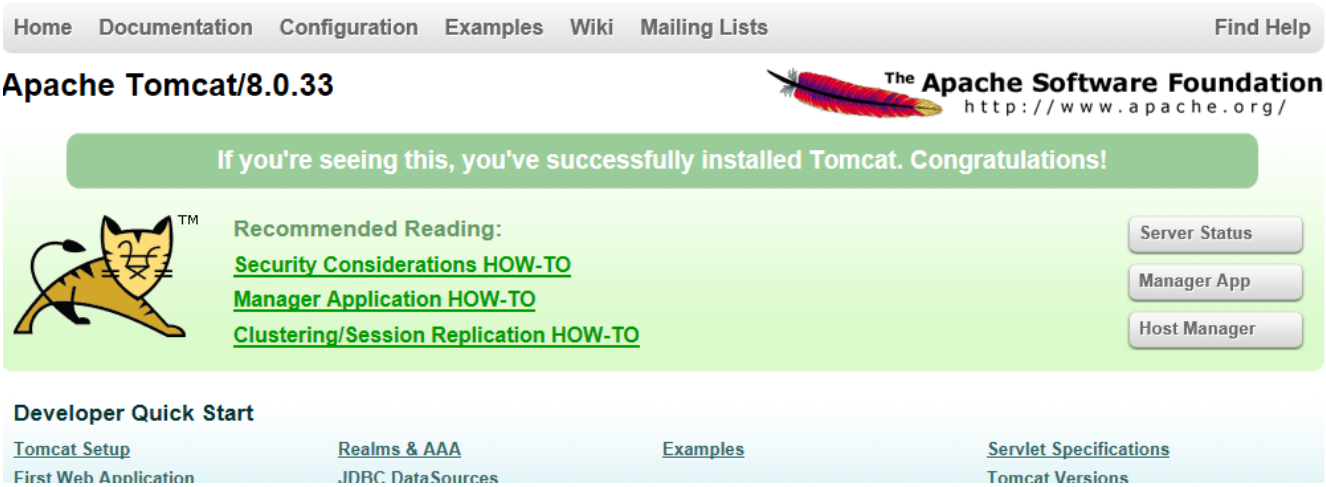

Figure 65. A successful Tomcat 7 installation.

Once you have downloaded and installed Tomcat 9 (see the sections below for plattform specific guidelines) you can start the corresponding service or deamon. To verify that Tomcat is actually running open a web browser of your choice and type http://localhost:8080 into the address bar. You should then see a confirmation of the successful installation according to Figure 65.

C.1. Platform Specific Instructions

According to the Tomcat setup installation for Windows. [12: Tomcat Windows setup: http://tomcat.apache.org/tomcat-9.0-doc/setup.html#Windows] download the package "32-bit/64-bit Windows Service Installer" from the Tomcat 9 download site. Then, start the installer and accept the proposed default settings.

For installing Tomcat on OS X systems download the "tar.gz" package from the Tomcat 9 download site. Then, follow the installation guide. [13: Installing Tomcat on OS X: http://wolfpaulus.com/journal/mac/tomcat8] provided by Wolf Paulus.

For Linux systems download the "tar.gz" package from the Tomcat 9 download site. Then, follow the description of the Unix setup. [14: Tomcat Linux setup: http://tomcat.apache.org/tomcat-9.0-doc/setup.html#Unix_daemon] to run Tomcat as a deamon. If you use Ubuntu, you may want to follow

the tutorial. [15: Apache Tomcat Tutorial: http://www.vogella.com/articles/ApacheTomcat/article.html] for downloading and installing Tomcat provided by Lars Vogel.

C.2. Directories and Files

Tomcat's installation directory follows the same organisation on all platforms. Here, we will only introduce the most important aspects of the Tomcat installation for the purpose of this book.

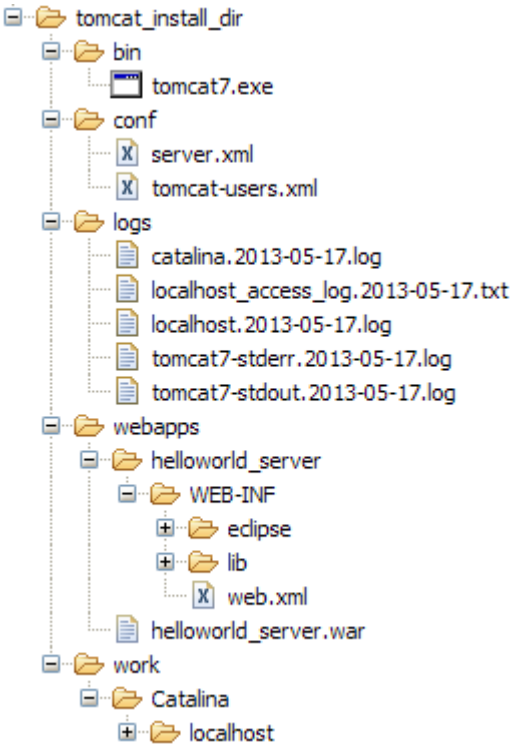

Figure 66. The organisation of a Tomcat installation including specific files of interest. As an example, the "Hello World" server application is contained in subdirectory `webapps`.

Note that some folders and many files of a Tomcat installation are not represented in Figure 66. We just want to provide a basic understanding of the most important parts to operate the web server in the context of this book. In the bin folder, the executable programs are contained, including scripts to start and stop the Tomcat instance.

The conf folder contains a set of XML and property configuration files. The file server.xml represents Tomcat's main configuration file. It is used to configure general web server aspects such as the port number of its connectors for the client server communication. For the default setup, port number 8080 is used for the communication between clients applications and the web server. The file tomcat-users.xml contains a database of users, passwords and associated roles.

Folder logs contains various logfiles of Tomcat itself as well as host and web application log files. TODO [7.0] jbr: need to provide more on what is where (especially application logs and exact setup to generate log entries from scout apps).

The folder needed for deploying web applications into a Tomcat instance is called webapps. It can be used as the target for copying WAR files into the web server. The installation of the WAR file then extracts its content into the corresponding directory structure as shown in Figure 66 in the case of the file helloworld_server.war.

Finally, folder work contains Tomcat's runtime "cache" for the deployed web applications. It is organized according to the hierarchy of the engine (Catalina), the host (localhost), and the web application (helloworld_server).

C.3. The Tomcat Manager Application

Tomcat comes with the pre installed "Manager App". This application is useful to manage web applications and perform tasks such as deploying a web application from a WAR file, or starting and stopping installed web applications. A comprehensive documentation for the "Manager App" can be found under the Tomcat homepage. [16: The Tomcat Manager Application: http://tomcat.apache.org/tomcat-9.0-doc/manager-howto.html.]. Here we only show how to start this application from the hompage of a running Tomcat installation.

To access this application you can switch to the "Manager App" with a click on the corresponding button on the right hand side. The button can be found on the right hand side of Figure 65. Before you are allowed to start this application, you need to provide username and password credentials of a user associated with Tomcats's manager-gui role.

Listing 56. Tomcat Users configuration file.

```
<tomcat-users>
  <!--
  NOTE: By default, no user is included in the "manager-gui" role required
  to operate the "/manager/html" web application. If you wish to use it
  you must define such a user - the username and password are arbitrary.
  -->
  <user name="admin" password="s3cret" roles="manager-gui"/>
</tomcat-users>
```

To get at user names and passwords you can open file tomcat-users.xml located in Tomcat's conf directory. In this file the active users with their passwords and associated roles are stored. See Listing Listing 56 for an example. From the content of this file, we see that user admin has password s3cret and also posesses the necessary role manager-gui to access the "Manager App". If file tomcat-users.xml does not contain any user with this role, you can simply add new user with this role to the existing users. Alternatively, you also can add the necessary role to an existing user. Just append a comma to the existing right(s) followed by the string manager-gui. Note that you will need to restart your Tomcat application after adapting the content of file tomcat-users.xml.

With working credentials you can now start the "Manager App" as described the "Hello World" tutorial in Section 2.5.

Do you want to improve this document? Have a look at the sources on GitHub.