Developers' Guide

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Chapter 1. Developers' Guide

This developers' guide is for:

- programmers who want to just use Apache Isis to build applications, and want help setting up their development environment or to build their code from the command line (eg to execute within a continuous integration server such as Jenkins)
- programmers who want to contribute back patches (bug fixes, new features) either to the codebase or the framework's documentation
- committers of Apache Isis itself who want guidance on release process, publishing documents and other related procedures.

1.1. Other Guides

Apache Isis documentation is broken out into a number of user, reference and "supporting procedures" guides.

The user guides available are:

- Fundamentals
- Wicket viewer
- Restful Objects viewer
- DataNucleus object store
- Security
- Testing
- Beyond the Basics

The reference guides are:

- Annotations
- Domain Services
- Configuration Properties
- Classes, Methods and Schema
- Apache Isis Maven plugin
- Framework Internal Services

The remaining guides are:

- Developers' Guide (this guide)
- Committers' Guide (release procedures and related practices)

Chapter 2. Using an IDE

The vast majority of Java developers use an IDE to assist with developing their code, and we highly recommend that you do likewise as you develop your Apache Isis applications using an IDE. Apache Isis is built with Maven, and all modern IDEs can import Maven projects.

This chapter shows how to setup and use two of the most popular IDEs, IntelliJ IDEA and Eclipse.

2.1. Developing using IntelliJ IDEA

This material does not constitute an endorsement; JetBrains is not affiliated to Apache Software Foundation in any way. JetBrains does however provide complimentary copies of the IntelliJ IDE to Apache committers.

This section describes how to install and setup JetBrains' IntelliJ IDEA, then how to import an application into IntelliJ and run it.

2.1.1. Installing and Setting up

This section covers installation and setup. These notes/screenshots were prepared using IntelliJ Community Edition 14.1.x, but are believed to be compatible with more recent versions/other editions of the IDE.

Download and Install

Download latest version of IntelliJ Community Edition, and install:

Start the wizard, click through the welcome page:

Figure 1. IntelliJ Installation Wizard - Welcome page

Choose the location to install the IDE:

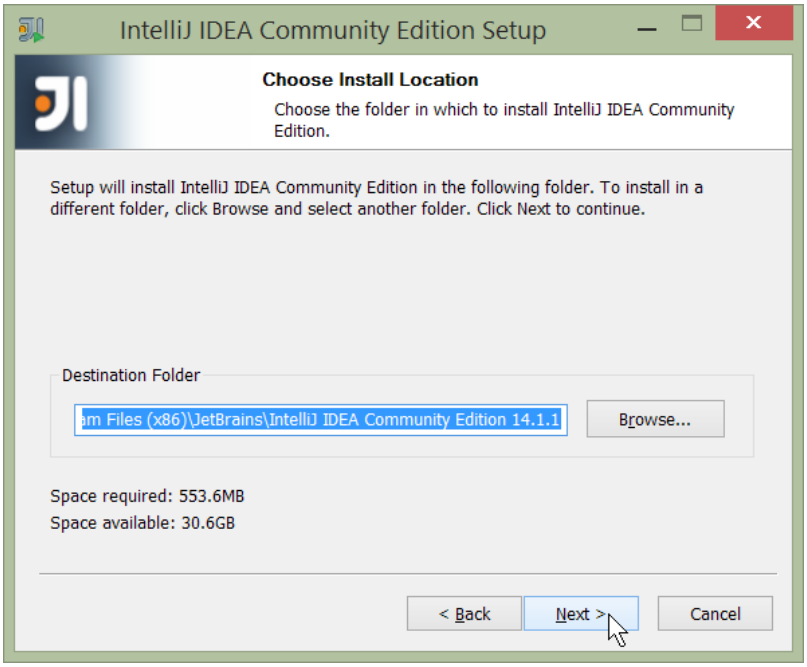


Figure 2. IntelliJ Installation Wizard - Choose Location

Adjust any installation options as you prefer:

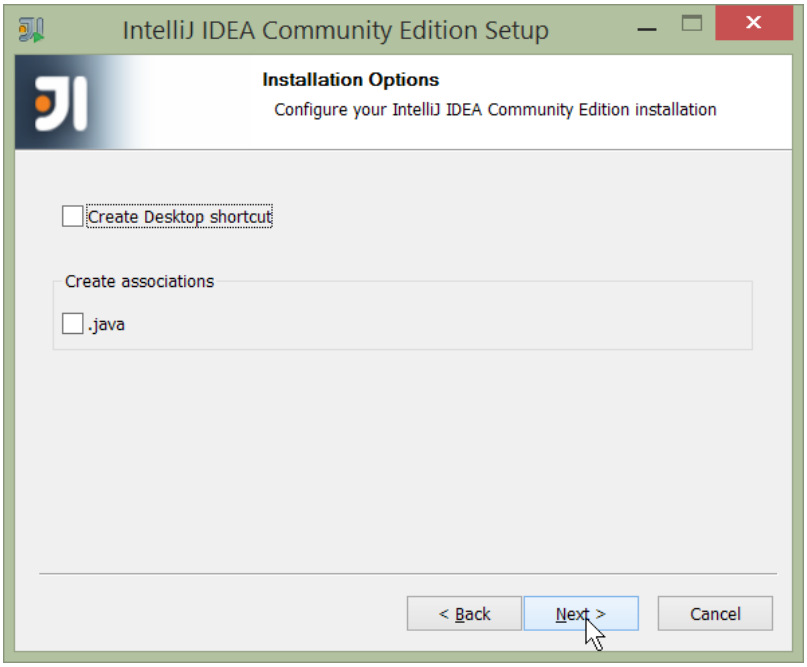


Figure 3. IntelliJ Installation Wizard - Installation Options

and the start menu:

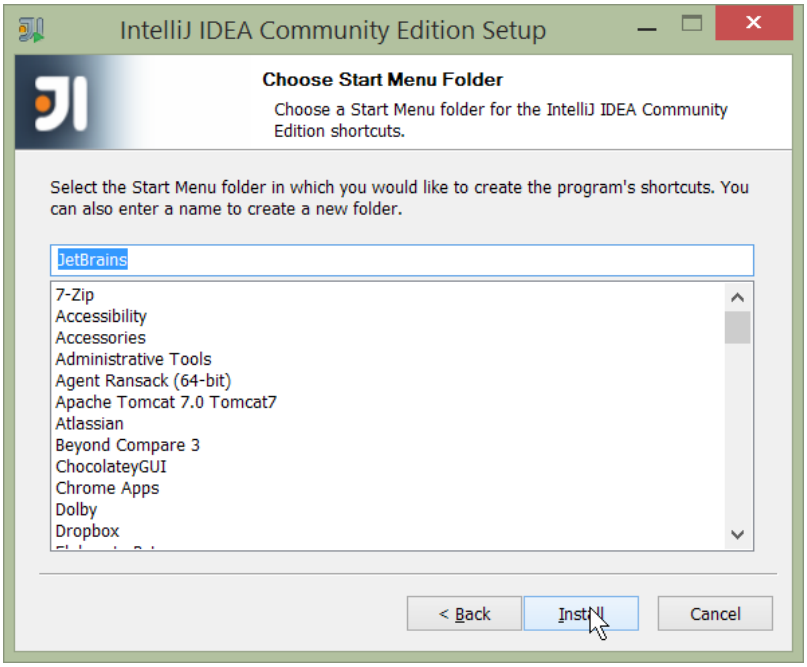


Figure 4. IntelliJ Installation Wizard - Start Menu Folder

and finish up the wizard:

Figure 5. IntelliJ Installation Wizard - Completing the Wizard

Later on we'll specify the Apache Isis/ASF code style settings, so for now select `I do not want to import settings`:

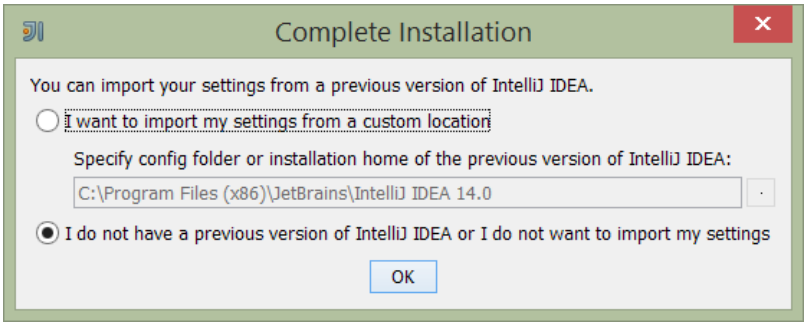


Figure 6. IntelliJ Installation Wizard - Import Settings

Finally, if you are a trendy hipster, set the UI theme to Darcula:

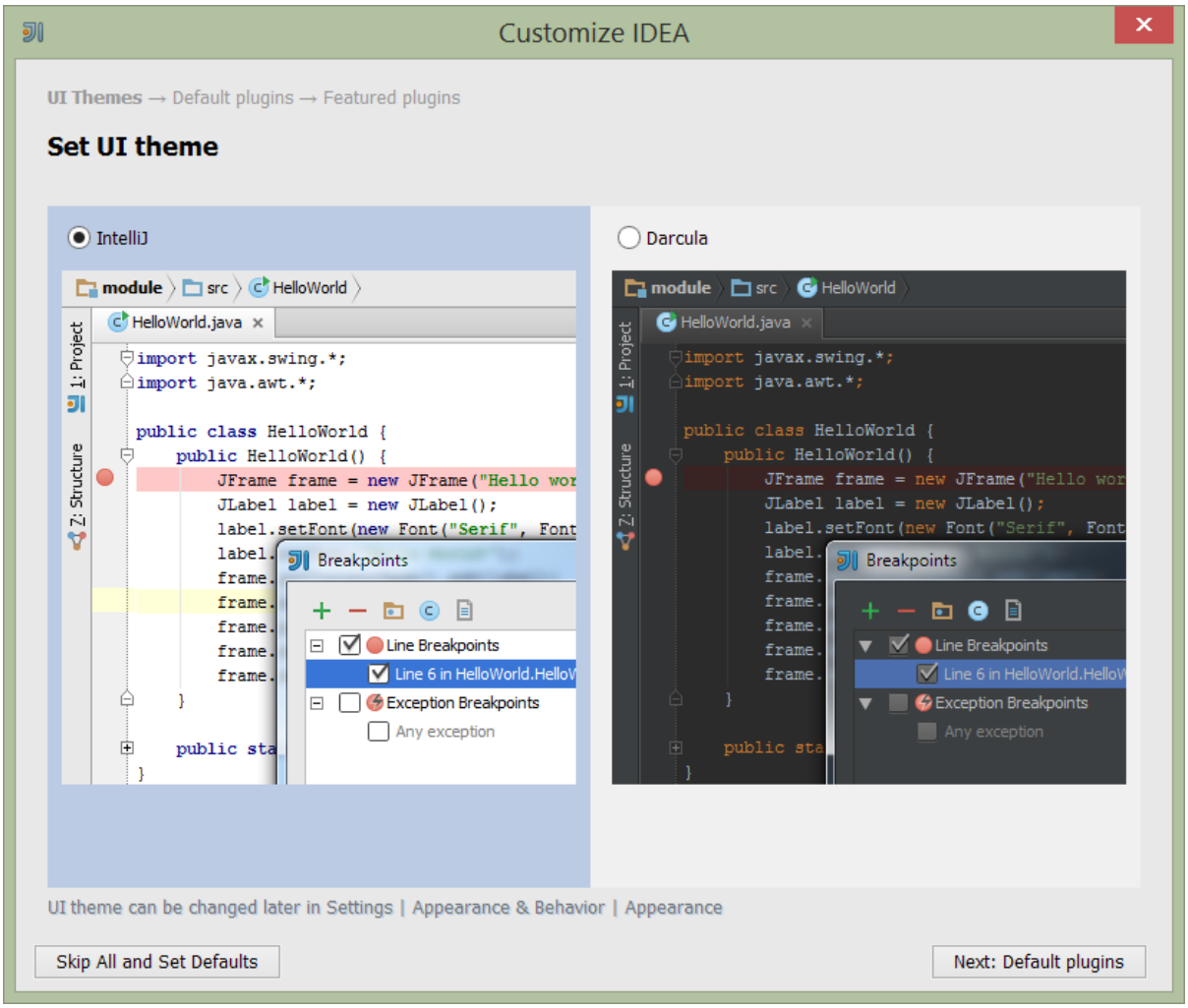


Figure 7. IntelliJ Installation Wizard Set UI Theme

New Project

In IntelliJ a project can contain multiple modules; these need not be physically located together. (If you are previously an Eclipse user, you can think of it as similar to an Eclipse workspace).

Start off by creating a new project:

Figure 8. IntelliJ Create New Project

We want to create a new **Java** project:

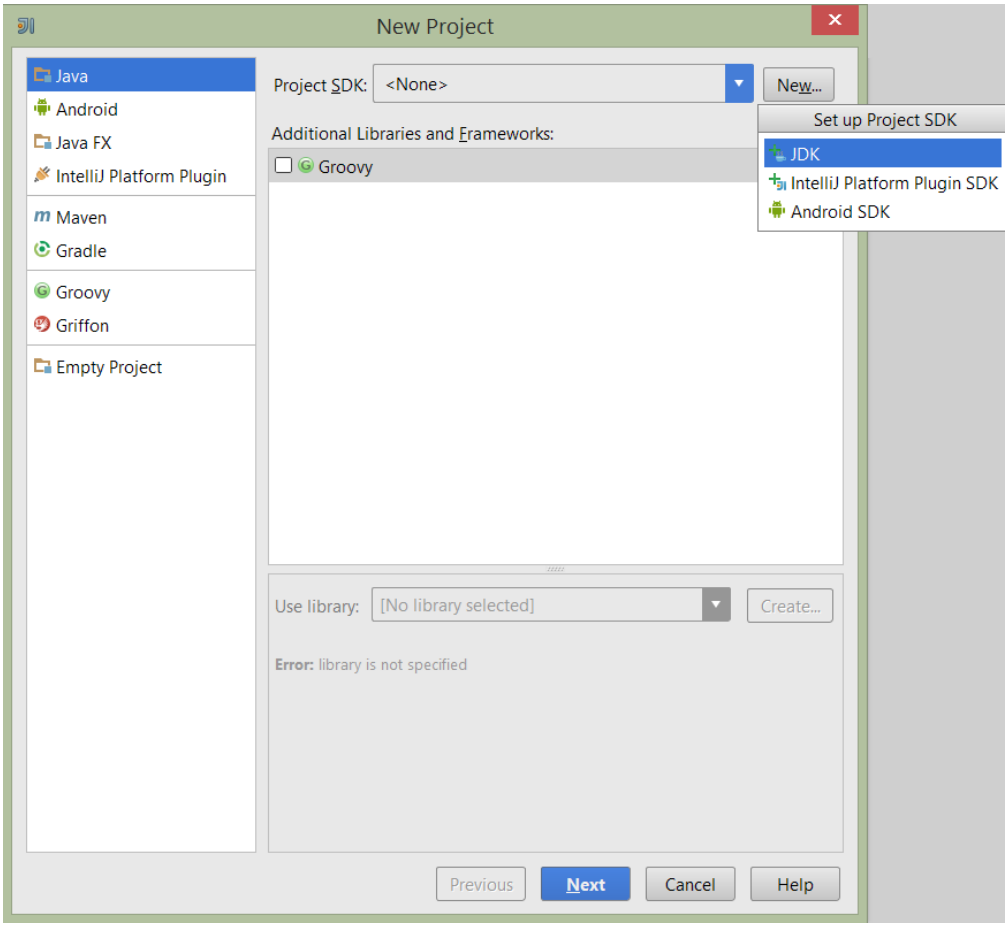


Figure 9. IntelliJ Create New Project - Create a Java project

We therefore need to specify the JDK. Apache Isis supports both Java 7 and Java 8.

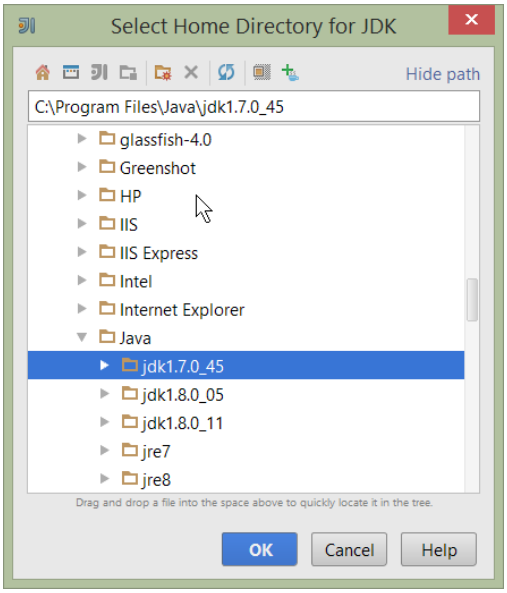


Figure 10. IntelliJ Create New Java Project - Select the JDK

Specify the directory containing the JDK:

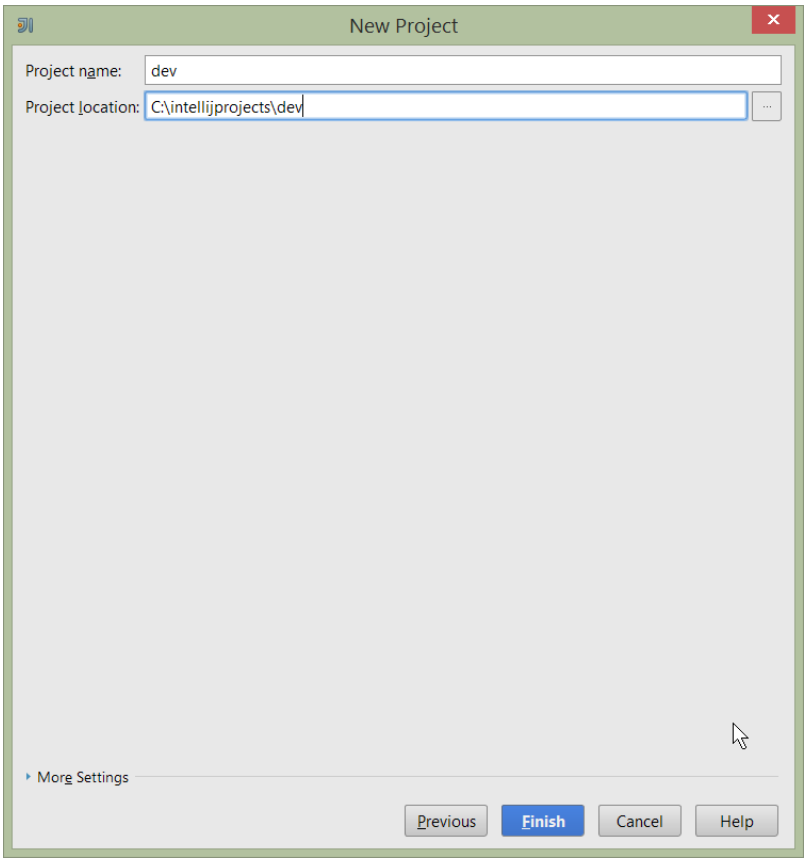


Figure 11. IntelliJ Create New Project - Select the JDK location

Finally allow IntelliJ to create the directory for the new project:

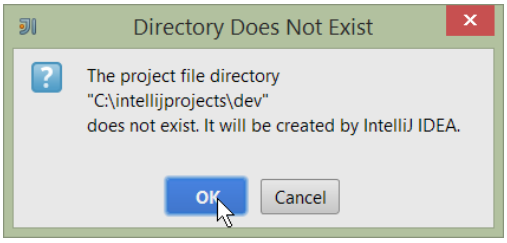


Figure 12. IntelliJ Create New Project

File templates

Next we recommend you import a set of standard file templates. These are used to create new classes or supporting files:

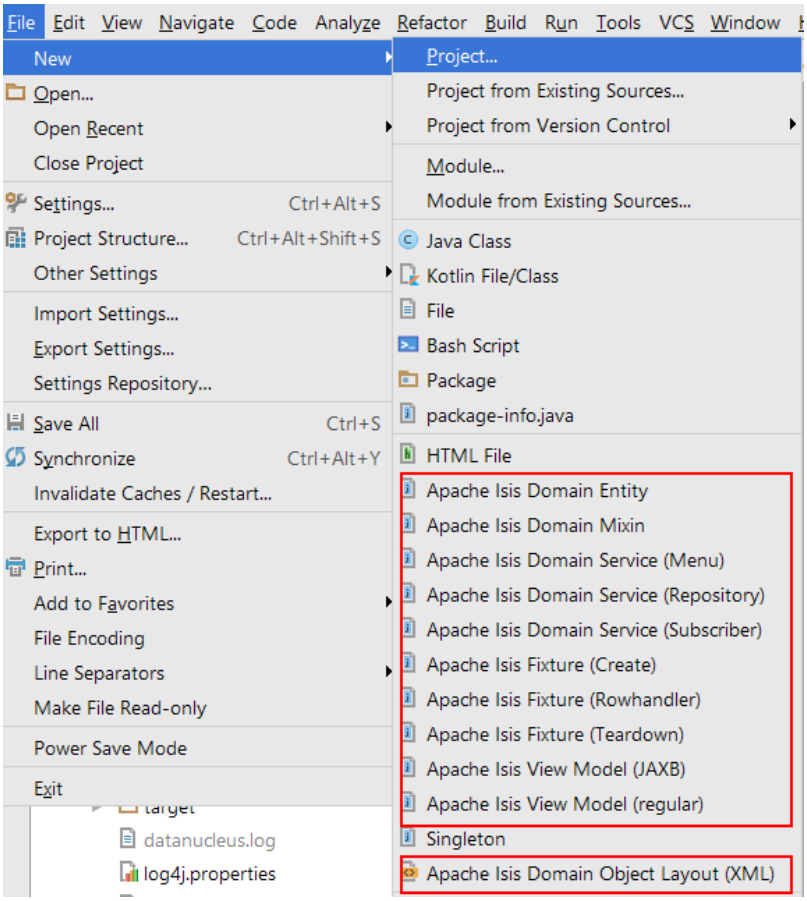


Figure 13. File templates

The file templates are provided as a settings JAR file, namely **isis-settings-file-templates.jar**. Download this file.

Next, import using `File > Import Settings`, specifying the directory that you have downloaded the file to:

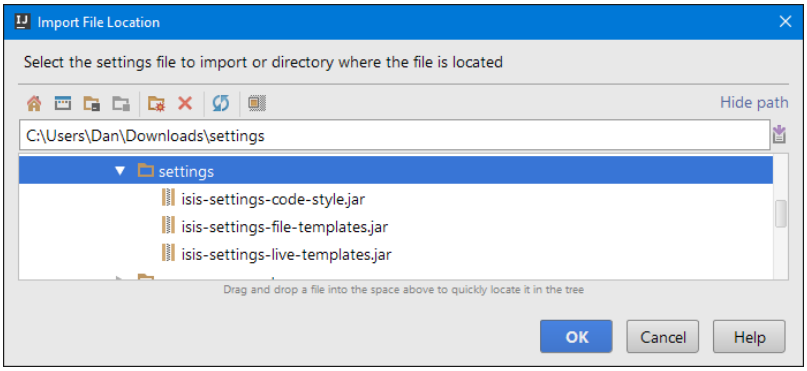


Figure 14. IntelliJ Import Settings - Specify JAR file

Select all the categories (there should just be one), and hit OK. then hit restart.

If importing into IntelliJ 2017.2.3 two categories are shown - "File templates" and "File templates (schemes)". Select all the categories.

Apparently no categories are shown if importing into IntelliJ 2016.1.1 Community Edition (and perhaps other 2016 versions). The file does import ok into IntelliJ 15.0.x, so we think this is a bug in the 2016 version.

The workaround is to extract the `.jar` file locally and copy the files into IntelliJ's `config` directory, somewhere in your home directory:

- Windows `<User home>\.IdeaIC2016\config`
- Linux `~/..IdeaIC2016/config`
- Mac OS `~/Library/Preferences/IdeaIC2016`

Live templates

We also recommend you import a set of live templates. These are used to add new methods to existing classes:

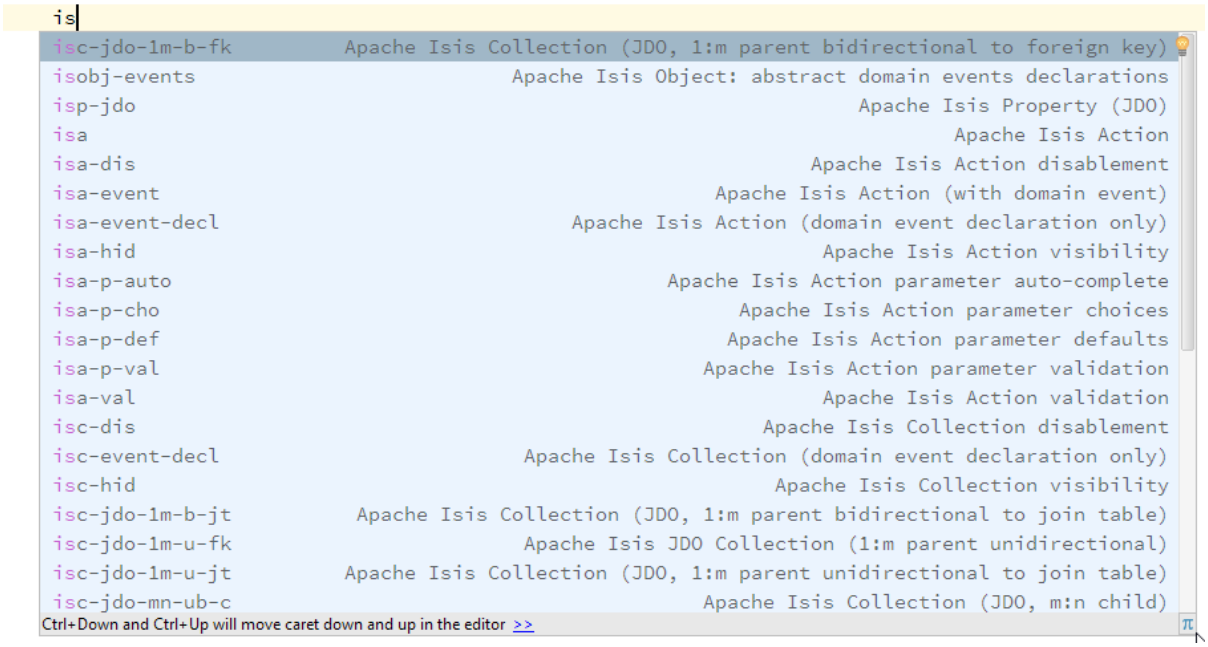


Figure 15. Live templates

The live templates have a prefix of either:

- `is` : for Apache Isis domain objects
- `ju` : for JUnit tests
- `jm` : for JMock mocks or libraries
- `ad` : for Asciidoc documentation; a full list can be found in the appendix.

The live templates are also provided as a settings JAR file, namely **isis-settings-live-templates.jar**. Download and import (as for the previous settings JAR files).

Coding Standards

Next, we suggest you import settings for standard ASF/Apache Isis coding conventions. This file is also provided as a settings file, namely **isis-settings-code-style.jar**. Download and import (as for the above settings JAR files).

Other Settings (Compiler)

There are also some other settings that influence the compiler. We highly recommend you set these.

On the **Compiler** Settings page, ensure that `build automatically` is enabled (and optionally `compile independent modules in parallel`):

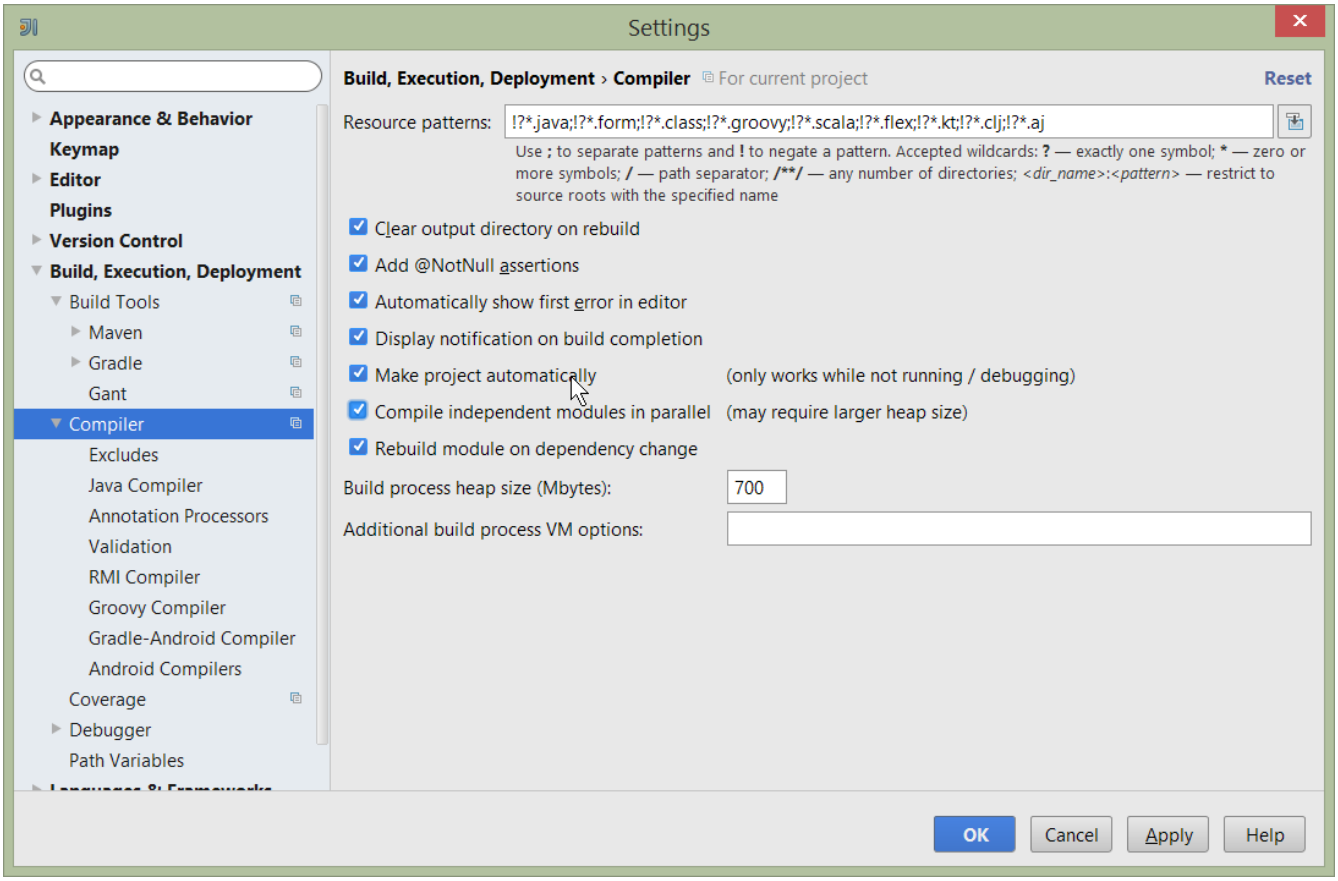


Figure 16. IntelliJ Compiler Settings

On the **Annotation Processors** page, enable and adjust for the 'default' setting:

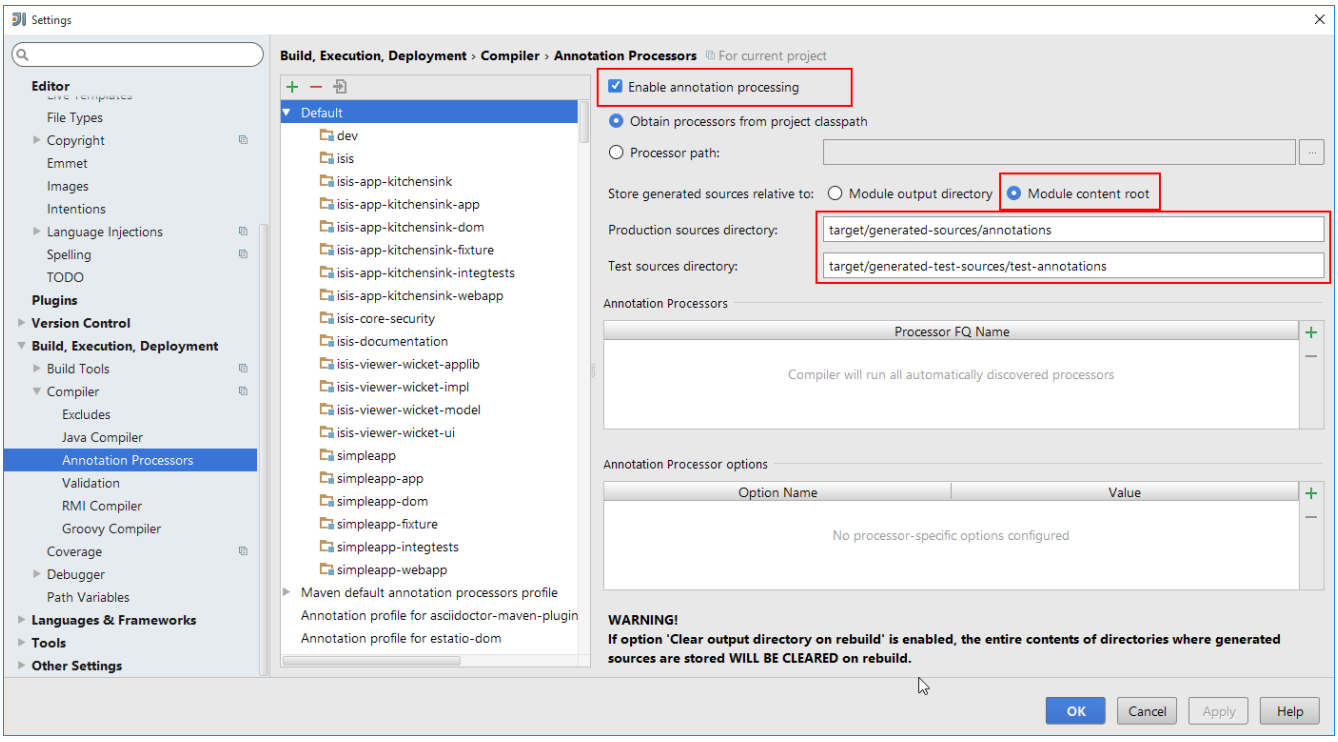


Figure 17. IntelliJ Annotation Processor Settings

This setting enables the generation of the `Q*` classes for DataNucleus type-safe queries, as well as being required for frameworks such as Project Lombok.

IntelliJ may also have inferred these settings for specific projects/modules when importing; review the list on the left to see if the default is overridden and fix/delete as required.

Other Settings (Maven)

There are also some other settings for Maven that we recommend you adjust (though these are less critical):

First, specify an up-to-date Maven installation, using `File > Settings` (or `IntelliJ > Preferences` if on MacOS):

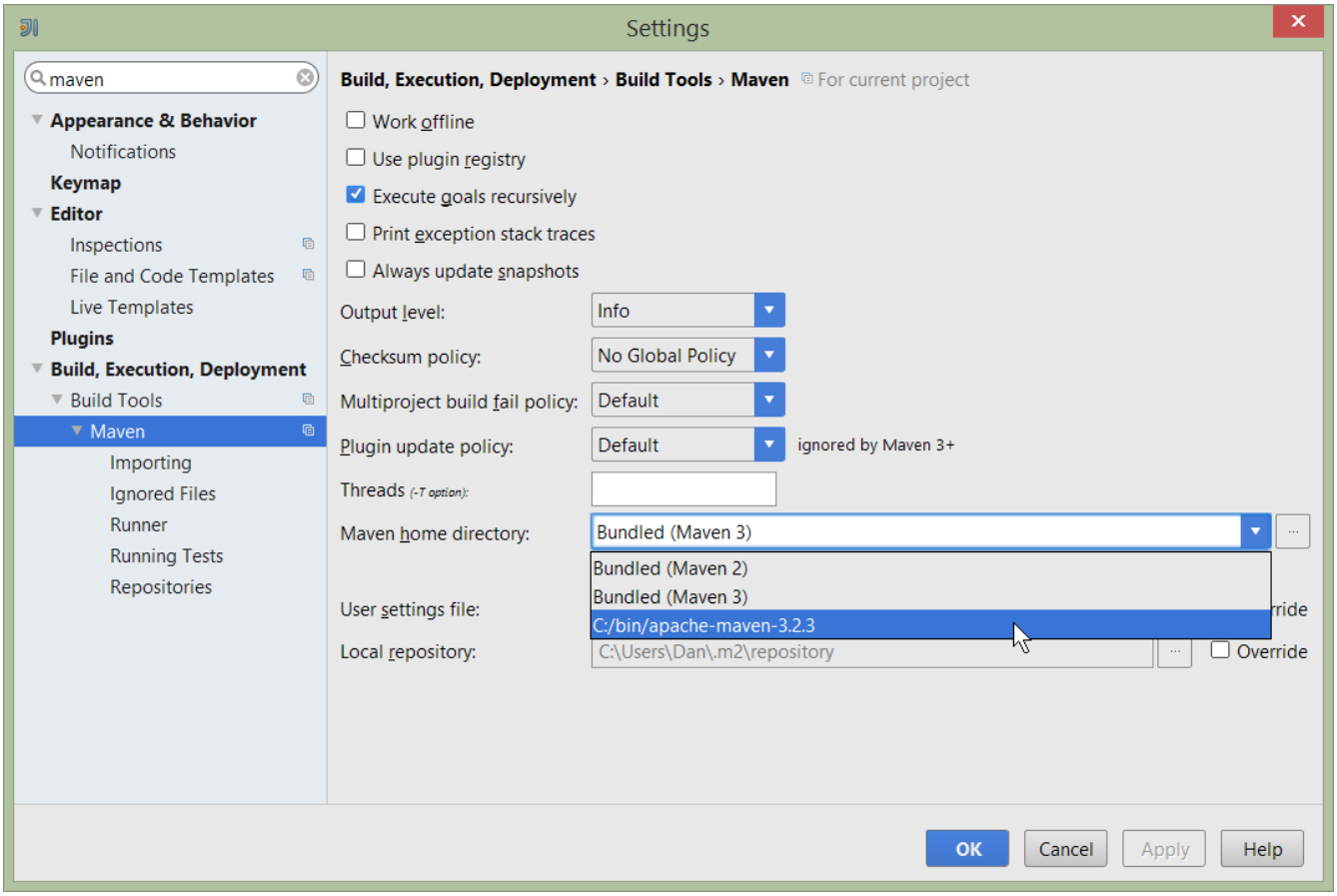


Figure 18. IntelliJ Maven Settings - Installation

Still on the Maven settings page, configure as follows:

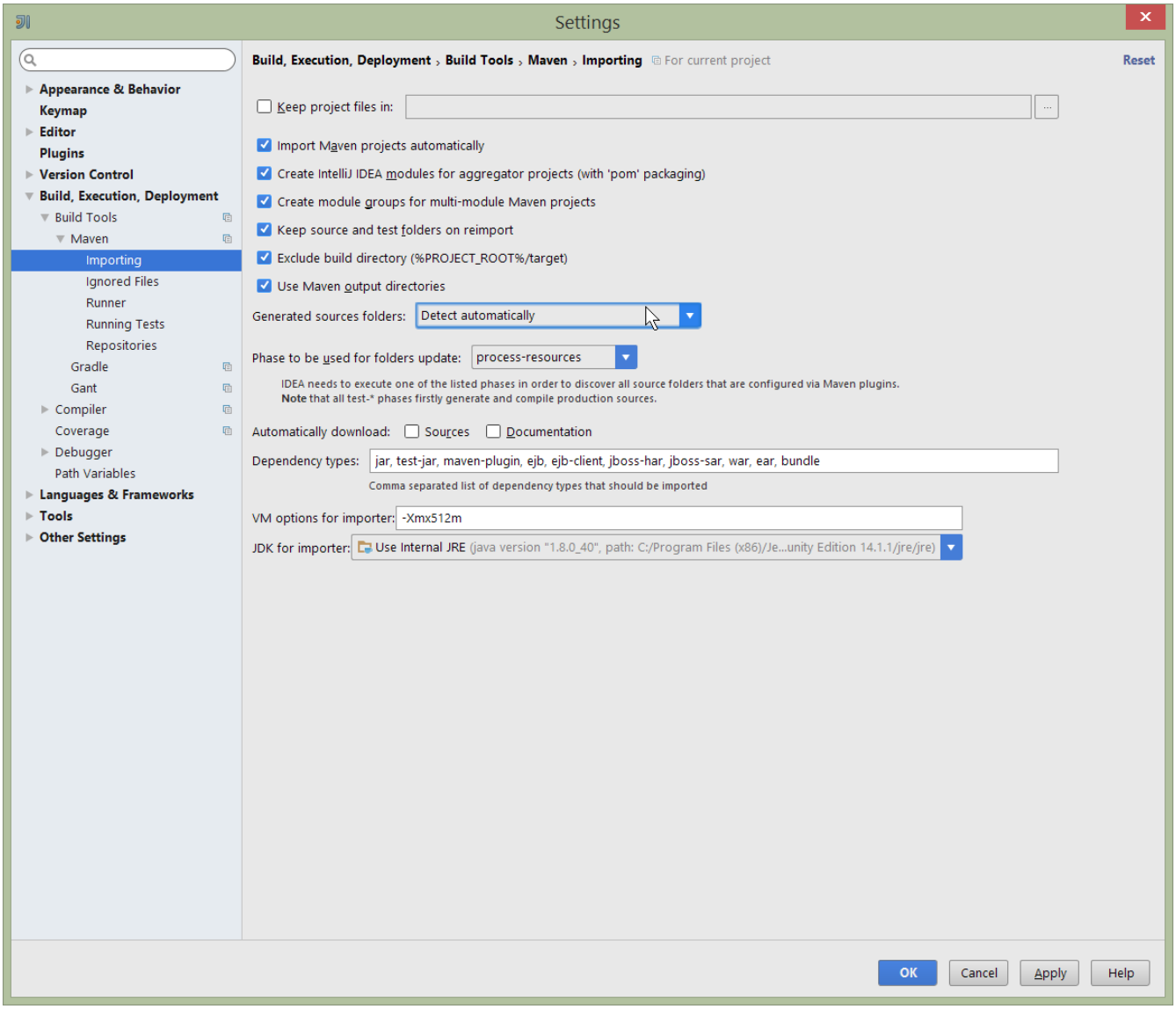


Figure 19. IntelliJ Maven Settings - Configuration

Other Settings (Misc)

These settings are optional but also recommended.

On the **auto import** page, check the `optimize imports on the fly` and `add unambiguous imports on the fly`

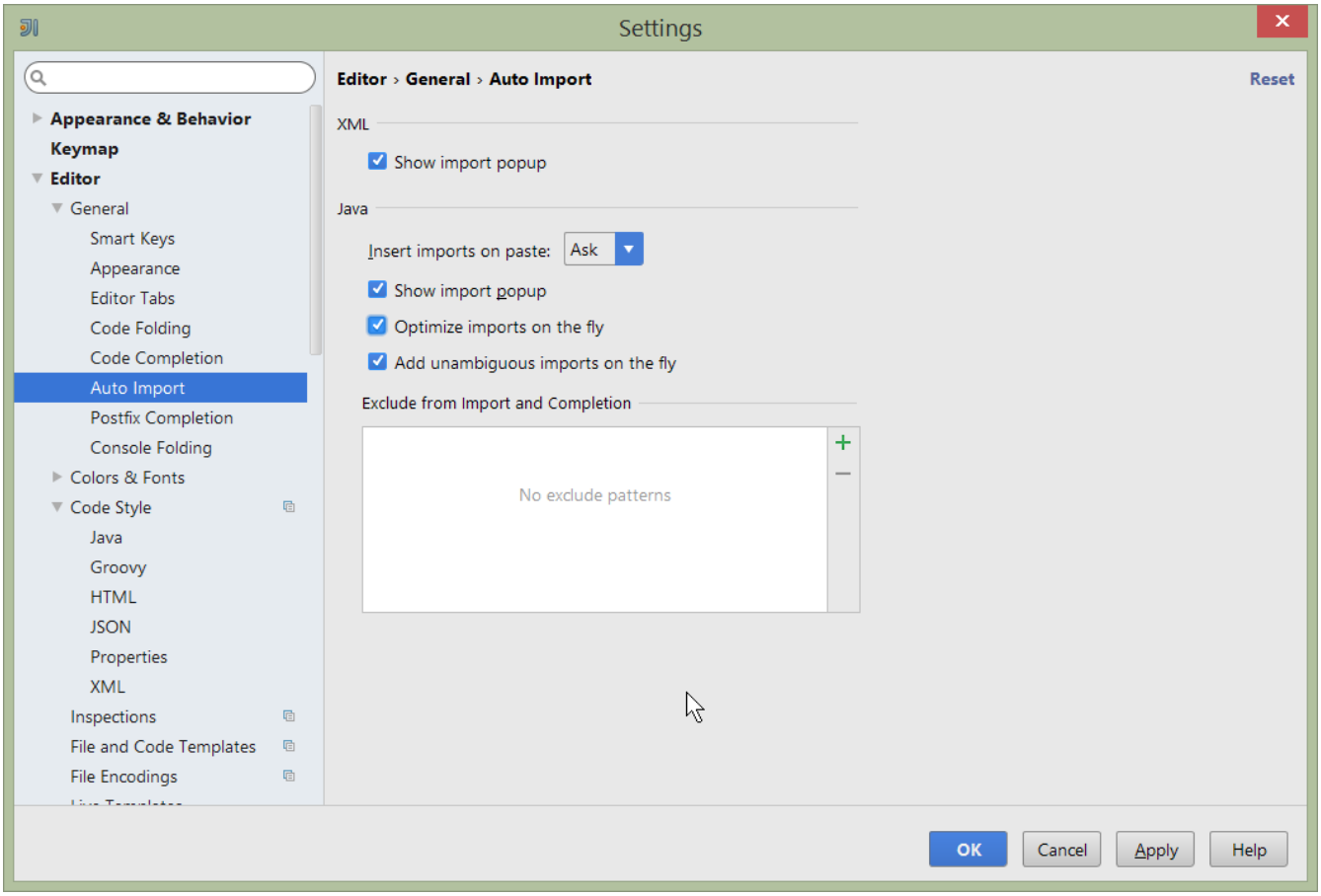


Figure 20. IntelliJ Maven Settings - Auto Import

2.1.2. Importing Maven Modules

Let's load in some actual code! We do this by importing the Maven modules.

First up, open up the Maven tool window (`View > Tool Windows > Maven Projects`). You can then use the 'plus' button to add Maven modules. In the screenshot you can see we've loaded in Apache Isis core; the modules are listed in the *Maven Projects* window and corresponding (IntelliJ) modules are shown in the *Projects* window:

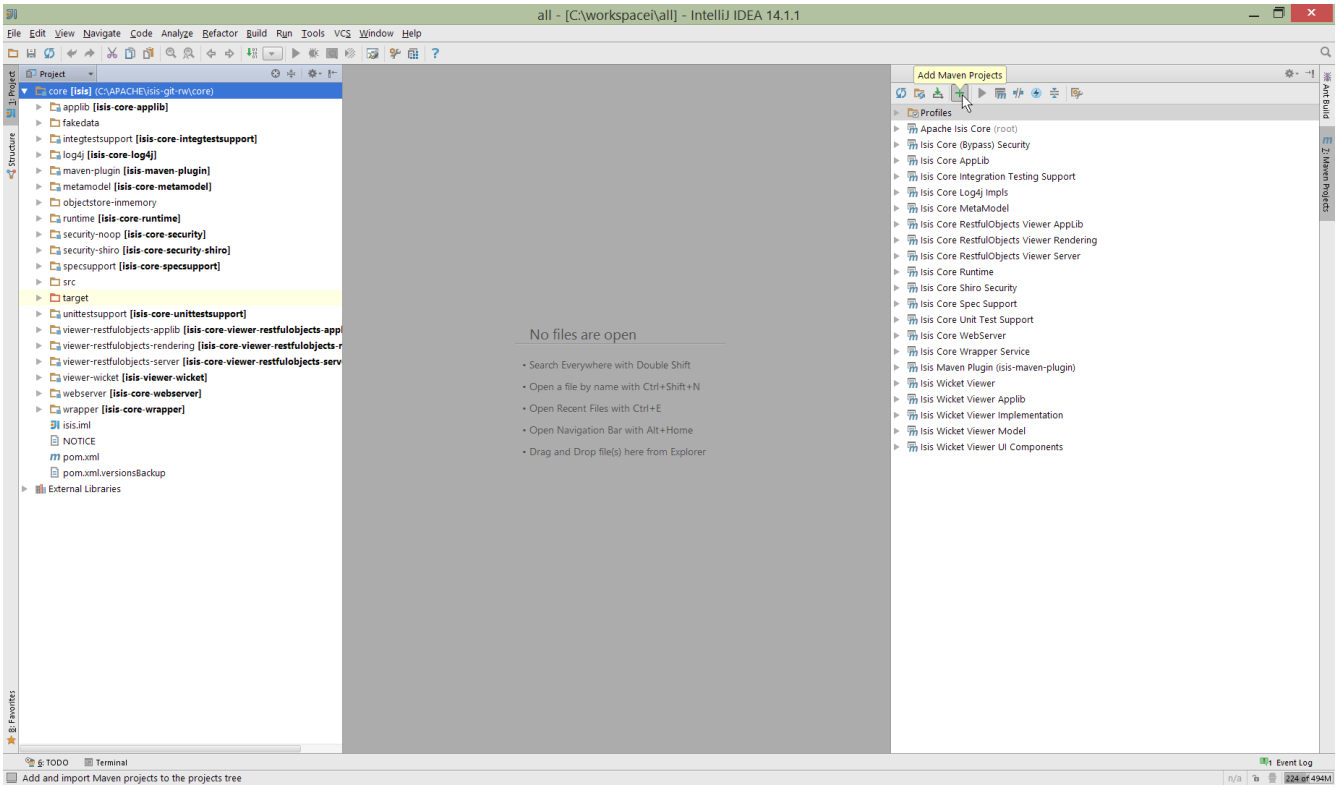


Figure 21. IntelliJ Maven Module Management - Importing Maven modules

We can then import another module (from some other directory). For example, here we are importing the Isis Addons' todoapp example:

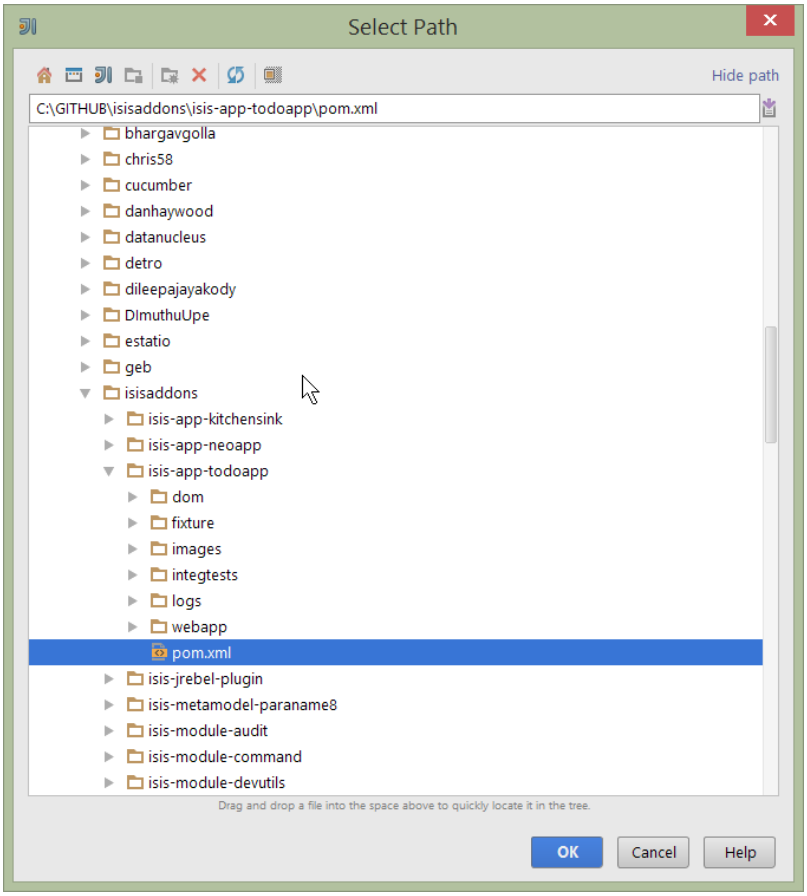


Figure 22. IntelliJ Maven Module Management - Importing another Module

You should then see the new Maven module loaded in the *Projects* window and also the *Maven*

Projects window:

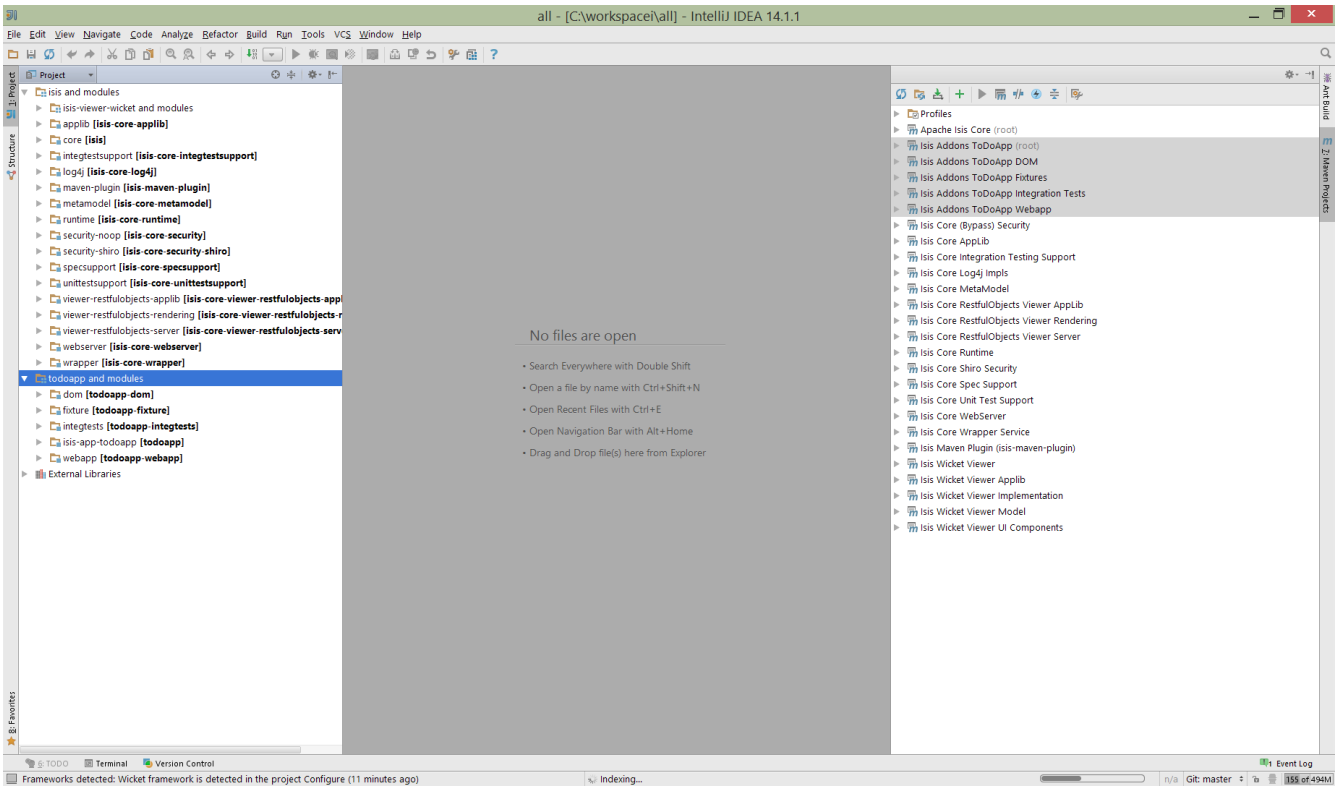


Figure 23. IntelliJ Maven Module Management -

If any dependencies are already loaded in the project, then IntelliJ will automatically update the CLASSPATH to resolve to locally held modules (rather from `.m2/repository` folder). So, for example (assuming that the `<version>` is correct, of course), the Isis todoapp will have local dependencies on the Apache Isis core.

You can press F4 (or use `File > Project Structure`) to see the resolved classpath for any of the modules loaded into the project.

If you want to focus on one set of code (eg the Isis todoapp but not Apache Isis core) then you *could* remove the module; but better is to ignore those modules. This will remove them from the *Projects* window but keep them available in the *Maven Projects* window for when you next want to work on them:

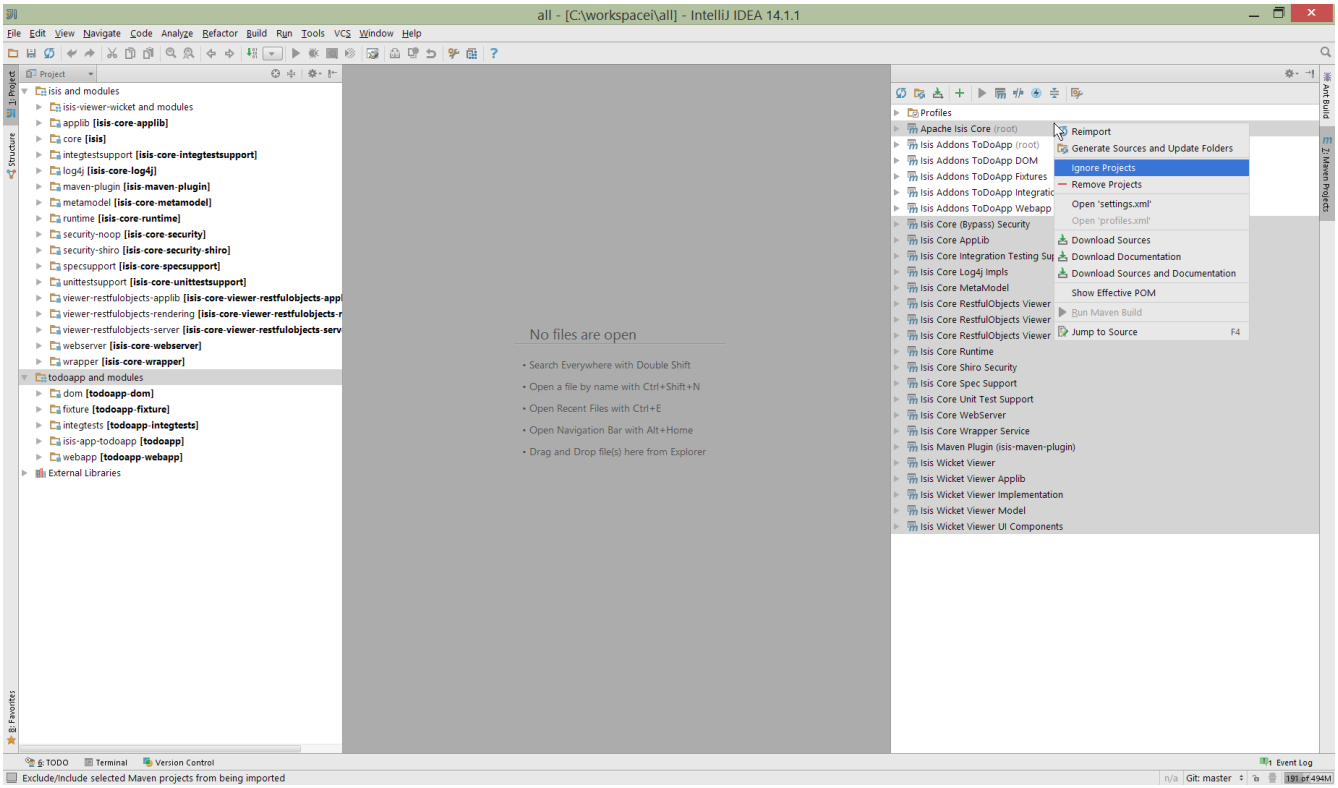


Figure 24. IntelliJ Maven Module Management - Ignoring Modules

Confirm that it's ok to ignore these modules:

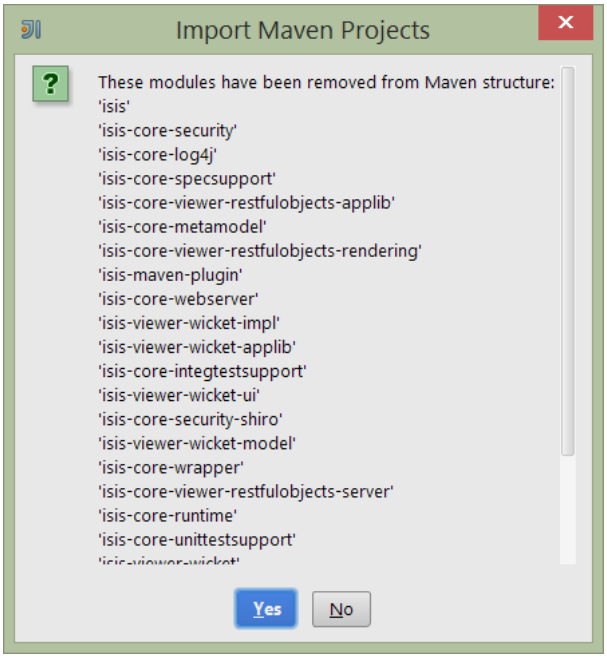


Figure 25. IntelliJ Maven Module Management - Ignoring Modules (ctd)

All being well you should see that the *Projects* window now only contains the code you are working on. Its classpath dependencies will be adjusted (eg to resolve to Apache Isis core from `.m2/repository`):

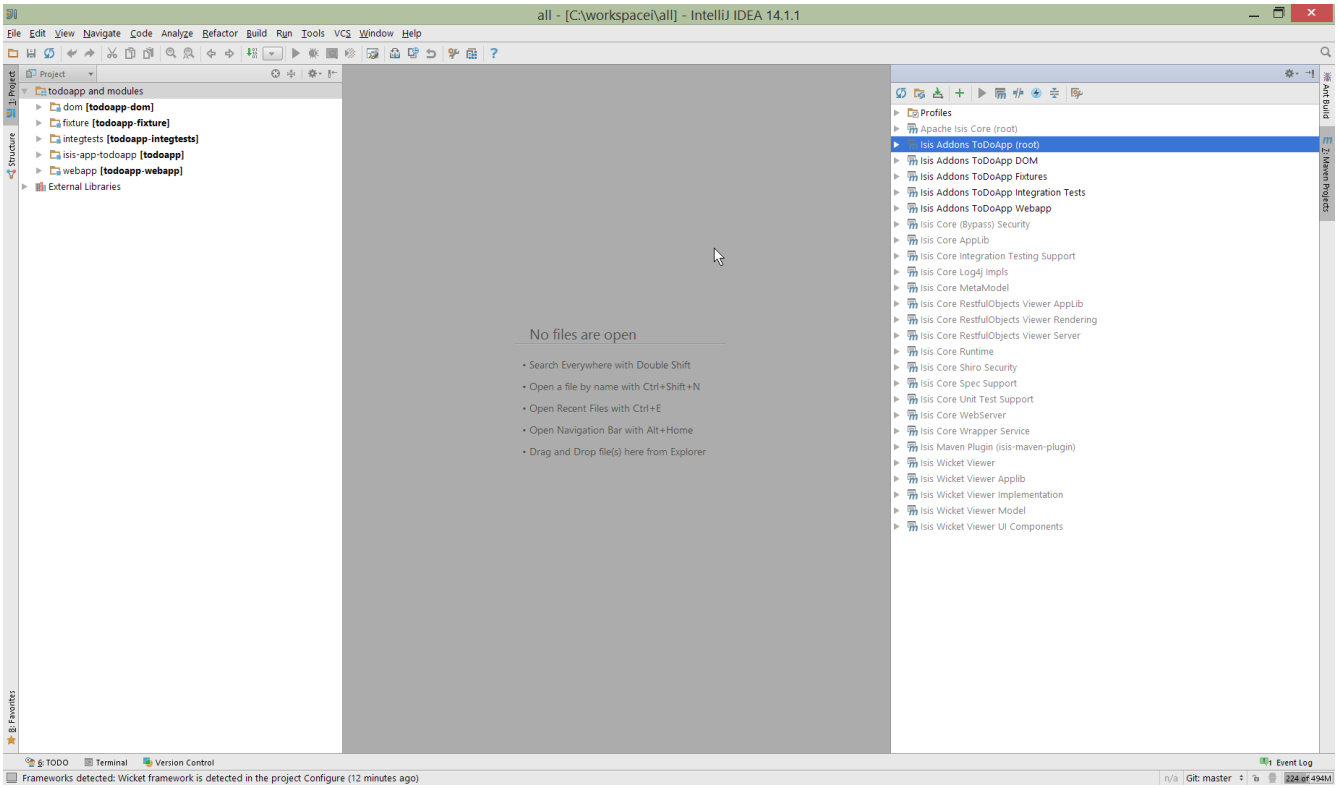


Figure 26. IntelliJ Maven Module Management - Updated Projects Window

2.1.3. Running

Let's see how to run both the app and the tests.

Running the App

Once you've imported your Apache Isis application, we should run it. We do this by creating a Run configuration, using `Run > Edit Configurations`.

Set up the details as follows:

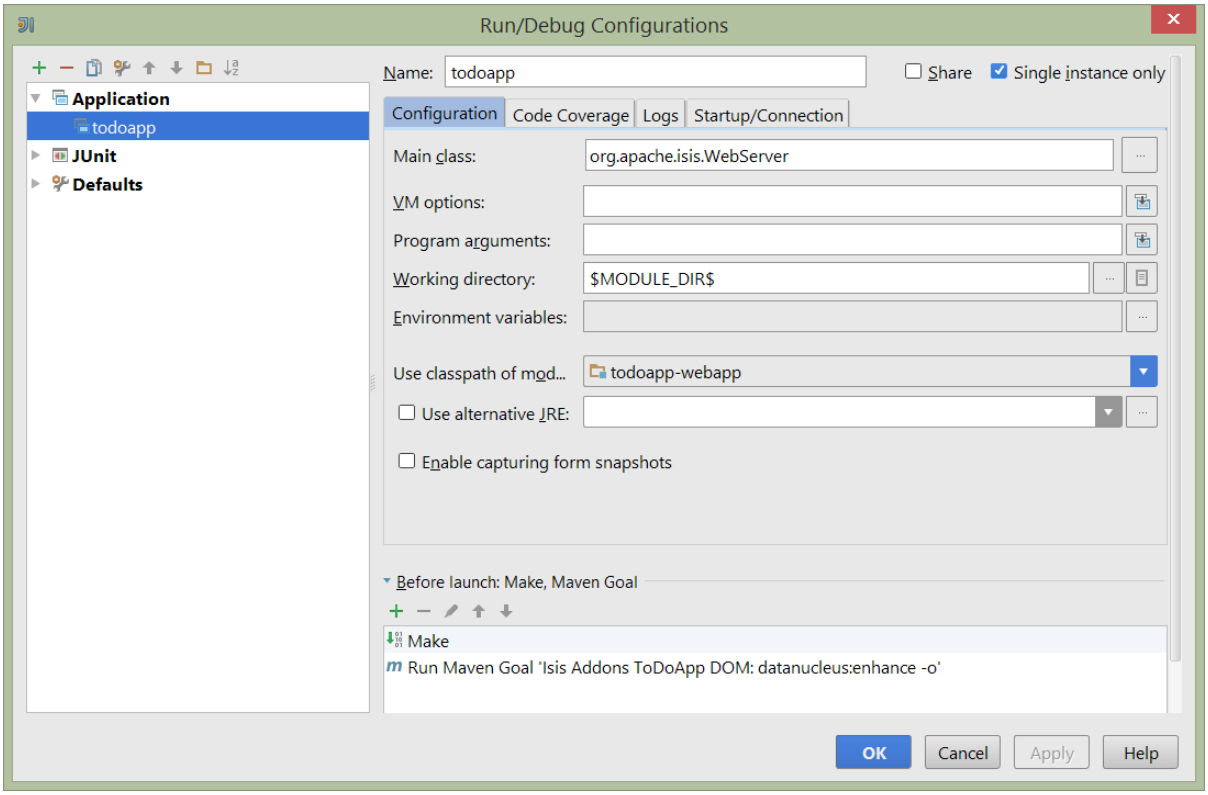


Figure 27. IntelliJ Running the App - Run Configuration

We specify the `Main class` to be `org.apache.isis.WebServer`; this is a wrapper around Jetty. It's possible to pass program arguments to this (eg to automatically install fixtures), but for now leave this blank.

Also note that `Use classpath of module` is the webapp module for your app, and that the `working directory` is `$MODULE_DIR$`.

Next, and most importantly, configure the DataNucleus enhancer to run for your `dom` goal. This can be done by defining a Maven goal to run before the app:

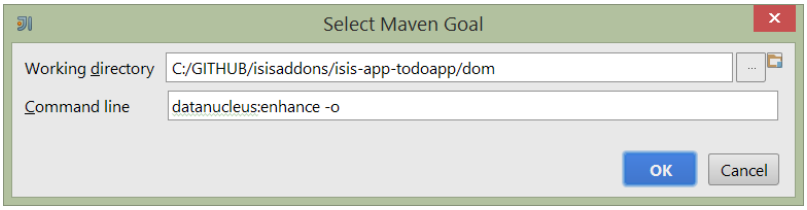


Figure 28. IntelliJ Running the App - Datanucleus Enhancer Goal

The `-o` flag in the goal means run off-line; this will run faster.

If you forget to set up the enhancer goal, or don't run it on the correct (dom) module, then you will get all sorts of errors when you startup. These usually manifest themselves as class cast exception in DataNucleus.

You should now be able to run the app using `Run > Run Configuration`. The same configuration can also be used to debug the app if you so need.

Under windows you may get 'Standard error from the DataNucleus tool + org.datanucleus.enhancer.DataNucleusEnhancer : The command line is too long' although 'fork=false' is set in pom.xml. Can be worked around via setting '-Dfork=false' before or after 'datanucleus:enhance -o'.

Running the Unit Tests

The easiest way to run the unit tests is just to right click on the `dom` module in the *Project Window*, and choose run unit tests. Hopefully your tests will pass (!).

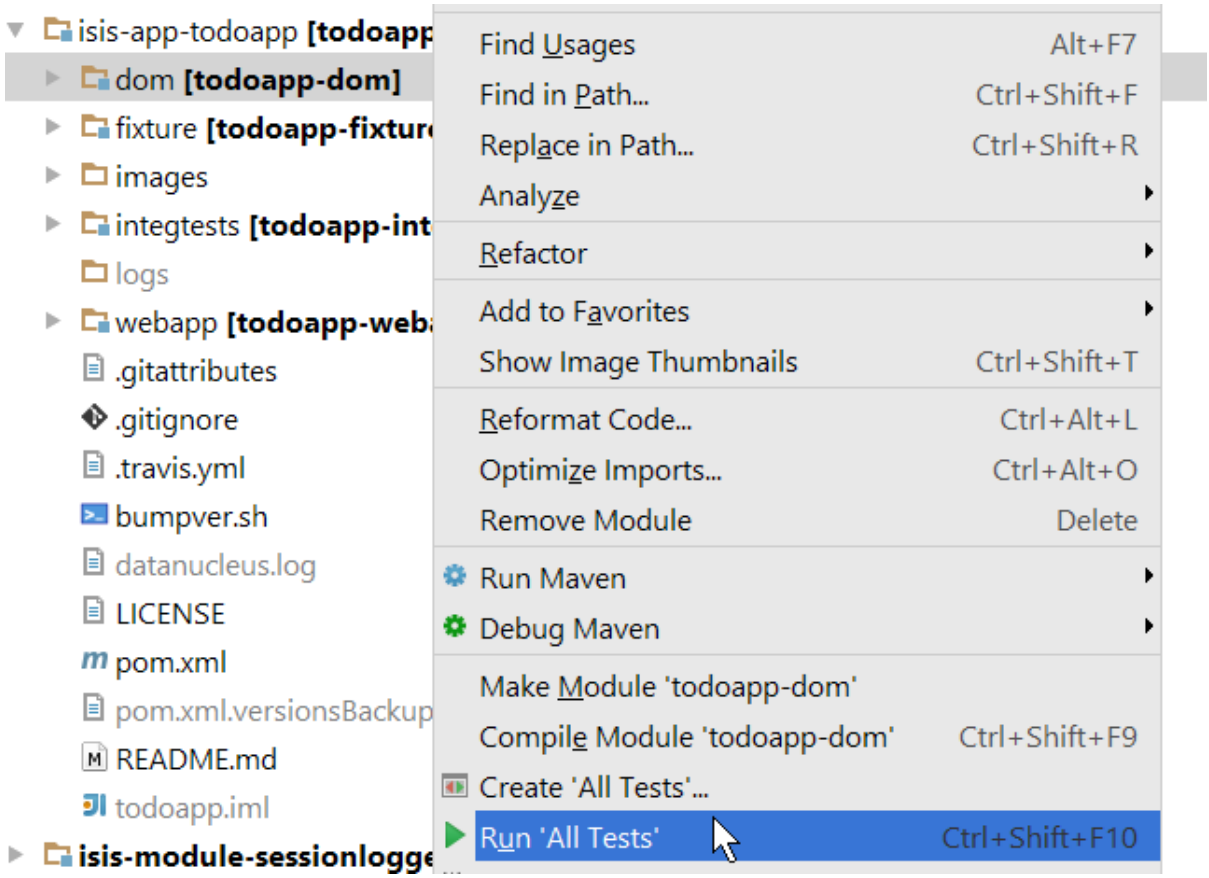


Figure 29. IntelliJ Running the App - Unit Tests Run Configuration

As a side-effect, this will create a run configuration, very similar to the one we manually created for the main app:

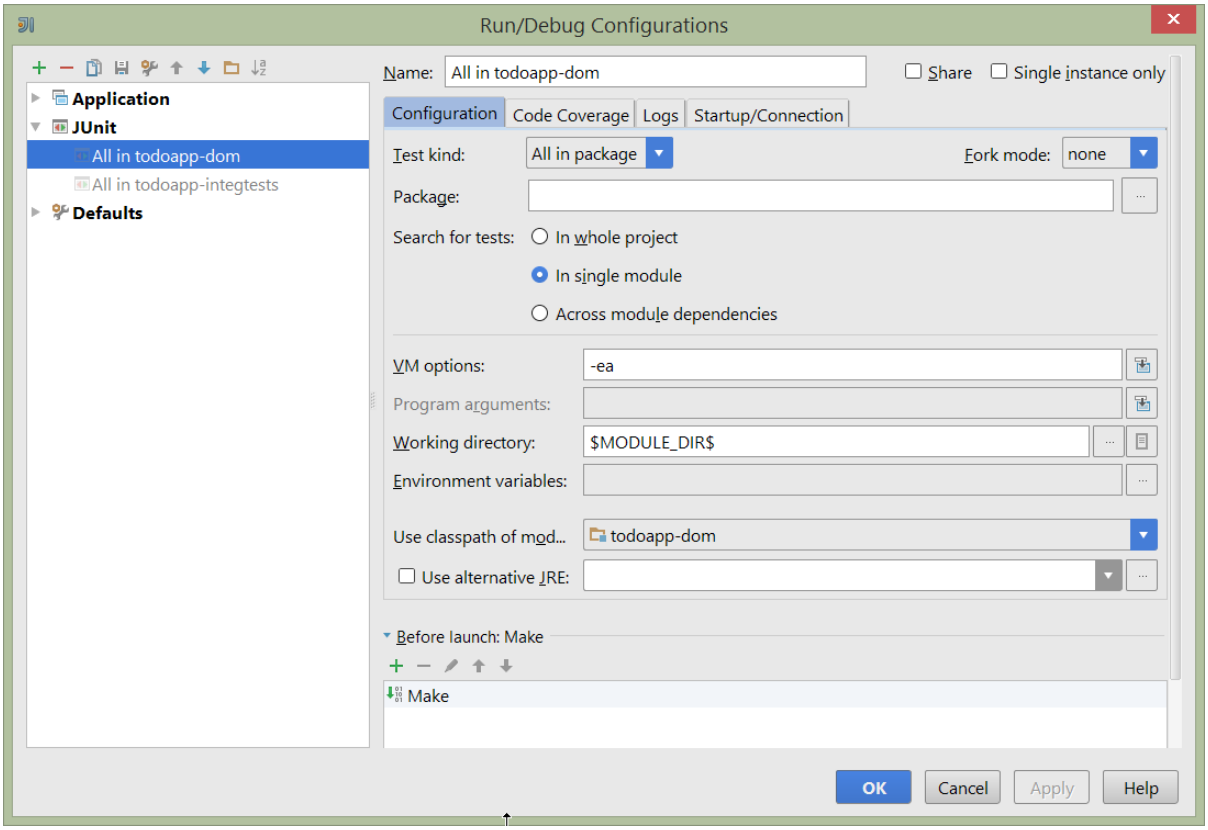


Figure 30. IntelliJ Running the App - Unit Tests Run Configuration

Thereafter, you should run units by selecting this configuration (if you use the right click approach you'll end up with lots of run configurations, all similar).

Running the Integration Tests

Integration tests can be run in the same way as unit tests, however the `dom` module must also have been enhanced.

One approach is to initially run the tests use the right click on the `integtests` module; the tests will fail because the code won't have been enhanced, but we can then go and update the run configuration to run the datanucleus enhancer goal (same as when running the application):

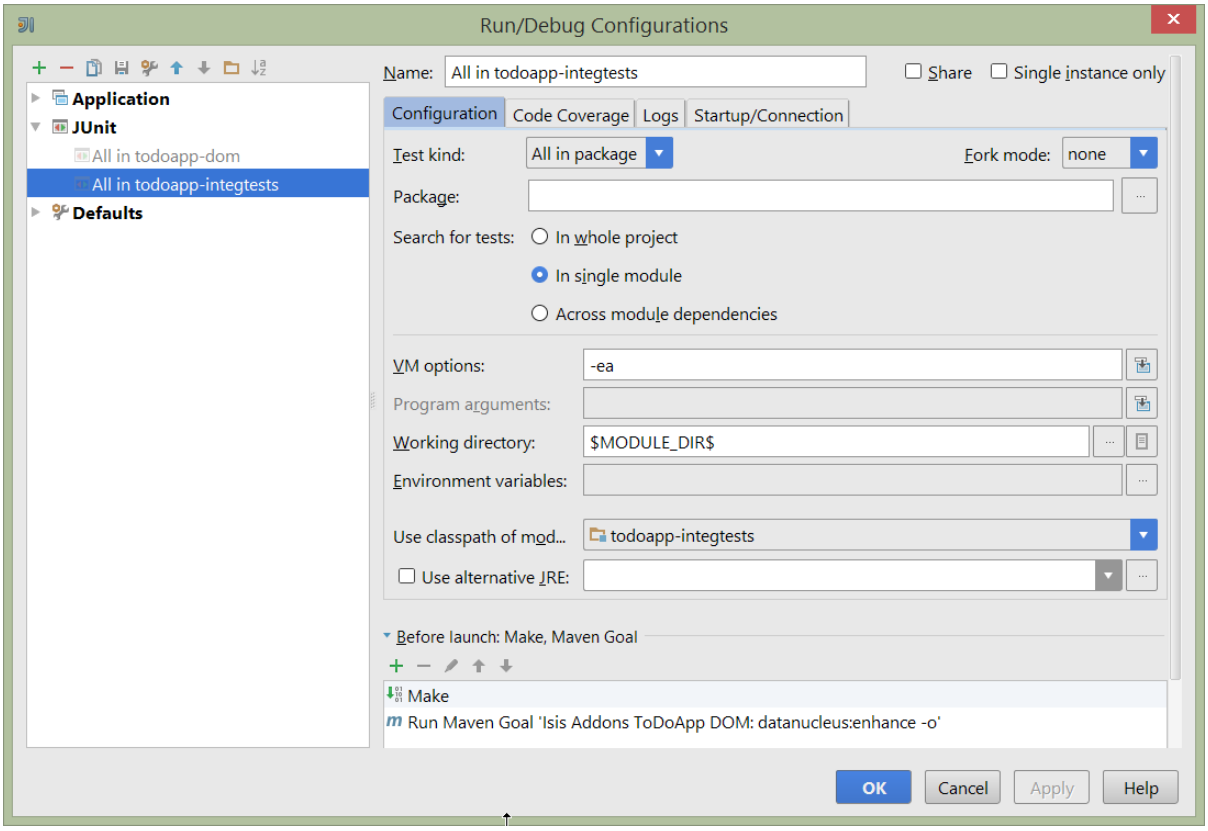
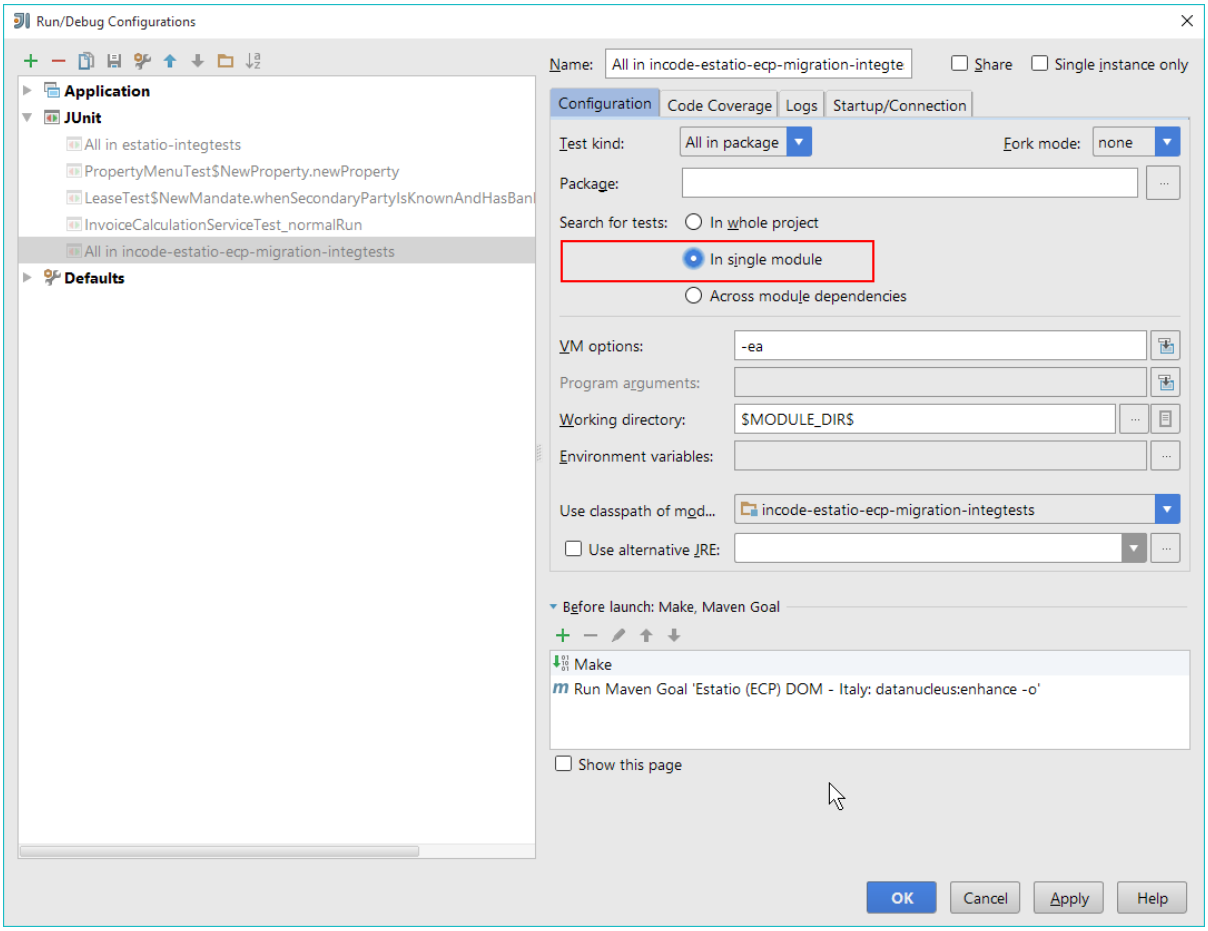


Figure 31. IntelliJ Running the App - Integration Tests Run Configuration

Also make sure that the `search for tests` radio button is set to `In single module`:



If this radio button is set to one of the other options then you may obtain class loading issues; these result from IntelliJ attempting to run unit tests of the `dom` project that depend on test classes in that

module, but using the classpath of the `integtests` module whereby the `dom` test-classes (`test-jar` artifact) are not exposed on the Maven classpath.

2.1.4. Hints and Tips

Keyboard Cheat Sheets

You can download 1-page PDFs cheat sheets for IntelliJ's keyboard shortcuts: * for Windows * for MacOS

Probably the most important shortcut on them is for `Find Action`: - `ctrl-shift-A` on Windows - `cmd-shift-A` on MacOS.

This will let you search for any action just by typing its name.

Switch between Tools & Editors

The Tool Windows are the views around the editor (to left, bottom and right). It's possible to move these around to your preferred locations.

- Use `alt-1` through `alt-9` (or `cmd-1` through `alt-9`) to select the tool windows
  - Press it twice and the tool window will hide itself; so can use to toggle
- If in the *Project Window* (say) and hit enter on a file, then it will be shown in the editor, but (conveniently) the focus remains in the tool window. To switch to the editor, just press `Esc`.
  - If in the *Terminal Window*, you'll need to press `Shift-Esc`.
- If on the editor and want to locate the file in (say) the *Project Window*, use `alt-F1`.
- To change the size of any tool window, use `ctrl-shift-arrow`

Using these shortcuts you can easily toggle between the tool windows and the editor, without using the mouse. Peachy!

Navigating Around

For all of the following, you don't need to type every letter, typing "ab" will actually search for "**.a.*b.**".

- to open classes or files or methods that you know the name of:
  - `ctrl-N` to open class
  - `ctrl-shift-N` to open a file
  - (bit fiddly this) `ctrl-shift-alt-N` to search for any symbol.
- open up dialog of recent files: `ctrl-E`
- search for any file: `shift-shift`

Navigating around: * find callers of a method (the call hierarchy): `ctrl-alt-H` * find subclasses or overrides: `ctrl-alt-B` * find superclasses/interface/declaration: `ctrl-B`

Viewing the structure (ie outline) of a class * `ctrl-F12` will pop-up a dialog showing all members ** hit `ctrl-F12` again to also see inherited members

Editing

- Extend selection using `ctrl-W`
  - and contract it down again using `ctrl-shift-W`
- to duplicate a line, it's `ctrl-D`
  - if you have some text selected (or even some lines), it'll actually duplicate the entire selection
- to delete a line, it's `ctrl-X`
- to move a line up or down: `shift-alt-up` and `shift-alt-down`
  - if you have selected several lines, it'll move them all togethe
- `ctrl-shift-J` can be handy for joining lines together
  - just hit enter to split them apart (even in string quotes; IntelliJ will "do the right thing")

Intentions and Code Completion

Massively useful is the "Intentions" popup; IntelliJ tries to guess what you might want to do. You can activate this using`alt-enter`, whenever you see a lightbulb/tooltip in the margin of the current line.

Code completion usually happens whenever you type '.'. You can also use `ctrl-space` to bring these up.

In certain circumstances (eg in methods0) you can also type `ctrl-shift-space` to get a smart list of methods etc that you might want to call. Can be useful.

Last, when invoking a method, use `ctrl-P` to see the parameter types.

Refactoring

Loads of good stuff on the `Refactor` menu; most used are:

- Rename (`shift-F6`)
- Extract
  - method: `ctrl-alt-M`
  - variable: `ctrl-alt-V`
- Inline method/variable: `ctrl-alt-N`
- Change signature

If you can't remember all those shortcuts, just use `ctrl-shift-alt-T` (might want to rebind that to something else!) and get a context-sensitive list of refactorings available for the currently selected object

Plugins

You might want to set up some additional plugins. You can do this using `File > Settings > Plugins` (or equivalently `File > Other Settings > Configure Plugins`).

Recommended are:

- Maven Helper plugin

  More on this below.

- AsciiDoctor plugin

  Useful if you are doing any authoring of documents.

Some others you might like to explore are:

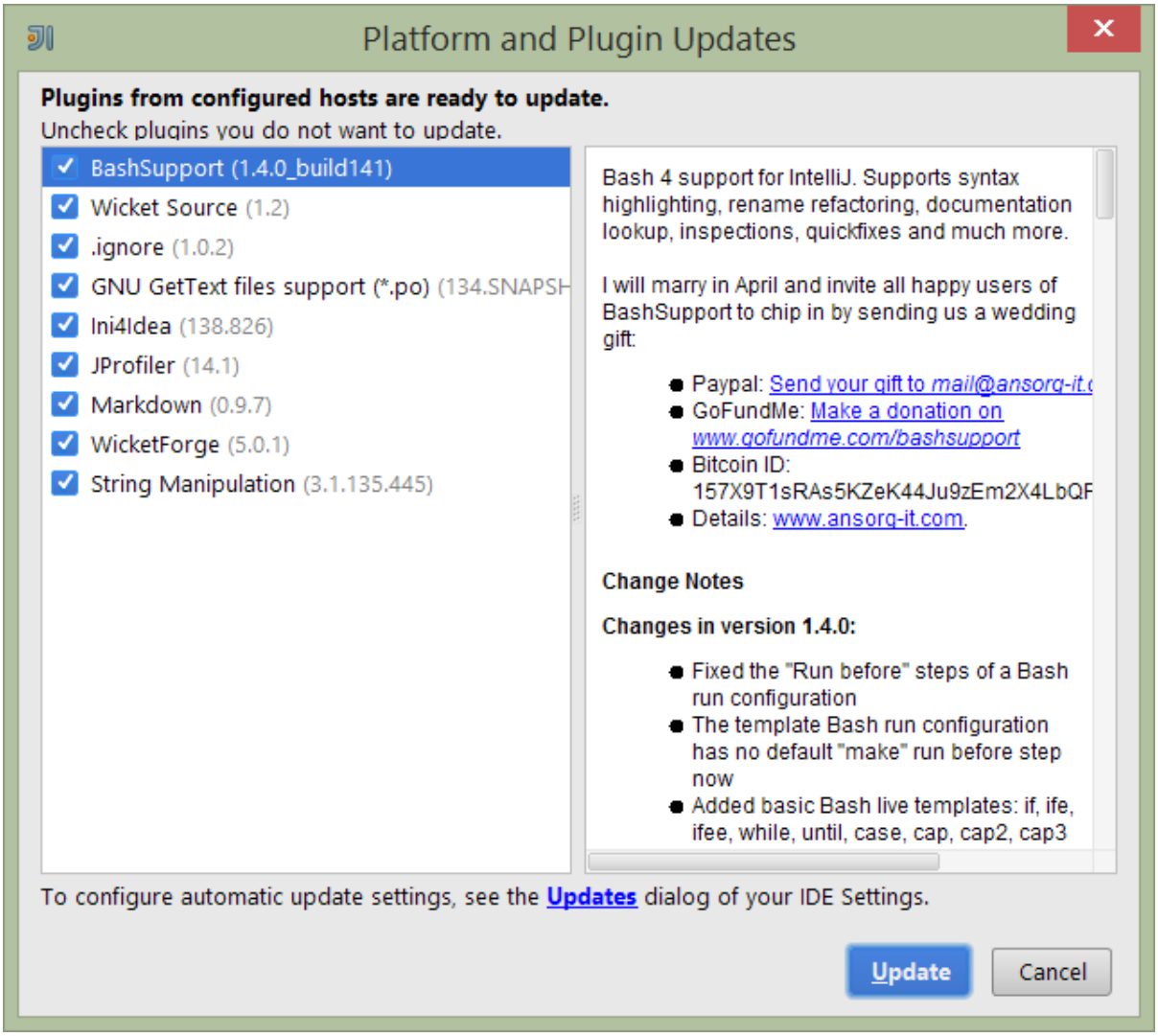
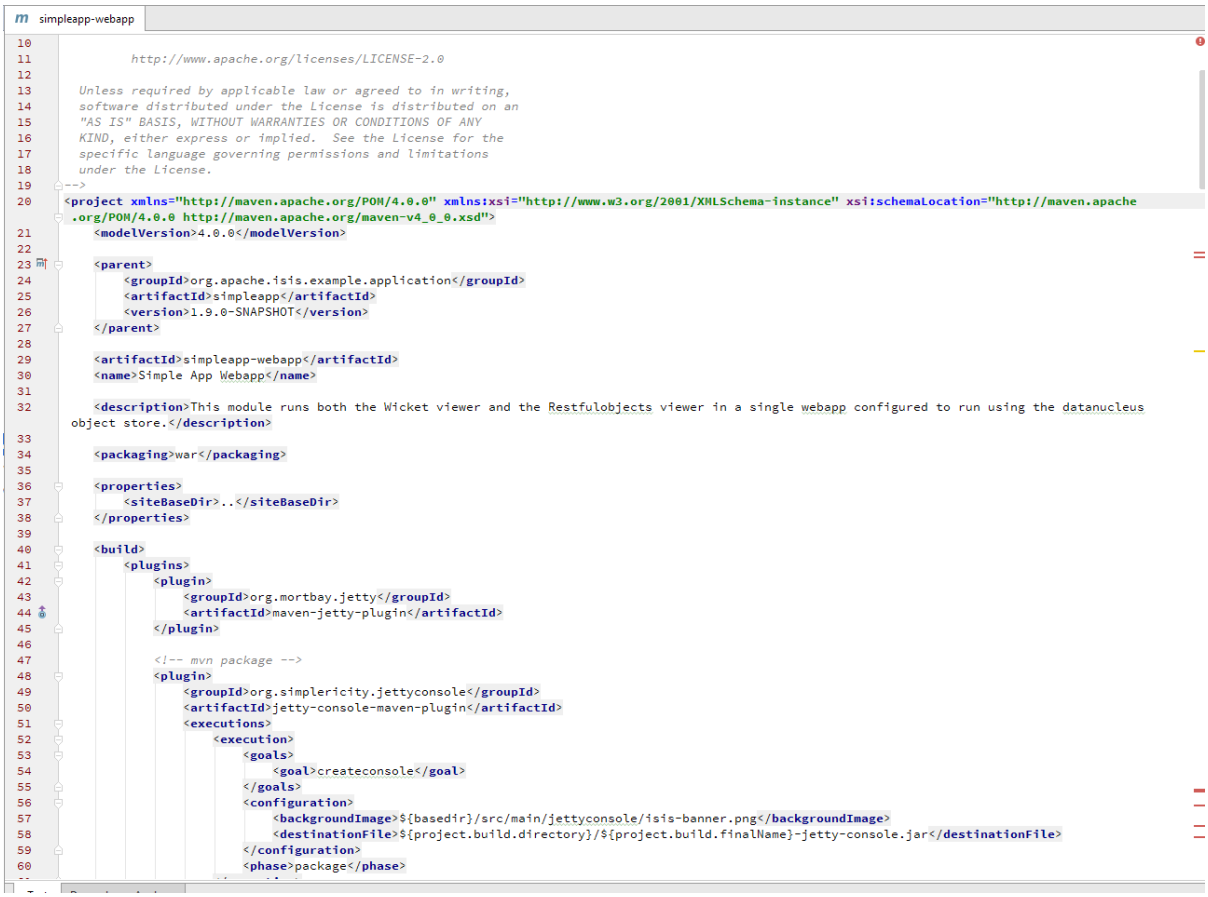


Figure 32. IntelliJ Plugins

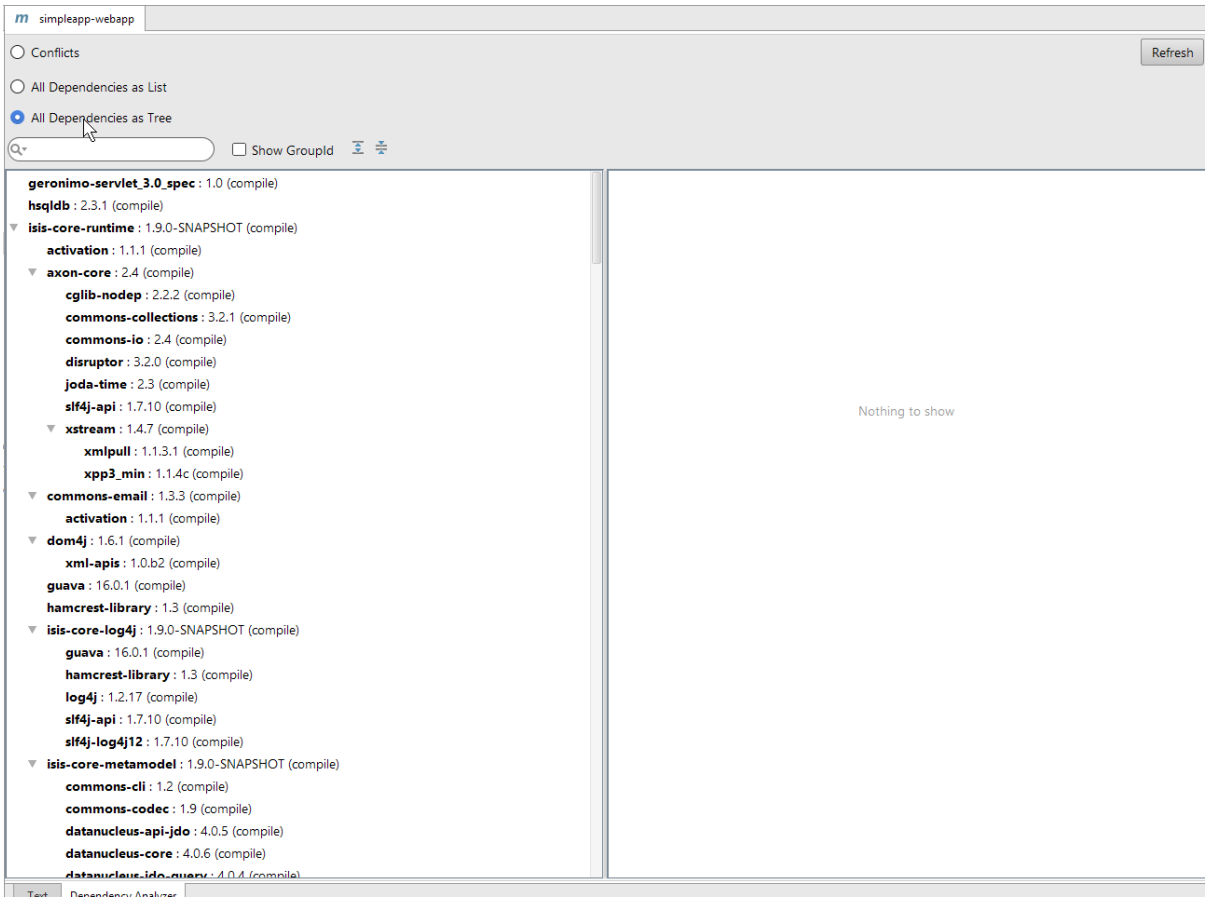
Maven Helper Plugin

This plugin provides a couple of great features. One is better visualization of dependency trees (similar to Eclipse).

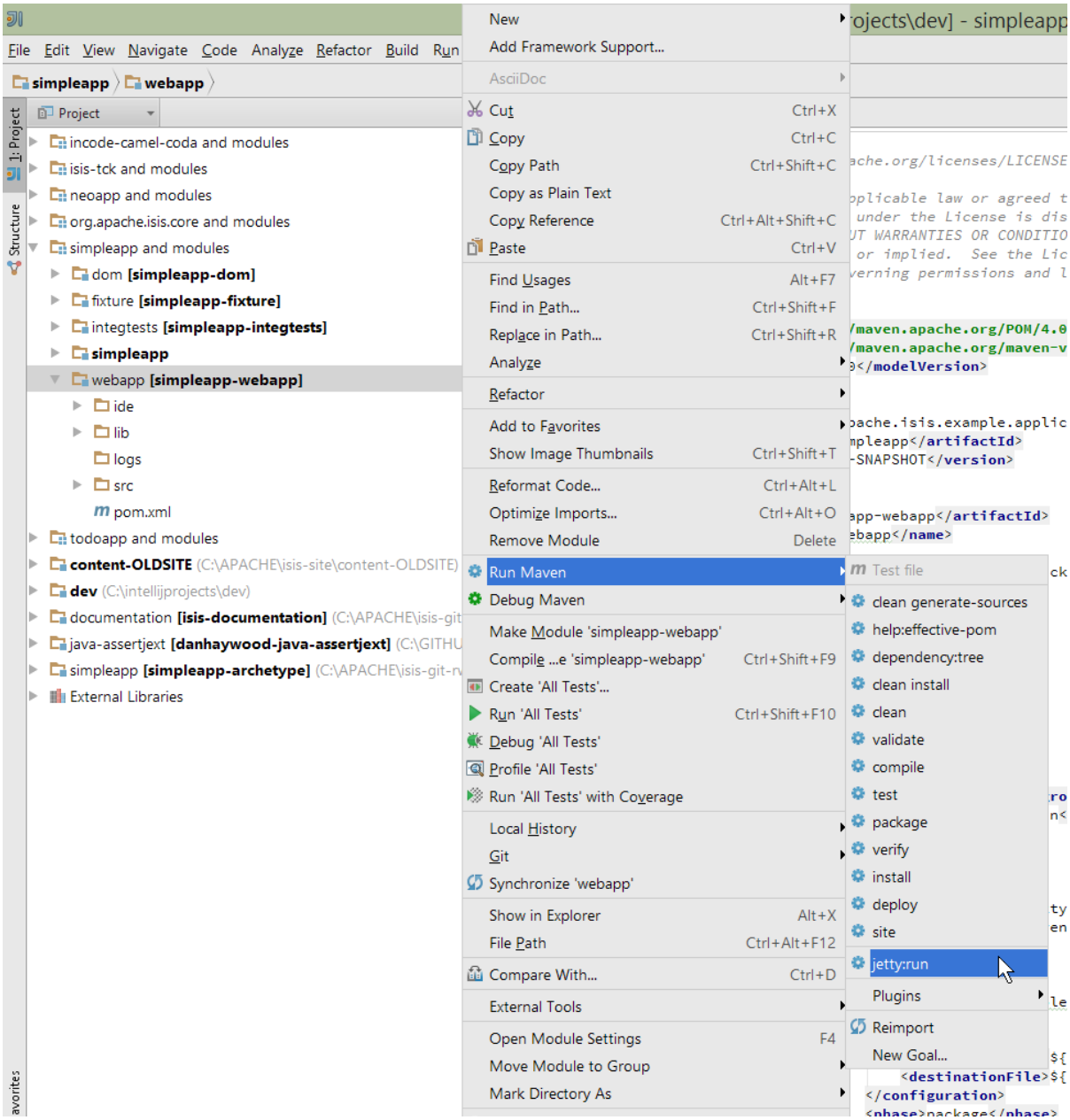
If you open a `pom.xml` file, you'll see an additional "Dependencies" tab:



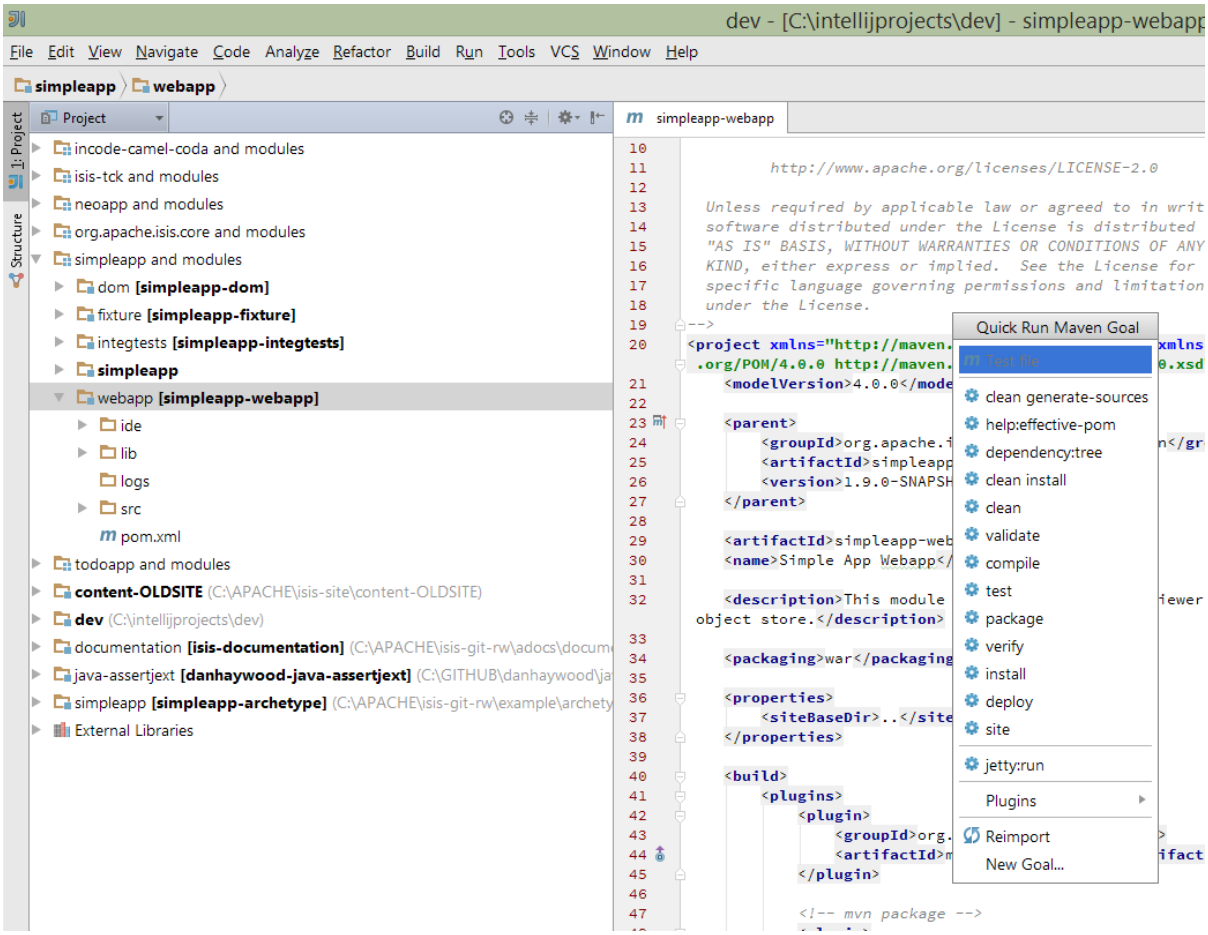
Clicking on this gives a graphical tree representation of the dependencies, similar to that obtained by `mvn dependency:tree`, but filterable.



The plugin also provides the ability to easily run a Maven goal on a project:



This menu can also be bound to a keystroke so that it is available as a pop-up:



Troubleshooting

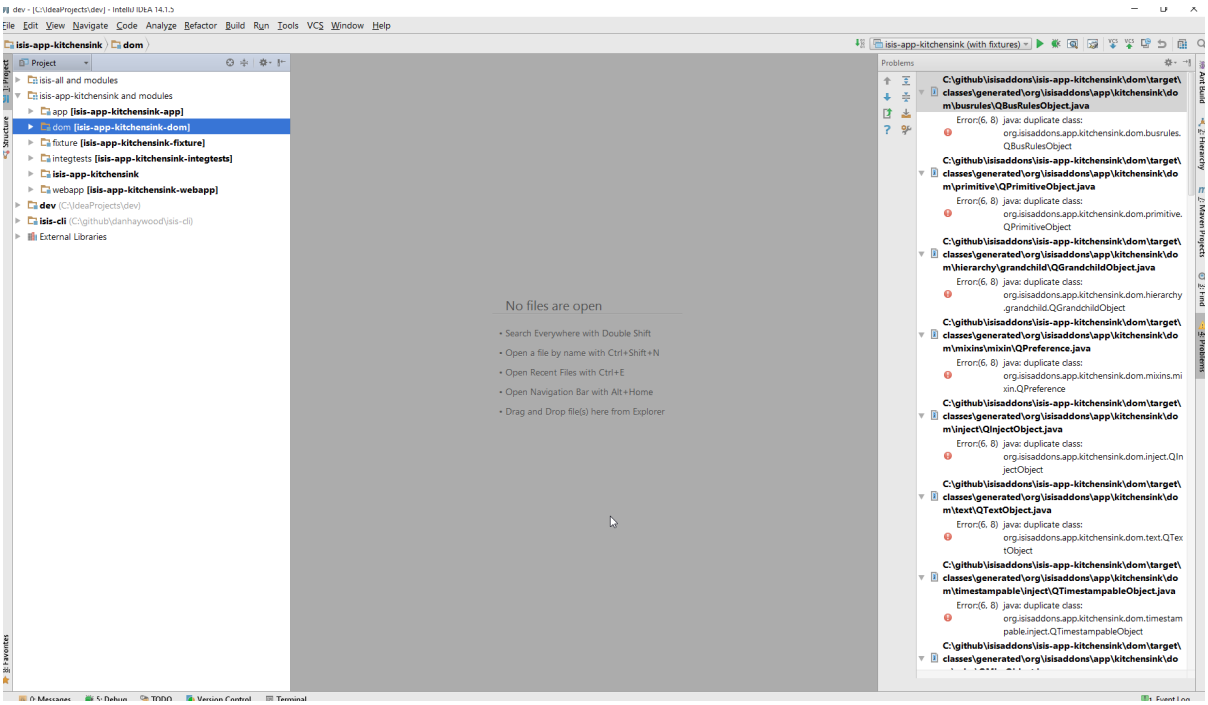
When a Maven module is imported, IntelliJ generates its own project files (suffix `.ipr`), and the application is actually built from that.

Occasionally these don't keep in sync (even if auto-import of Maven modules has been enabled).

To fix the issue, try: * reimport module * rebuild selected modules/entire project * remove and then re-add the project * restart, invalidating caches * hit StackOverflow (!)

One thing worth knowing; IntelliJ actively scans the filesystem all the time. It's therefore (almost always) fine to build the app from the Maven command line; IntelliJ will detect the changes and keep in sync. If you want to force that, use `File > Synchronize`, `ctrl-alt-Y`.

If you hit an error of "duplicate classes":



then make sure you have correctly configured the annotation processor settings. Pay attention in particular to the "Production sources directory" and "Test sources directory", that these are set up correctly.

2.1.5. Faster turnaround times

In this section are several options that will reduce the time it takes between making a source code edit and seeing the results in the running app. code/build/deploy/review feedback loop.

Using Grade to compile/enhance

Running an Apache Isis application requires that the DataNucleus enhancer runs on the compiled bytecode. As described above, the recommended way to do this with IntelliJ is to use a Run configuration that runs the enhancer goal prior to launch.

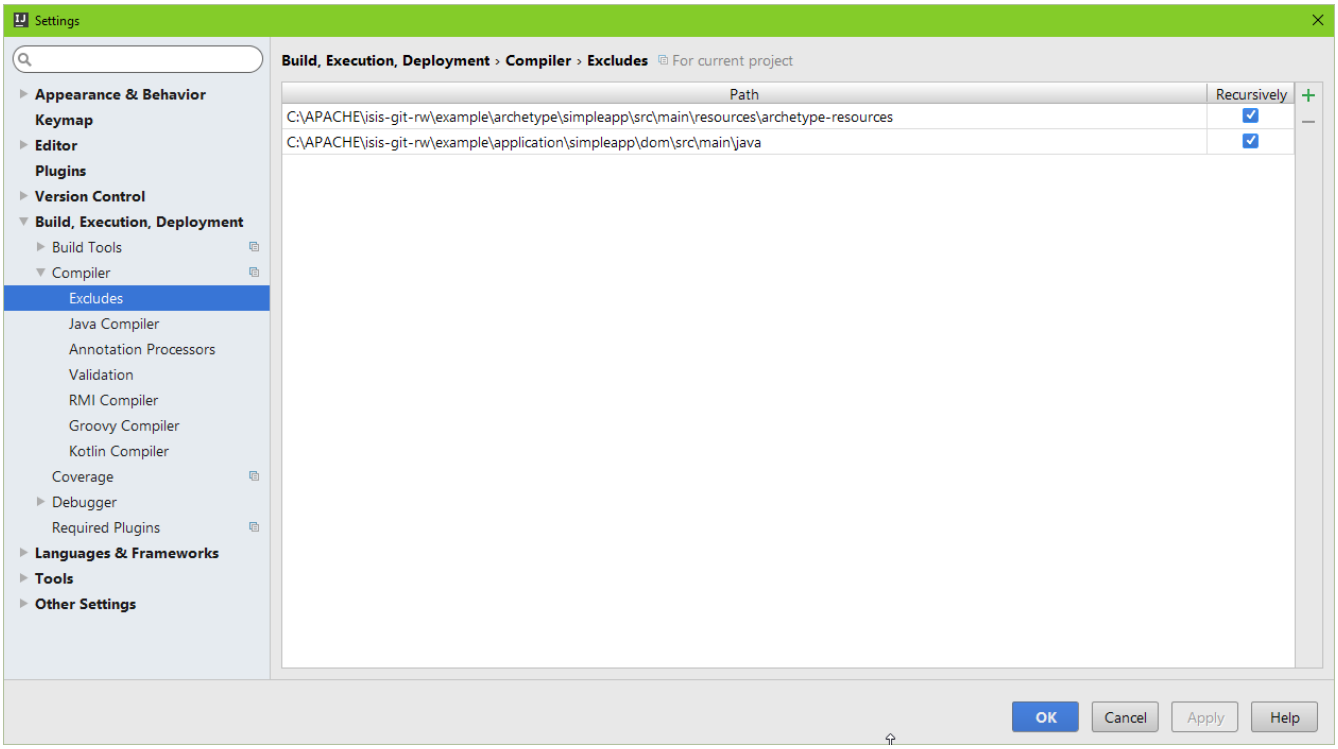
Alternative, you can use the following `build.gradle` script in your `dom` module:

build.gradle

```
apply plugin: 'java'
apply plugin: 'tangram.tools'
sourceCompatibility = 1.8
targetCompatibility = 1.8
version = (new XmlParser()).parse('pom.xml').parent.version.text()
buildscript {
  repositories {
    maven { url "http://oss.jfrog.org/artifactory/oss-snapshot-local" }
    jcenter()
  }
  dependencies {
    classpath 'tangram:gradle-plugin:1.1.2'
  }
}
repositories {
    mavenLocal()
    maven { url "http://oss.jfrog.org/artifactory/oss-snapshot-local" }
    jcenter()
}
dependencies {
    compile group: 'org.apache.isis.core', name: 'isis-core-applib', version: version
}
task copyClasses << {
    copy {
        from 'build/classes/main'
        into 'target/classes'
    }
}
```

The script is intended to be in the background as a daemon while editing/developing; whenever a change is made to any source code, gradle will automatically compile *and* enhance the code. In this way it eliminates the need to start up Maven and run the enhancer goal.

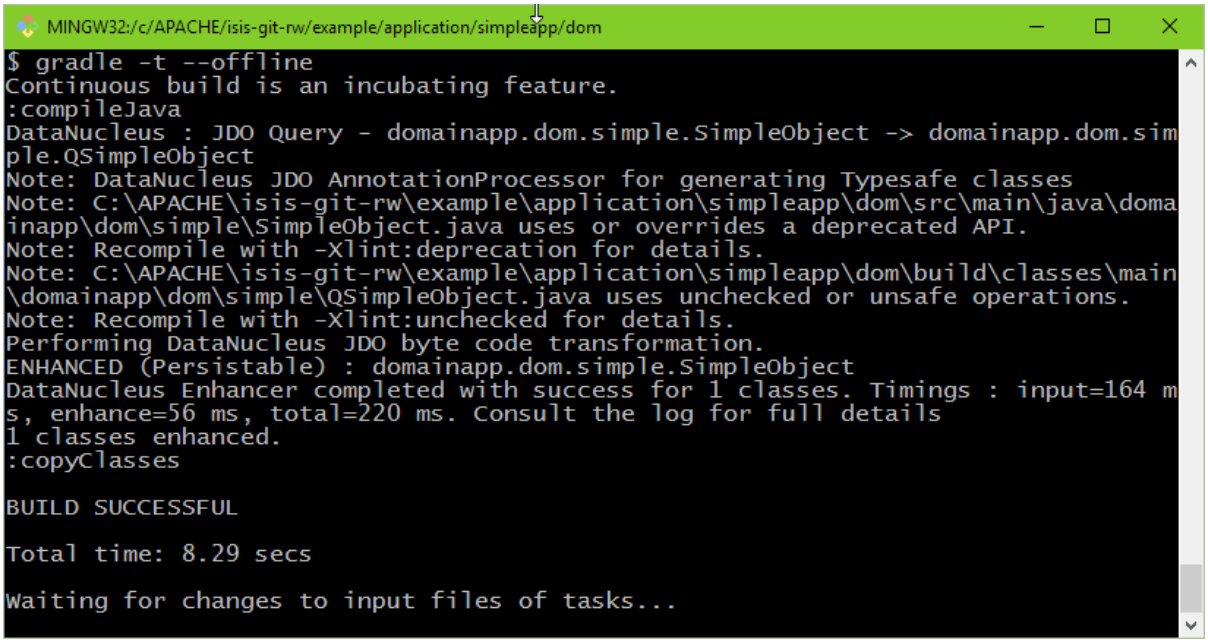
To use, you must disable the IntelliJ's automatic building of the 'dom' project. This is done using: `File > Settings > Build, Execution, Deployment > Compiler > Excludes`, and then exclude the `⋯/dom/src/main/java` directory:



The script can be run in the background using:

```
gradle -t --offline &
```

from the command line (in the `dom` module).



Using Gradle for liveReload

Similarly, gradle can be run to reduce the turn-around time when tweaking the UI (defined by the `*.layout.xml` file for each domain class), when the app is running.

The framework will automatically notice any changes to `.layout.xml` files, but these are read from the classpath (the `target/classes` directory), not the source path. With IntelliJ these can be copied

over manually by invoking `Run > Reload Changed Classes`. Once the browser is refreshed, the new layout will be rendered.

We've occasionally noticed that this interferes with Wicket's own javascript - switching tabs becomes unresponsive. The work-around is just to reload the page.

To reduce the turn-around time there are therefore two steps to be automated:

- the copying of the `.layout.xml` files over to the `target/classes` directory
- the triggering of a page refresh by the browser.

The `layouts.gradle` script takes care of the first of these; whenever a change is made to any `.layout.xml` file, gradle will automatically copy over the file to the `target/classes` directory:

`layouts.gradle`

```
defaultTasks 'copyLayouts'
task copyLayouts(type:Copy) {
    from 'src/main/java'
    into 'target/classes'
    include '**/*.layout.xml'
}
```

Similarly, the `liveReload.gradle` script takes care of the browser refresh:

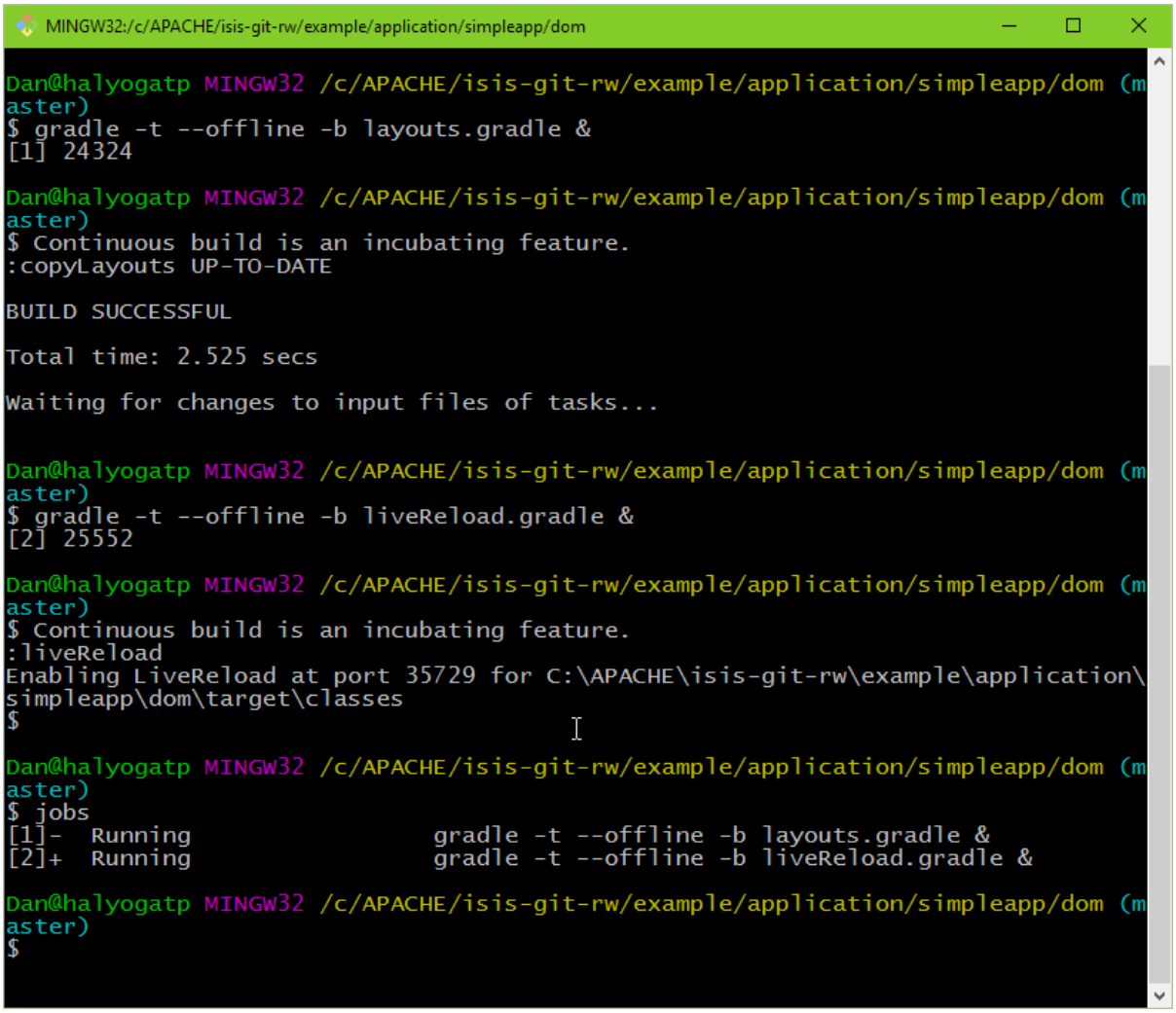
`liveReload.gradle`

```
defaultTasks 'liveReload'
buildscript {
    repositories {
        jcenter()
    }
    dependencies {
        classpath 'org.kordamp.gradle:livereload-gradle-plugin:0.2.1'
    }
}
apply plugin: 'org.kordamp.gradle.livereload'
liveReload {
    docRoot new File('target/classes').canonicalPath
}
```

These scripts can be run together using:

```
gradle -t --offline -b layouts.gradle &
gradle -t --offline -b liveReload.gradle &
```

from the command line (in the `dom` module):

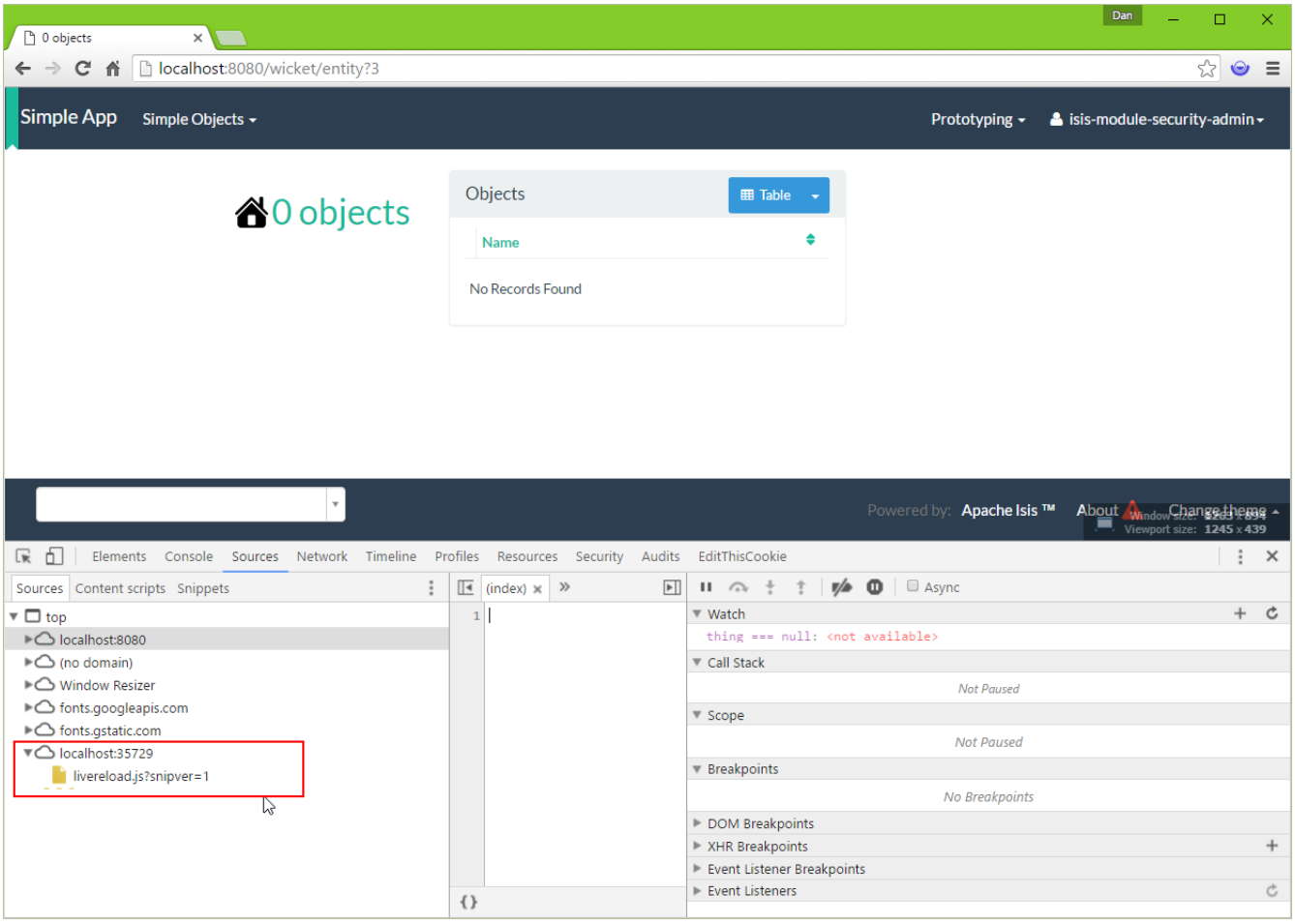


Live reload also requires that the `isis.viewer.wicket.liveReloadUrl` configuration property is set appropriately:

`viewer_wicket.properties`

```
isis.viewer.wicket.liveReloadUrl=http://localhost:35729/livereload.js?snipver=1
```

You can confirm the script is loaded correctly using the web browser's development tools, eg:



Setting up DCEVM

DCEVM enhances the JVM with true hot-swap adding/removing of methods as well as more reliable hot swapping of the implementation of existing methods.

In the context of Apache Isis, this is very useful for contributed actions and mixins and also view models; you should then be able to write these actions and have them be picked up without restarting the application.

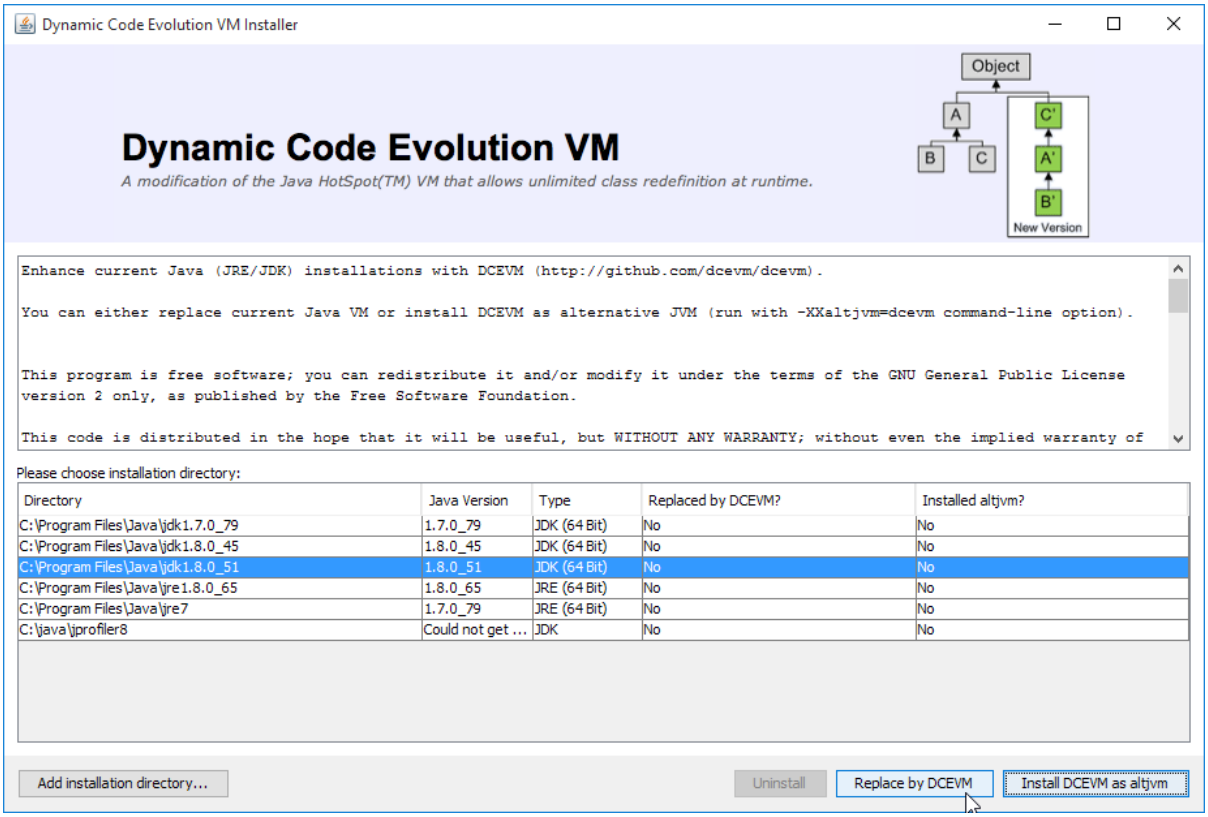
Changing persisting domain entities is more problematic, for two reasons: the JDO/DataNucleus enhancer needs to run on domain entities, and also at runtime JDO/DataNucleus would need to rebuild its own metamodel. You may find that adding actions will work, but adding new properties or collections is much less likely to.

To set up DCEVM, download the appropriate JAR from the github page, and run the installer. For example:

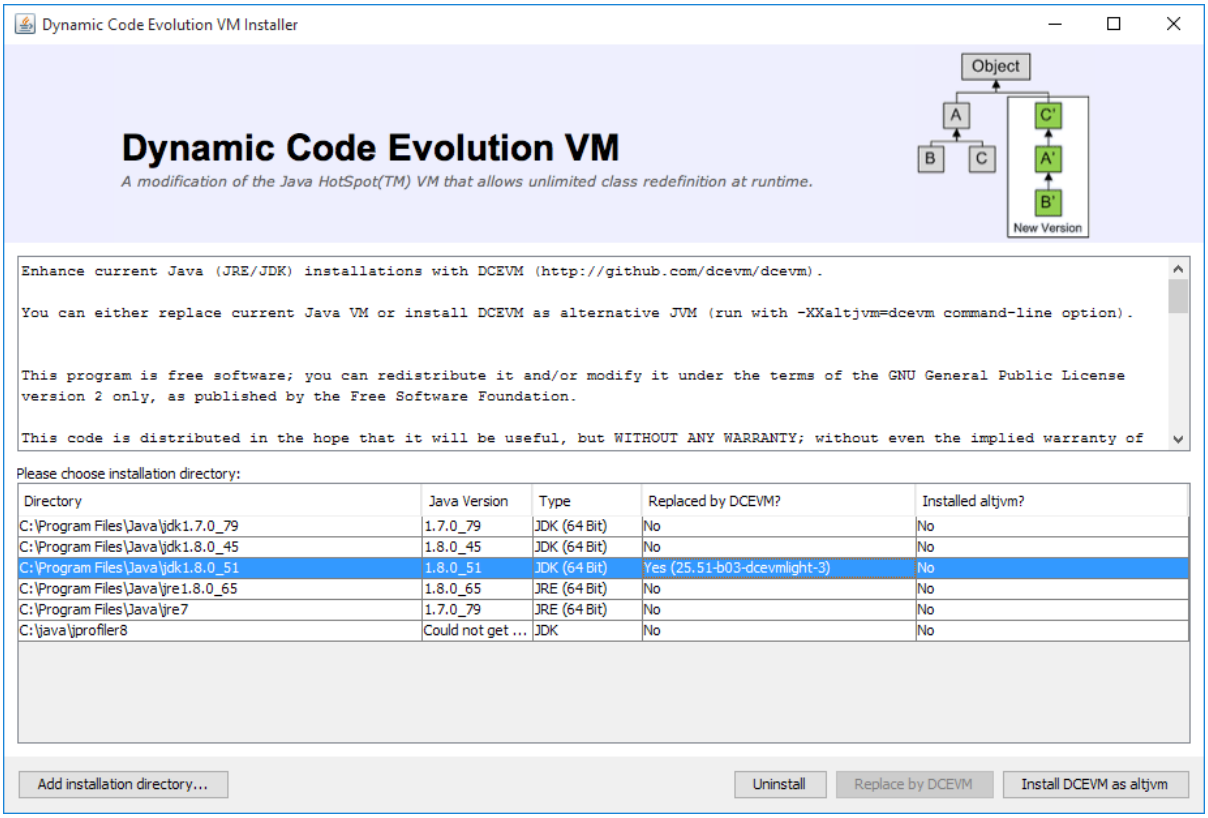
```
java -jar DCEVM-light-8u51-installer.jar
```

Be sure to run with appropriate privileges to be able to write to the installation directories of the JDK. If running on Windows, that means running as `Administrator`.

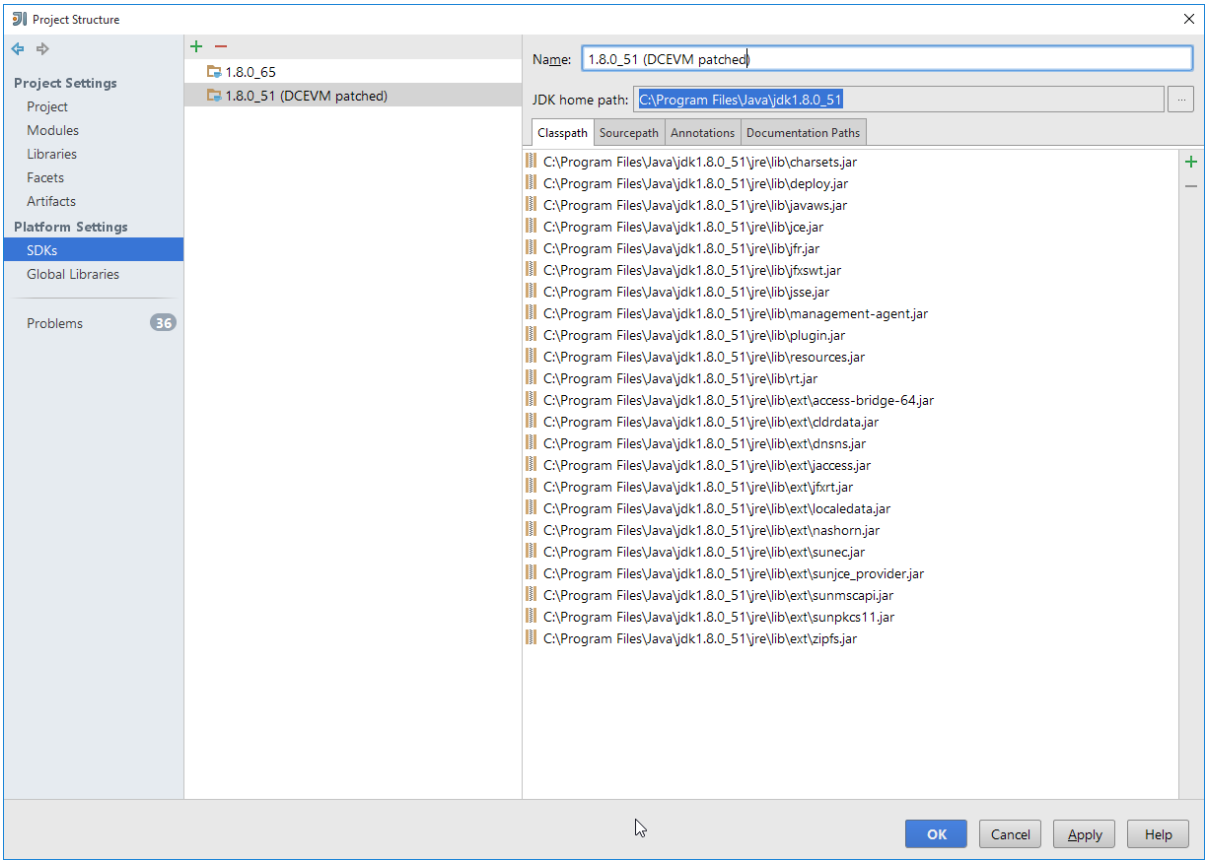
After a few seconds this will display a dialog listing all installations of JDK that have been found:



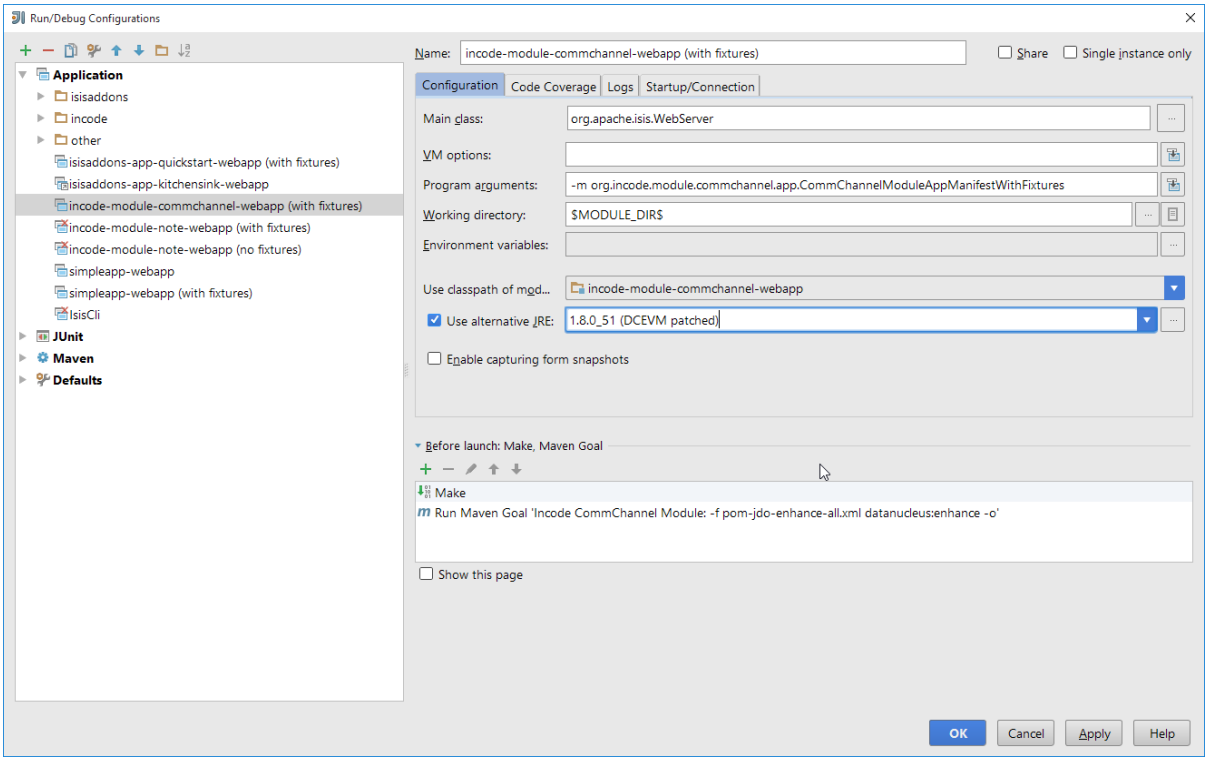
Select the corresponding installation, and select `Replace by DCEVM`.



In IntelliJ, register the JDK in `File > Project Structure` dialog:



Finally, in the run configuration, select the patched JDK:



Setting up JRebel

See the repo for the (non-ASF) Isis JRebel plugin.

Note that JRebel is a commercial product, requiring a license. At the time of writing there is also currently a non-commercial free license (though note this comes with some usage conditions).

2.2. Developing using Eclipse

This material does not constitute an endorsement; Eclipse foundation is not affiliated to Apache Software Foundation in any way.

If you are an Eclipse user, then we recommend you download the "Eclipse JEE package" configuration.

When running an Apache Isis application, it's necessary to setup the development environment so that the Java bytecode can be enhanced by the DataNucleus enhancer. If working in Eclipse, then JDO enhancement is most easily done by installing the DataNucleus' Eclipse plugin. This hooks the bytecode enhancement of your domain objects into Eclipse's normal incremental compilation.

This plugin needs to be configured for each of your domain modules (usually just one in any given app).

2.2.1. Editor Templates

We provide a set of editor templates. These are used to add new methods to existing classes. (These are equivalent to the IntelliJ live templates):

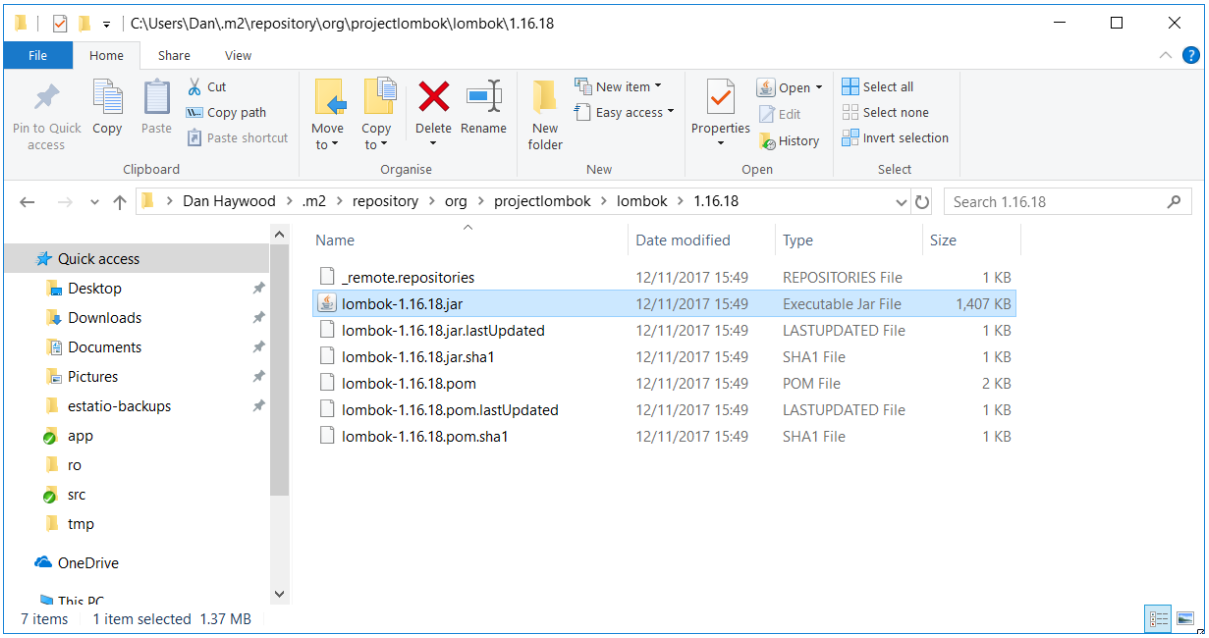
- `is` (Apache Isis domain objects). Download
- `ju` (for JUnit tests) Download
- `jm` (for JMock mocks or libraries) Download

To install, download each XML file, then go to `Windows > Preferences > Java > Editor > Templates` and choose `Import`.

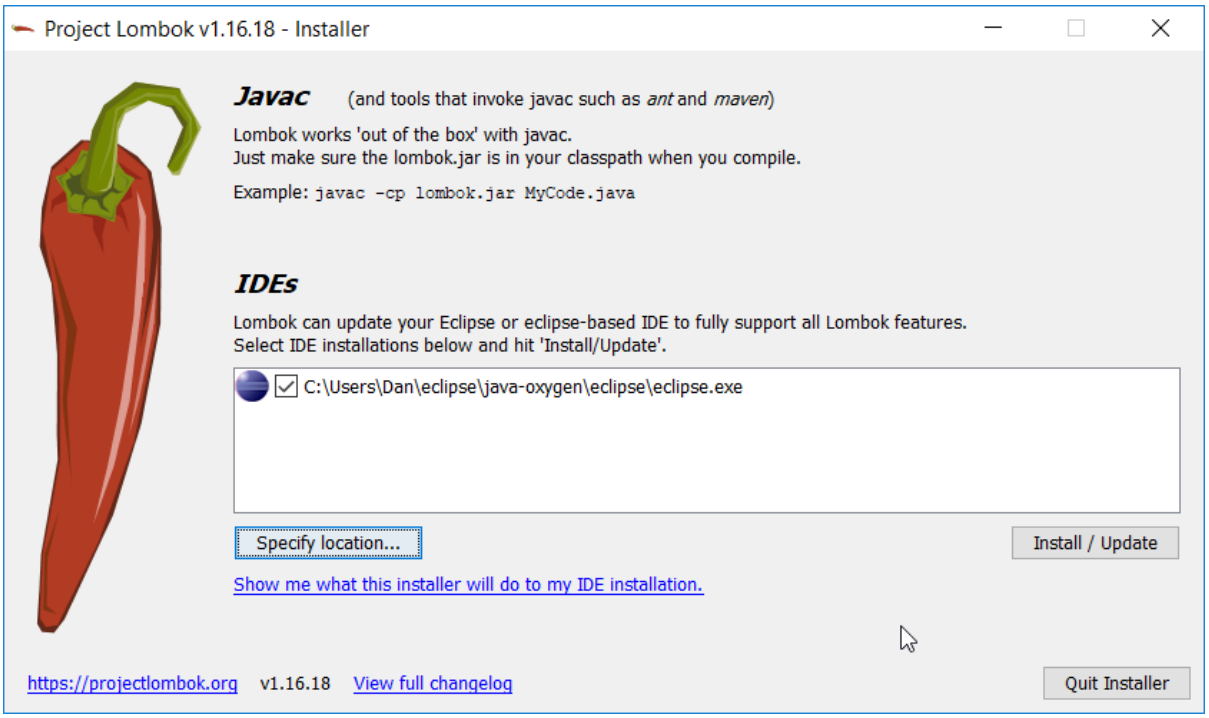
2.2.2. Install Project Lombok

The SimpleApp archetype uses Project Lombok annotations (`@Getter` and `@Setter` and so on) to reduce the boilerplate. For Eclipse IDE this requires an installation step:

- Locate the `lombok.jar` jar file:



- Run using `java -jar` (or double click on Windows):

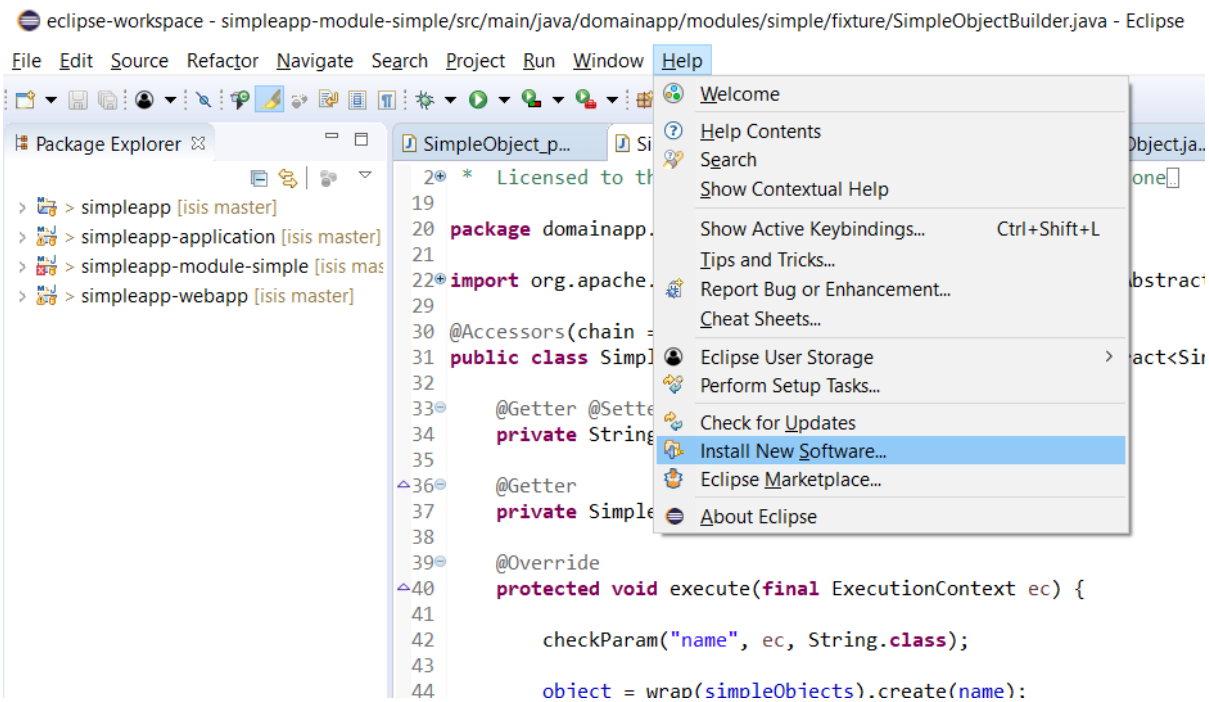


Then restart Eclipse.

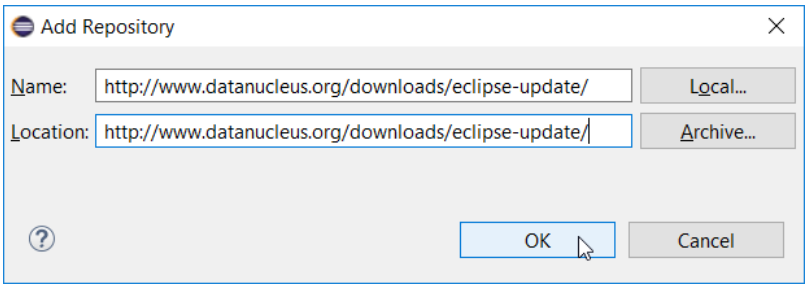
2.2.3. Install the DataNucleus plugin

The DataNucleus plugin hooks into the Eclipse compiler and will automatically enhance the compiled class files:

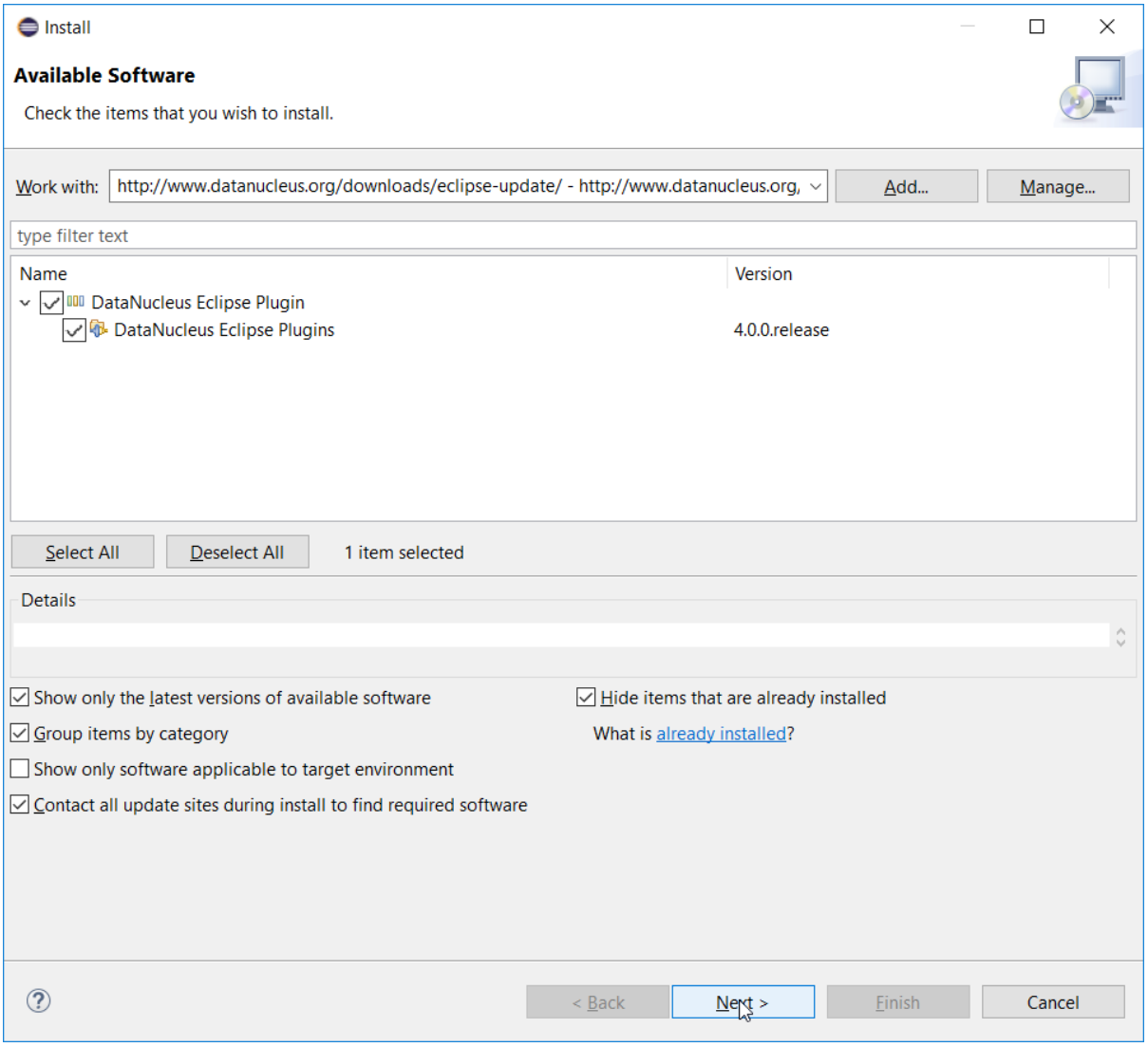
- Use Help > Install New Software:



- Specify the DataNucleus plugin repository:



- Select the plugin



- Press Next and Finish to complete the installation of the plugin

Then restart Eclipse

2.2.4. Importing the Project

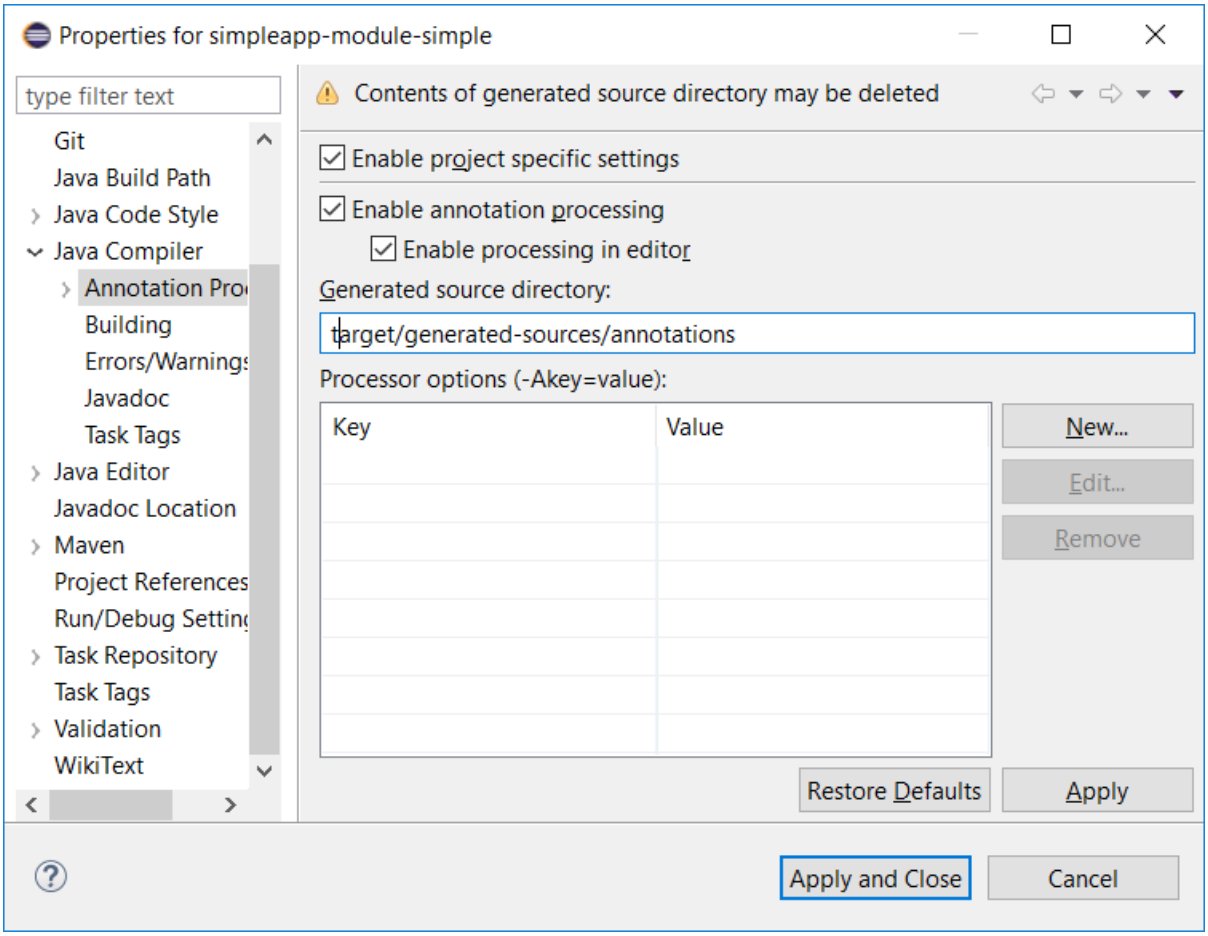
Use File > Import, then Maven > Existing Maven Projects.

However, you will have some compile errors until you enable annotation processing, discussed below.

Enable Annotation Processing

Both DataNucleus and Project Lombok use annotation processors that must be enabled in Eclipse.

For each project, open its *Properties* page and then *Java Compiler* > *Annotation Processing* to specify the generated source directory of `target/generated-sources/annotations`:

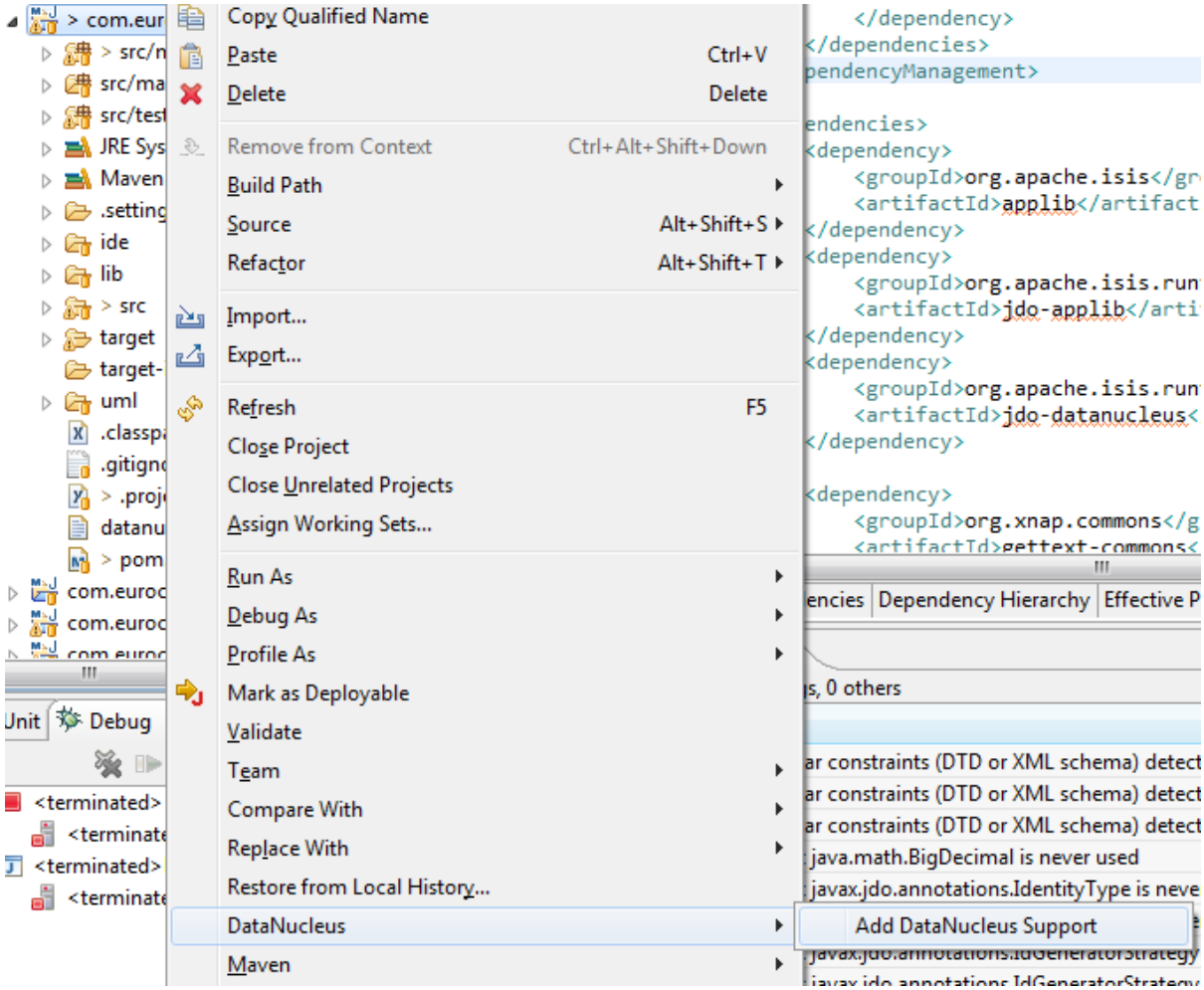


Eclipse should automatically add this directory as a source path; at this point all remaining compiler errors should disappear.

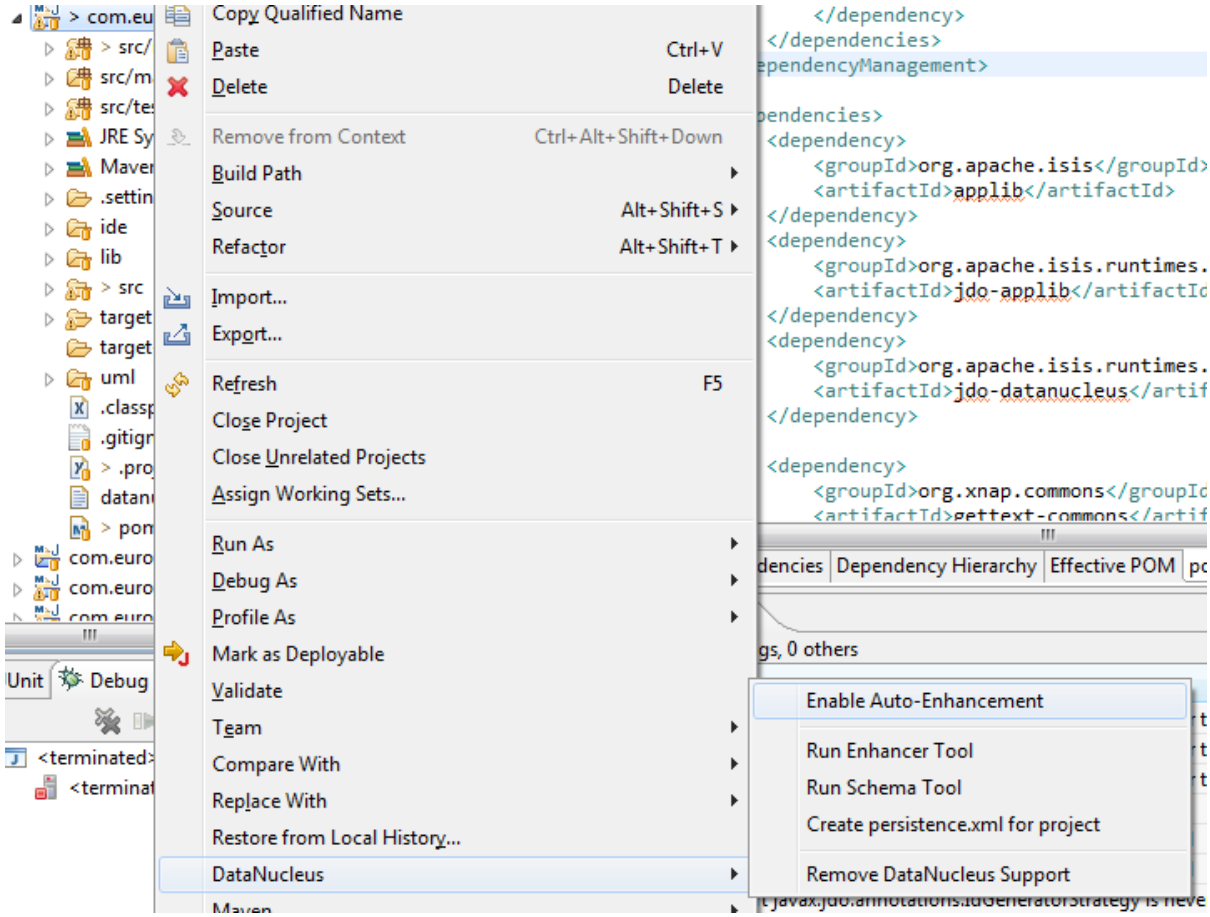
2.2.5. Configure DataNucleus

Make sure you are in the 'Java' Perspective, not the 'Java EE' Perspective.

In Eclipse, for the *domain object model* project(s), first add DataNucleus support:



Then turn on Auto-Enhancement:

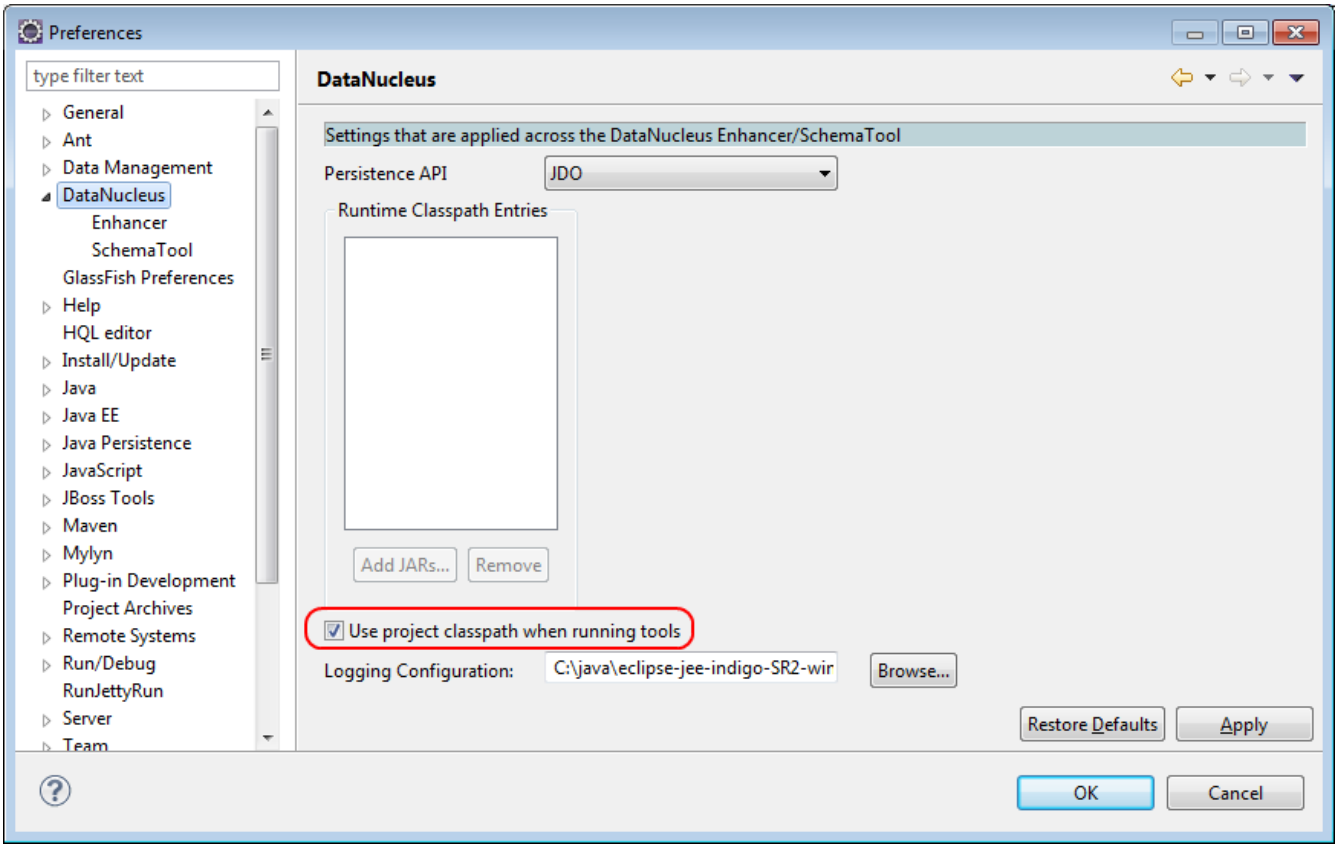


Update the classpath

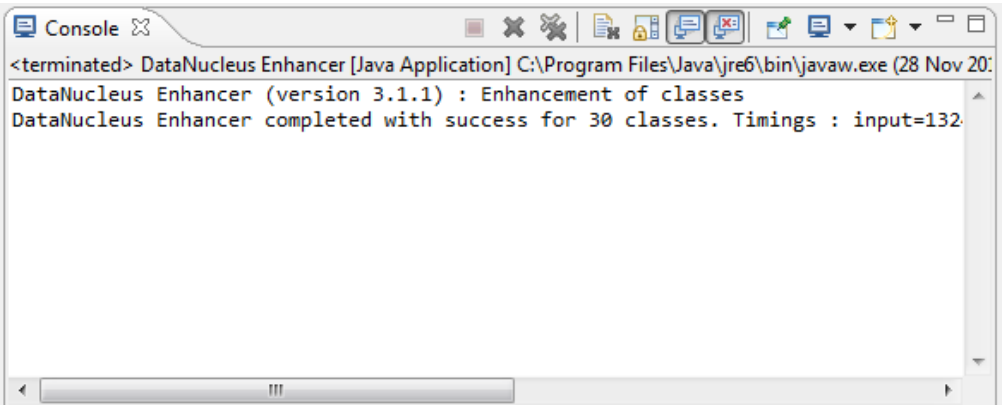
DataNucleus' enhancer uses the domain object model's own classpath to reference DataNucleus JARs. So, even though your domain objects are unlikely to depend on DataNucleus, these references must still be present.

See the section in DataNucleus enhancer for details of the contents of the `pom.xml`. Chances are it is already set up from running the HelloWorld or the SimpleApp archetype.

Then, tell DataNucleus to use the project classpath:



When the enhancer runs, it will print out to the console:

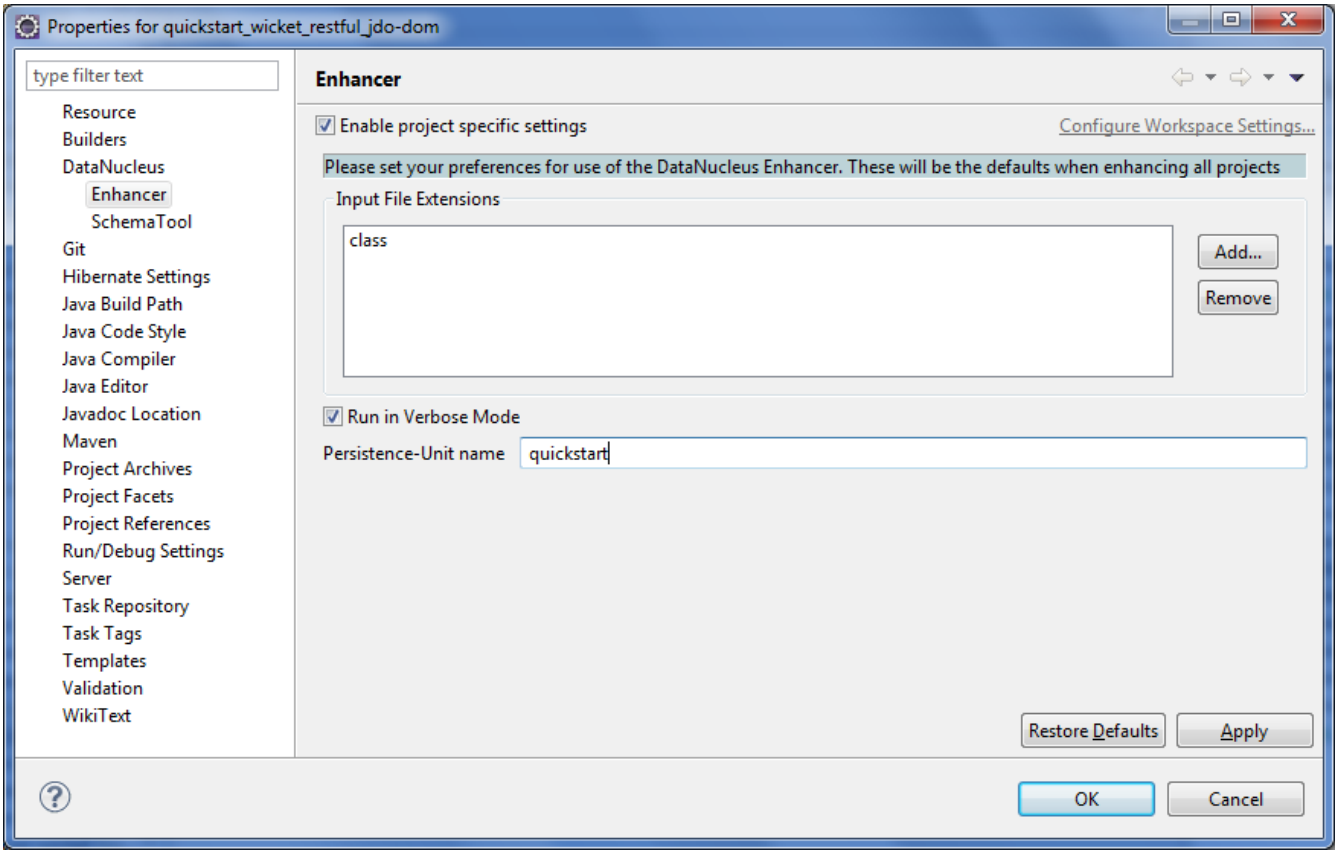


Workaround for path limits (the DN plugin to use the persistence.xml)

If running on Windows then the DataNucleus plugin is very likely to hit the Windows path limit.

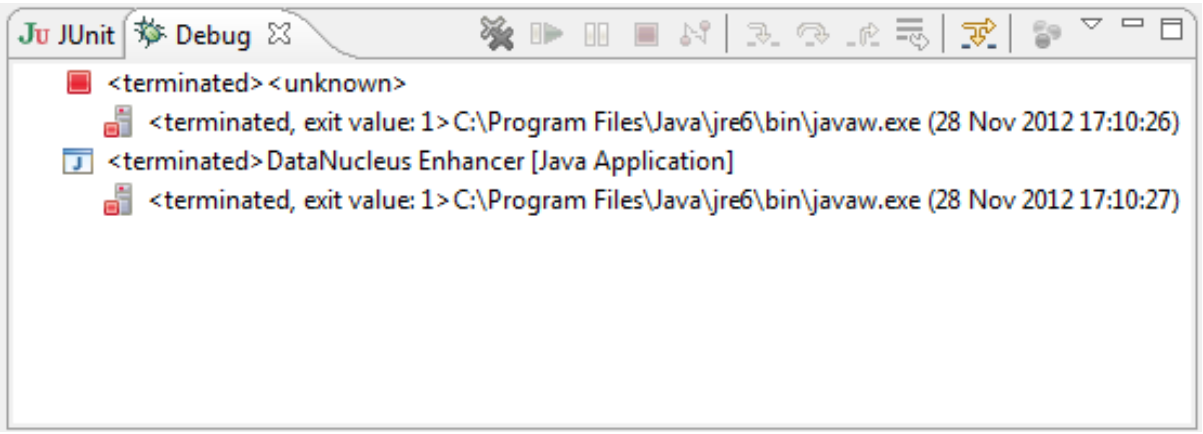
To fix this, we configure the enhancer to read from the `persistence.xml` file.

As a prerequisite, first make sure that your domain object model has a `persistence.xml` file. Then specify the `persistence-unit` in the project properties:

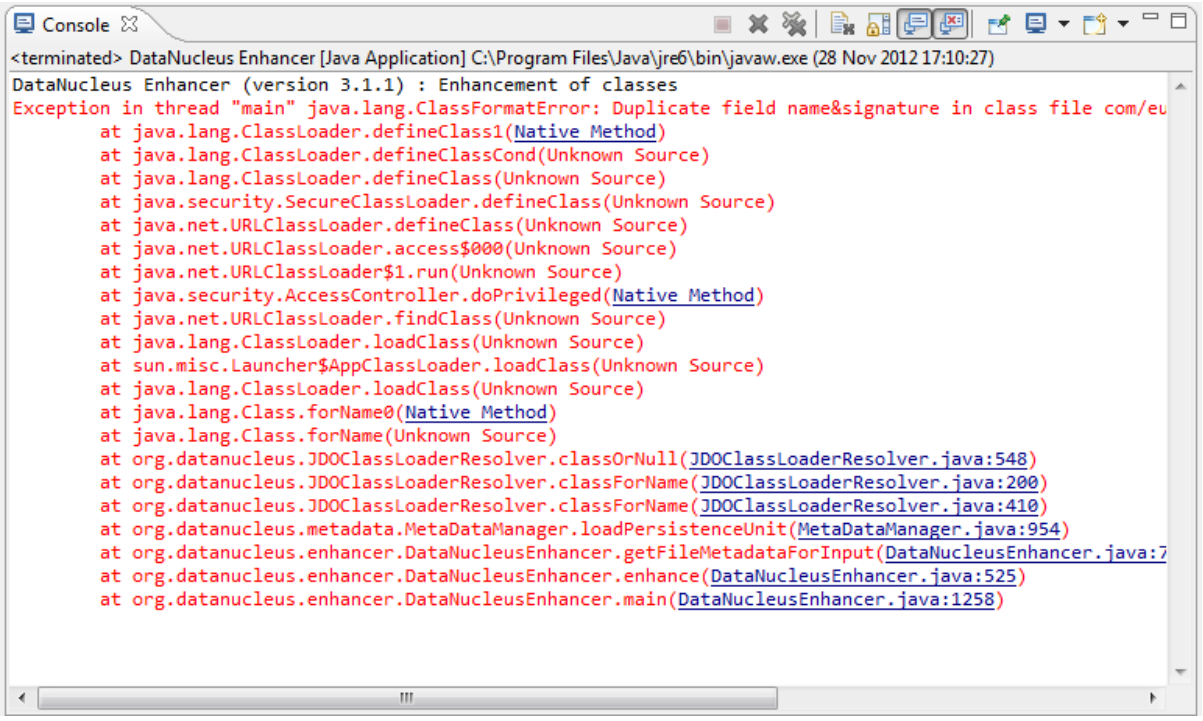


Workaround: If the enhancer fails

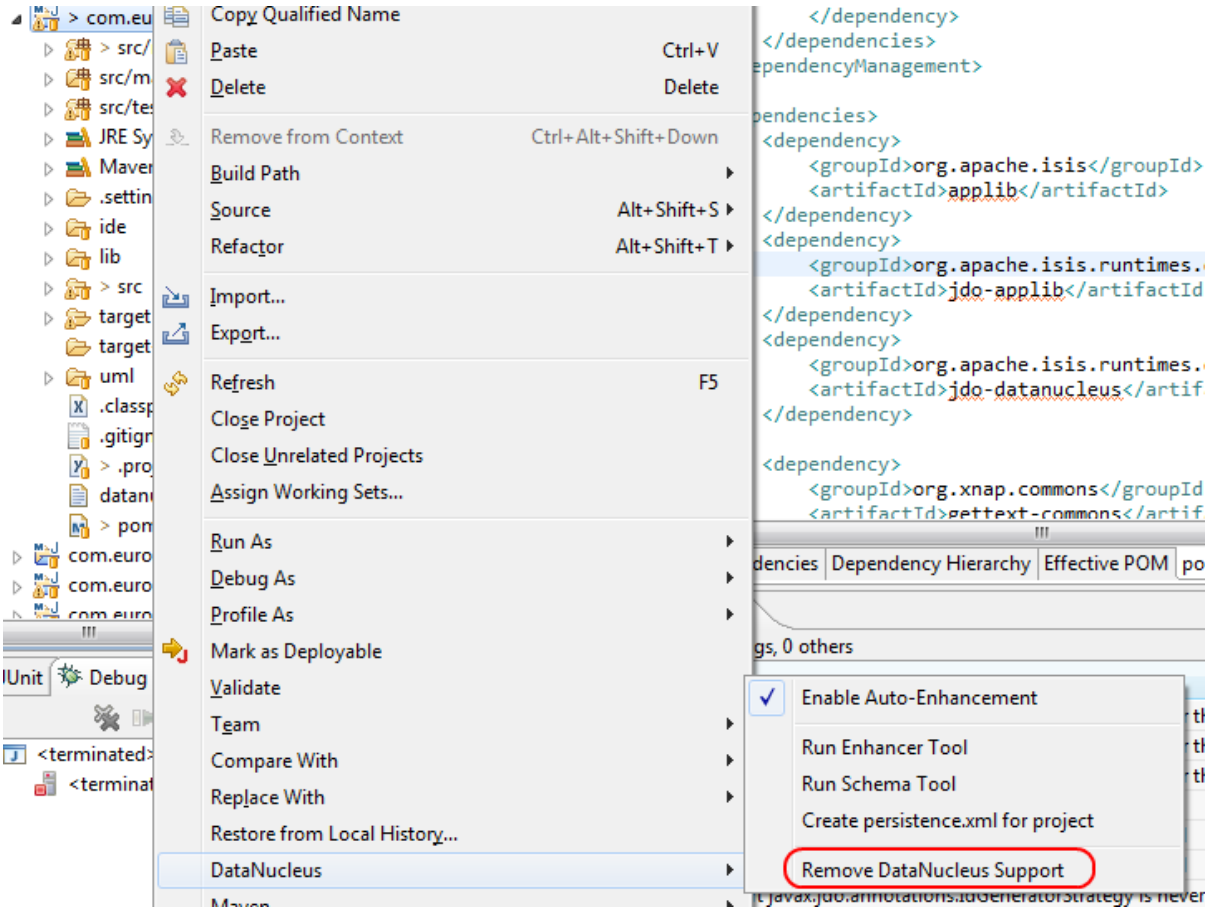
On occasion it appears that Eclipse can attempt to run two instances of the DataNucleus enhancer. This is probably due to multiple Eclipse builders being defined; we've noticed multiple entries in the Eclipse's `Debug` view:



At any rate, you'll know you've encountered this error if you see the following in the console:



The best solution is to remove DataNucleus support and then to re-add it:



If you consistently hit problems, then the final recourse is to disable the automatic enhancement and to remember to manually enhance your domain object model before each run.

Not ideal, we know. Please feel free to contribute a better solution :-)

2.2.6. Running the App

The simpleapp archetype automatically provides a `.launch` configurations in the `webapp` module. You can therefore very simply run the application by right-clicking on one of these files, and choosing "Run As..." or "Debug As...".

The screencast above shows this in action.

2.2.7. Other domain projects.

There is nothing to prevent you having multiple domain projects. You might want to do such that each domain project corresponds to a DDD module, thus guaranteeing that there are no cyclic dependencies between your modules.

If you do this, make sure that each project has its own `persistence.xml` file. And, remember also to configure Eclipse's DataNucleus plugin for these other domain projects.

2.2.8. Advanced

In this section are a couple of options that will reduce the length of the change code/build/deploy/review feedback loop.

Setting up DCEVM

DCEVM enhances the JVM with true hot-swap adding/removing of methods as well as more reliable hot swapping of the implementation of existing methods.

In the context of Apache Isis, this is very useful for contributed actions and mixins and also view models; you should then be able to write these actions and have them be picked up without restarting the application.

Changing persisting domain entities is more problematic, for two reasons: the JDO/DataNucleus enhancer needs to run on domain entities, and also at runtime JDO/DataNucleus would need to rebuild its own metamodel. You may find that adding actions will work, but adding new properties or collections is much less likely to.

For details of setting up DCEVM, see the corresponding section in the IntelliJ documentation.

Chapter 3. Hints and Tips

This chapter provides some solutions for problems we've encountered ourselves or have been raised on the Apache Isis mailing lists.

See also hints-n-tips chapters in the:

- the Developers' guide (this chapter)
- the Wicket viewer guide
- the Restful Objects viewer guide
- the Datanucleus ObjectStore guide
- the Security guide
- the Beyond the Basics guide.

3.1. Datanucleus Enhancer

DataNucleus is the reference implementation of the JDO (Java data objects) spec, and Apache Isis integrates with DataNucleus as its persistence layer. Datanucleus is a very powerful library, allowing domain entities to be mapped not only to relational database tables, but also to NoSQL stores such as Neo4J, MongoDB and Apache Cassandra.

With such power comes a little bit of complexity to the development environment: all domain entities must be enhanced through the DataNucleus enhancer.

Bytecode enhancement is actually a requirement of the JDO spec; the process is described in outline here.

What this means is that the enhancer — available as both a Maven plugin and as an Eclipse plugin — must, one way or another, be integrated into your development environment.

If working from the Maven command line, JDO enhancement is done using the `maven-datanucleus-plugin`.

Both the HelloWorld and SimpleApp Maven archetypes generate applications that have this plugin pre-configured.

3.1.1. META-INF/persistence.xml

It's also a good idea to ensure that every domain module(s) containing entities has a JDO `META-INF/persistence.xml` file:

```
<?xml version="1.0" encoding="UTF-8" ?>
<persistence xmlns="http://java.sun.com/xml/ns/persistence"
    xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
    xsi:schemaLocation="http://java.sun.com/xml/ns/persistence
http://java.sun.com/xml/ns/persistence/persistence_1_0.xsd" version="1.0">

    <persistence-unit name="simple"> ①
    </persistence-unit>
</persistence>
```

① change as required; typically is the name of the domain module.

Again, the applications generated by both the HelloWorld and Simpleapp Maven archetypes do this.

If running on Windows, then there's a good chance you'll hit the maximum path length limit. In this case the `persistence.xml` file is mandatory rather than optional.

This file is also required if you are using developing in Eclipse and relying on the DataNucleus plugin for Eclipse rather than the DataNucleus plugin for Maven. More information can be found here.

3.2. Enabling Logging

Sometimes you just need to see what is going on. There are various ways in which logging can be enabled, here are the ones we tend to use.

- In Apache Isis

  Modify `WEB-INF/logging.properties` (a log4j config file)

- In DataNucleus

  As per the DN logging page

- In the JDBC Driver

  Configure `log4jdbc` JDBC rather than the vanilla driver (see `WEB-INF/persistor_datanucleus.properties`) and configure log4j logging (see `WEB-INF/logging.properties`). There are examples of both in the SimpleApp archetype.

- In the database

  Details below.

Database logging can be configured:

- for HSQLDB

  by adding `;sqllog=3` to the end of the JDBC URL.

- for PostgreSQL:

  Can change `postgresql\9.2\data\postgresql.conf`; see this article for details.

- for MS SQL Server Logging:

  We like to use the excellent SQL Profiler tool.

3.3. Enhance only (IntelliJ)

From the Apache Isis mailing list is:

- *Is there a simple way to make a run configuration in IntelliJ for running the datanucleus enhancer before running integration test?*

Yes, you can; here's one way:

- Duplicate your run configuration for running the webapp
  - the one where the main class is `org.apache.isis.WebServer`
  - there's a button for this on the run configurations dialog.
- then, on your copy change the main class to `org.apache.isis.Dummy`

Or, you could just write a small shell script and run from the command line:

enhance.sh

```
mvn -pl dom datanucleus:enhance -o
```

3.4. How run fixtures on startup?

From this thread on the Apache Isis users mailing list:

- *my fixtures have grown into a couple of files the application needs to read in when it starts the first time (and possibly later on when the files content change). What is the right way to do this? Hook up into the webapp start? Use events?*

The standard approach is to use fixture scripts. These can be run in on start-up typically by being specified in the `AppManifest`, see for example the SimpleApp archetype.

Alternatively just set `isis.fixtures` and `isis.persistor.datanucleus.install-fixtures` properties.

In terms of implementations, you might also want to check out the (non-ASF) Incode Platform's excel module, by using `ExcelFixture` and overriding `ExcelFixtureRowHandler`.

An example can be found in this (non ASF) contactapp, see `ContactRowHandler`.

Chapter 4. Building Apache Isis

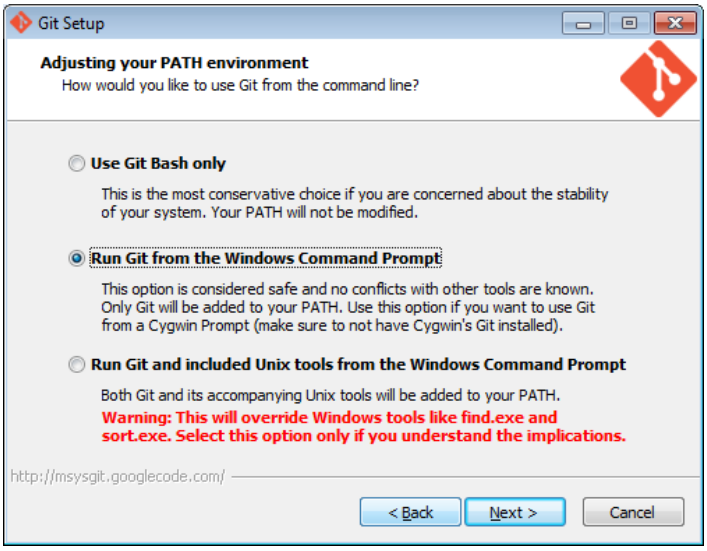
4.1. Git

The Apache Isis source code lives in a git repo.

4.1.1. Installation

The easiest place to get hold of command-line git is probably the github download page.

On Windows, this also installs the rather good mSysGit Unix shell. We recommend that you enable git for both the mSysgit and the Windows command prompt:



Once git is installed, the two main command line tools to note are:

- `git` command line tool
- `gitk` for viewing the commit history

If using Windows, note that github also have a dedicated Windows client. With a little hacking around, it can also be made to work with non-github repositories.

If using Mac, you might also want to check out Atlassian's Sourcetree.

Cloning the Apache Isis repo

First, clone the Apache Isis repo:

```
git clone https://github.com/apache/isis.git
```

Configuring Git

Next up is to configure your user name and password; see also Apache's git docs:

```
git config user.name "<i>My Name Here</i>"
git config user.email <i>myusername@apache.org</i>
```

Next, configure the `core.autocrlf` so that line endings are normalized to LF (Unix style) in the rep; again see Apache's git page:

- on Windows, use:

```
git config core.autocrlf true
```

- on Mac/Linux, use:

```
git config core.autocrlf input
```

The Windows setting means that files are converted back to CRLF on checkout; the Mac/Linux setting means that the file is left as LF on checkout.

We also recommend setting `core.safecrlf`, which aims to ensure that any line ending conversion is repeatable. Do this on all platforms:

```
git config core.safecrlf true
```

Note that these settings are supplemented in the repo by the `.gitattributes` file and that explicitly specifies line handling treatment for most of the common file types that we have.

Next, we recommend you setup this a refspec so that you can distinguish remote tags from local ones. To do that, locate the `[remote "origin"]` section in your `.git/config` and add the third entry shown below:

```
[remote "origin"]
    url = ... whatever ...
    fetch = ... whatever ...
    fetch = +refs/tags/*:refs/tags/origin/*
```

This will ensure that a `git fetch` or `git pull` places any remote tags under `origin/xxx. For example, the`isis-1.0.0`tag on the origin will appear under`origin/isis-1.0.0`.

If you don't use git outside of Apache, you can add the `--global` flag so that the above settings apply for all repos managed by git on your PC.

4.1.2. Getting help

Three commands of git that in particular worth knowing:

- `git help command`

  will open the man page in your web browser

- `git gui`

  will open up a basic GUI client to staging changes and making commits.

- `gitk --all`

  will open the commit history for all branches. In particular, you should be able to see the local `master`, which branch you are working on (the `HEAD`), and also the last known position of the `master` branch from the central repo, called `origin/master`.

You might also want to explore using a freely available equivalent such as Atlassian SourceTree.

For further reading, see:

- git config man page
- .gitattributes man page
- .gitattributes git-scm.com docs

4.2. Installing Java

Apache Isis is compatible with Java 7 and Java 8. For every-day use, the framework is usually compiled against Java 8.

Releases however are cut using Java 7, leveraging the Maven toolchains plugin).

Therefore install either/both of Java 7 JDK and Java 8 JDK. Note that the JRE is *not* sufficient.

If you intend to contribute back patches to Apache Isis, note that while you can develop using Java 8 within your IDE, be sure not to use any Java 8 APIs.

4.2.1. Configure Maven toolchains plugin

If you are a committer that will be performing releases of Apache Isis, then you *must* configure the toolchains plugin so that releases can be built using Java 7.

This is done by placing the `toolchains.xml` file in `~/.m2` directory. Use the following file as a template, adjusting paths for your platform:

```
<?xml version="1.0" encoding="UTF8"?>
<toolchains>
    <toolchain>
        <type>jdk</type>
        <provides>
            <version>1.8</version>
            <vendor>oracle</vendor>
        </provides>
        <configuration>
            <jdkHome>/usr/lib64/jvm/jdk1.8.0_65</jdkHome>
            <!--
            <jdkHome>c:\Program Files\Java\jdk1.8.0_65</jdkHome>
            -->
        </configuration>
    </toolchain>
    <toolchain>
        <type>jdk</type>
        <provides>
            <version>1.7</version>   ①
            <vendor>oracle</vendor>
        </provides>
        <configuration>
            <jdkHome>/usr/lib64/jvm/jdk1.7.0_79</jdkHome>
            <!--
            <jdkHome>c:\Program Files\Java\jdk1.7.0_79</jdkHome>
            -->
        </configuration>
    </toolchain>
</toolchains>
```

① The Apache Isis build is configured to search for the (`1.7, oracle`) JDK toolchain.

The Apache Isis parent `pom.xml` activates this plugin whenever the `apache-release` profile is enabled.

4.3. Installing Maven

Install Maven 3.0.x, downloadable here.

Set `MAVEN_OPTS` environment variable:

```
export MAVEN_OPTS="-Xms512m -Xmx1024m"
```

4.4. Building all of Apache Isis

To build the source code from the command line, simply go to the root directory and type:

```
mvn clean install
```

The first time you do this, you'll find it takes a while since Maven needs to download all of the Apache Isis prerequisites.

Thereafter you can speed up the build by adding the `-o` (offline flag). To save more time still, we also recommend that you build in parallel. (Per this blog post), you could also experiment with a number of JDK parameters that we've found also speed up Maven:

```
export MAVEN_OPTS="-Xms512m -Xmx1024m -XX:+TieredCompilation -XX:TieredStopAtLevel=1"
mvn clean install -o -T1C
```

For the most part, though, you may want to rely on an IDE such as Eclipse to build the codebase for you. Both Eclipse and Idea (12.0+) support incremental background compilation.

When using Eclipse, a Maven profile is configured such that Eclipse compiles to `target-ide` directory rather than the usual `target` directory. You can therefore switch between Eclipse and Maven command line without one interfering with the other.

4.5. Checking for Vulnerabilities

Apache Isis configures the OWASP dependency check Maven plugin to determine whether the framework uses libraries that are known to have security vulnerabilities.

To check, run:

```
mvn org.owasp:dependency-check-maven:aggregate -Dowasp
```

This will generate a single report under `target/dependency-check-report.html`.

The first time this runs can take 10~20 minutes to download the NVD data feeds.

To disable, either run in offline mode (add `-o` or `--offline`) or omit the `owasp` property.

4.6. Checking for use of internal JDK APIs

Apache Isis configures the jdeps maven plugin to check for any usage of internal JDK APIs. This is in preparation for Java 9 module system (Jigsaw) which will prevent such usage of APIs.

To check, run:

```
mvn clean install -Djdeps
```

This will fail the build on any module that currently uses an internal JDK API.

At the time of writing the `isis-core-schema` module fails the build.

Chapter 5. AsciiDoc Documentation

Apache Isis' documentation (meaning the website and the users' guide, the reference guide and this contributors' guide) is written using Asciidoc, specifically the Asciidoctor implementation.

The website and guides are created by running build tools (documented below) which create the HTML version of the site and guides. You can therefore easily check the documentation before raising a pull request (as a contributor) or publishing the site (if a committer).

To help write the Asciidoc text itself, we provide some Asciidoc templates.

Publishing is performed by copying the generated HTML to a different git repository (isis-site). Since this can only be done by Apache Isis committers, the process for doing this is described in the committers' guide. This is synced by ASF infrastructure over to isis.apache.org.

5.1. Where to find the Docs

The (Asciidoc) source code can be found at `adocs/documentation` (relative to root). Online you'll find it cloned to github here.

5.2. Naming Conventions

For documents with inclusions, use '_' to separate out the logical hierarchy:

```
xxx-xxx/xxx-xxx.adoc
        _xxx-xxx_ppp-ppp.adoc
        _xxx-xxx_qqq-qqq.adoc
        _xxx-xxx_qqq-qqq_mmm-mmm.adoc
        _xxx-xxx_qqq-qqq_nnn-nnn.adoc
```

Any referenced images should be in subdirectories of the `images` directory:

```
xxx-xxx/images/.
              /ppp-ppp/.
              /qqq-qqq/.
                       /mmm-mmm
                       /nnn-nnn
```

And similarly any resources should be in the `resources` subdirectory:

```
xxx-xxx/resources/.
                  ppp-ppp/.
                  qqq-qqq/.
                          /mmm-mmm/
                          /nnn-nnn/
```

5.3. Writing the docs

We highly recommend that you install the (IntelliJ) live templates for Asciidoctor, as described in IDE templates. These provide a large number of helper templates.

An appendix lists all the templates available, demonstrating their intended usage and output.

5.4. Build and Review (using Maven)

To (re)build the documentation locally prior to release, change into the `adocs/documentation` directory and use:

```
mvn clean compile
```

The site will be generated at `target/site/index.html`.

You could then use a web server such as Python's SimpleHTTPServer to preview (so that all Javascript works correctly). However, instead we recommend using instant preview, described next.

5.5. Instant Rebuild (using Ruby)

The ruby script, `monitor.rb` emulates the `mvn compile` command, regenerating any changed Asciidoctor files to the relevant `target/site` directory. Moreover if any included files are changed then it rebuilds the parent (per the above naming convention).

5.5.1. One-time setup

To setup:

- download and install ruby 2.0.0, from http://rubyinstaller.org/downloads/
- download devkit for the Ruby 2.0 installation, also from http://rubyinstaller.org/downloads/. Then follow the installation instructions on their wiki

We use Ruby 2.0 rather than 2.1 because the wdm gem (required to monitor the filesystem if running on Windows) is not currently compatible with Ruby 2.1.

To download the required Ruby dependencies, use:

```
gem install bundler
bundle install
```

5.5.2. Instant Rebuild

To run, we typically just use:

```
sh preview-html.sh
```

This script just runs `mvn compile` for HTML files only, then calls `python` to start the web browser and run a simple web server (on port 8000).

If you want to double-check the PDFs also, then use:

```
sh preview-pdf.sh
```

5.6. Publish procedure

Only Apache Isis committers can publish to isis.apache.org. See the committers' guide for further details.

Chapter 6. Contributing

This page explains how you can contribute to Apache Isis. You'll probably also want set up your IDE and learn how to build Apache Isis.

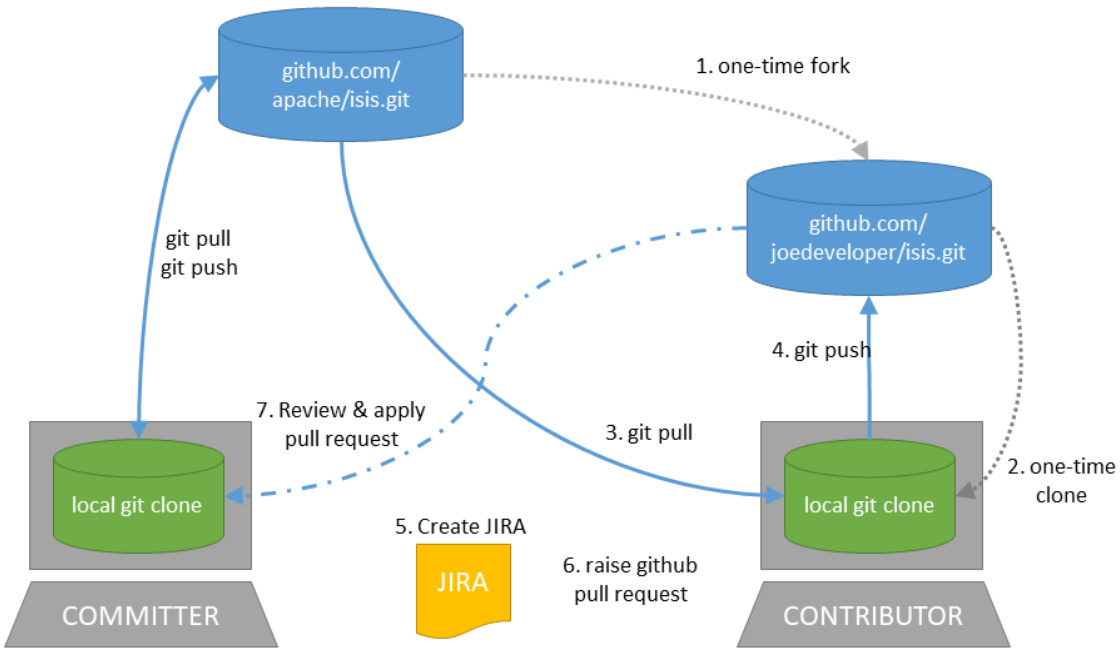
Thanks for considering to help out, your contributions are appreciated!

6.1. Recommended Workflow (github)

Apache Isis' source code is hosted in at github (https, or ssh: `git@github.com:apache/isis.git`).

As you might imagine, only committers are permitted to push changes to the github repo. As a contributor, we recommend that you fork the apache/isis github repo, and then use your fork as a way of publishing your patches for the Apache Isis committers to apply.

The diagram below illustrates the process:



That is:

1. as a one-time activity, you fork the github.com/apache/isis repo into your own fork on github.com
2. as a one-time activity, you clone your fork to your local computer
3. you set the github.com/apache/isis as your upstream branch; this will allow you to keep your local clone up-to-date with new commits
    - note the asymmetry here: the `upstream` repo (the Apache github repo) is **not** the same as the

`origin` repo (your fork).

4. you work on your changes locally; when done, you push them to your github fork
5. to contribute back a change, raise a JIRA ticket, and ensure your commit message is in the form: `ISIS-nnnn: ⋯` so that changes can be tracked (more discussion on this point below). In any case, before you decide to start hacking with Apache Isis, it's always worth creating a ticket in JIRA and then have a discussion about it on the mailing lists.
6. Use github to raise a pull request for your feature
7. An Apache Isis committer will review your change, and apply it if suitable.

6.2. Setting up your fork/clone

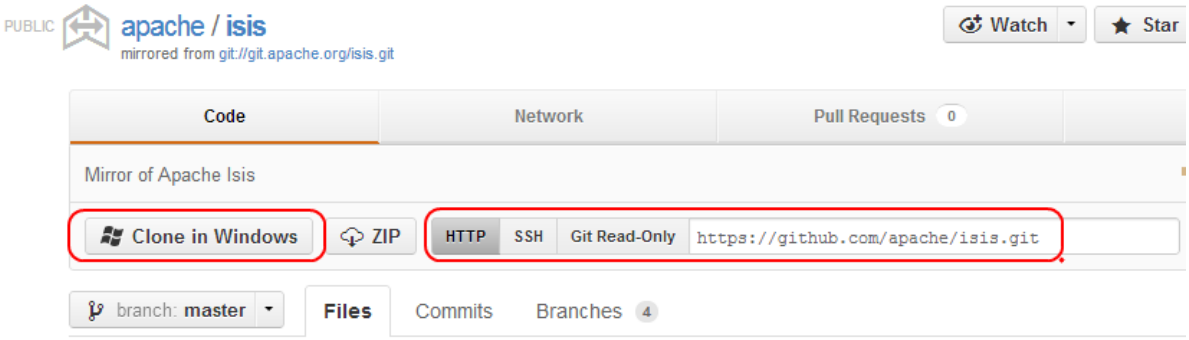
If you choose to create your own fork then you'll need an account on github.com. You then fork simply by pressing the "Fork" button:

An account isn't needed if you just clone straight from the github.com/apache/isis.

Whether you've forked or not, you then need to clone the repo onto your computer. Github makes this very easy to do:

- for Windows users, we suggest you use github's 'Clone in Windows' feature
- for Mac/Linux users, create a clone from the command line:

Again, the info is easily found in the github page:



If you've created your own fork, then you need to add the `upstream` remote to the github.com/apache/isis. This remote is traditionally called `upstream`. You should then arrange for your `master` branch to track the `upstream/master` remote branch:

If you didn't create your own fork, you can omit the above step. Either way around, you can now fetch new commits using simply:

```
git fetch
```

For more info on tracking branches here and here.

6.3. Commit messages

Although with git your commits are always performed on your local repo, those commit messages become public when the patch is applied by an Apache Isis committer. You should take time to write a meaningful commit message that helps explain what the patch refers to; if you don't then there's a chance that your patch may be rejected and not applied. No-one likes hard work to go to waste!

We therefore recommend that your commit messages are as follows [1]:

```
ISIS-999: Make the example in CONTRIBUTING imperative and concrete

Without this patch applied the example commit message in the CONTRIBUTING
document is not a concrete example.  This is a problem because the
contributor is left to imagine what the commit message should look like
based on a description rather than an example.  This patch fixes the
problem by making the example concrete and imperative.

The first line is a real life imperative statement with a ticket number
from our issue tracker.  The body describes the behavior without the patch,
why this is a problem, and how the patch fixes the problem when applied.
```

6.4. Creating the patch file

If you are working without a github fork of Apache Isis, then you can create the patches from your own local git repository.

As per this stackoverflow question, create the patch using `git format-patch`:

```
git format-patch -10 HEAD --stdout > 0001-last-10-commits.patch
```

Here `-10` is the last 10 commits you have done. You need to change that integer according to the commits you need to apply into the patch.

6.5. Sample Contribution Workflow

Assuming you're development environment is all setup, let's walk through how you might make contribute a patch. In this example, suppose that you've decided to work on JIRA ticket #123, an enhancement to support Blob/Clob datatypes.

6.5.1. Update your master branch

The first thing to do is to make sure your local clone is up-to-date. We do this by retrieving new commits from upstream repo and then merging them as a fast-forward into your local branch.

Irrespective of whether you are using a github fork, the upstream for your local `master` branch will be tracking the appropriate remote's `master` branch. So n either case, the same commands work:

Alternatively, you can combine the `git fetch` and `git merge` and just use `git pull`: <pre> git checkout master git pull –ff-only </pre>

If the `merge` or `pull` fails, it means that you must have made commits and there have been changes meanwhile on the remote `master's branch. You can use `gitk --all` to confirm. If this fails, see our git cookbook page for a procedure to retrospectively sort out this situation.

6.5.2. Create a topic branch

We recommend you name topic branches by the JIRA ticket, ie <tt>ISIS-nnn-description</tt>. So let's create a new branch based off `master` and call it "ISIS-123-blobs"

You can confirm the branch is there and is your new `HEAD` using either `gitk --all`. Alternatively, use the command line:

```
$ git checkout -b ISIS-123-blobs
```

The command line prompt should also indicate you are on a branch, isolated from any changes that might happen on the `master` branch.

6.5.3. Make File Changes and Commit

Next, make changes to your files using the usual commands (see also our git cookbook section):

- `git add`
- `git mv`
- `git rm`
- `git commit`
- `git status`

and so on.

Continue this way until happy with the change. Remember to run all your tests on the topic branch (including a full `mvn clean install`).

6.5.4. Rebasing with `master`

Before you can share your change, you should rebase (in other words replay) your changes on top of the `master` branch.

The first thing to do is to pull down any changes made in upstream remote's `master` since you started your topic branch:

These are the same commands that you would have run before you created your topic branch. If you use `gitk --all`, there's a good chance that new commits have come in.

Next, we reintegrate our topic branch by rebasing onto `master`: <pre> git checkout ISIS-123-blobs git rebase master </pre>

This takes all of the commits in your branch, and applies them on top of the new `master` branch. When your change is eventually integrated back in, it will result in a nice clear linear history on the public repo.

If the rebase fails because of a conflict, then you'll be dumped into REBASE mode. Edit the file that has the conflict, and make the appropriate edits. Once done:

Once the rebase has completed, re-run your tests to confirm that everything is still good.

6.5.5. Raising a pull request

If you have your own fork, you can now simply push the changes you've made locally to your fork:

This will create a corresponding branch in the remote github repo. If you use `gitk --all`, you'll also see a `remotes/origin/ISIS-123-blobs` branch.

Then, use github to raise a pull request. Pull requests sent to the Apache GitHub repositories will forward a pull request e-mail to the dev mailing list. You'll probably want to sign up to the dev mailing list first before issuing your first pull request (though that isn't mandatory).

The process to raise the pull request, broadly speaking:

- Open a web browser to your github fork of isis
- Select your topic branch (pushed in the previous step) so that the pull request references the topic branch.
- Click the `Pull Request` button.
- Check that the Apache Isis mailing list email came through.

6.6. If your pull request is accepted

To double check that your pull request is accepted, update your `master` branch from the `upstream` remote:

You can then use `gitk --all` (or `git log` if you prefer the command line) to check your contribution has been added.

You can now delete your topic branch and remove the branch in your github:

Finally, you might want to push the latest changes in master back up to your github fork. If so, use:

6.6.1. If your pull request is rejected

If your pull request is rejected, then you'll need to update your branch from the main repository and then address the rejection reason.

You'll probably also want to remove the remote branch on github:

```
git push origin –delete ISIS-123-blobs
```

… and continue as before until you are ready to resubmit your change.

[1] inspiration for the recommended commit format comes from the puppet project's contributing page.

Chapter 7. Appendix: Git Cookbook

This appendix describes the commands often used while working with git. In addition to these basic commands, please make sure you have read:

- building Apache Isis
- Contributing
- Git policy

7.1. Modifying existing files

To modify existing files:

```
git add filename
git commit -m "ISIS-nnn: yada yada"
```

The `git add` command adds the changes to the file(s) to the git index (aka staging area). If you were to make subsequent changes to the file these would not be committed.

The `git commit` takes all the staged changes and commits them locally. Note that these changes are not shared public with Apache Isis' central git repo.

You can combine these two commands using `-am` flag to git commit:

```
git commit -am "ISIS-nnn: yada yada"
```

7.2. Adding new files

To add a new file:

```
git add .
git commit -m "ISIS-nnn: yada yada"
```

Note that this sequence of commands is identical to modifying an existing file. However, it isn't possible to combine the two steps using `git commit -am`; the `git add` is always needed when adding new files to the repo.

7.3. Deleting files

To delete a file:

```
git rm filename
git commit -m "ISIS-nnn: yada yada"
```

7.4. Renaming or moving files

To rename or move a file:

```
git mv <i>filename</i> <i>newfilename</i>
git commit -m "ISIS-nnn: yada yada"
```

7.5. Common Workflows

The contributing page describes the workflow for non-committers. The Git policy page describes a workflow for Apache Isis **committers**.

7.6. Backing up a local branch

If committing to a local branch, the changes are still just that: local, and run risk of a disk failure or other disaster.

To create a new, similarly named branch on the central repo, use:

```
git push -u origin <i>branchname</i>
```

Using `gitk --all` will show you this new branch, named **origin/branchname**.

Thereafter, you can push subsequent commits using simply:

```
git push
```

Doing this also allows others to collaborate on this branch, just as they would for `master`.

When, eventually, you have reintegrated this branch, you can delete the remote branch using:

```
git push origin --delete <i>branchname</i>
```

For more detail, see this stackoverflow post.

7.7. Quick change: stashing changes

If you are working on something but are not ready to commit, then use:

```
git stash
```

If you use `gitk --all` then you'll see new commits are made that hold the current state of your working directory and staging area.

You can then, for example, pull down the latest changes using `git pull --rebase` (see above).

To reapply your stash, then use:

```
git stash pop
```

Note that stashing works even if switching branches

7.8. Ignoring files

Put file patterns into `.gitignore`. There is one at the root of the git repo, but they can additionally appear in subdirectories (the results are cumulative).

See also:

- github's help page
- man page

7.9. More advanced use cases

7.9.1. If accidentally push to remote

Suppose you committed to `master`, and then pushed the change, and then decided that you didn't intend to do that:

```
C1  -  C2  -  C3  -  C4  -  C5  -  C6  -  C7
                                          ^
                                          master
                                          ^
                                          origin/master
```

To go back to an earlier commit, first we wind back the local `master`:

```
git reset --hard C5
```

where `C5` is the long sha-id for that commit.

This gets us to:

```
C1  -  C2  -  C3  -  C4  -  C5  -  C6  -  C7
                            ^
                            master
                                        ^
                                        origin/master
```

Then, do a force push:

```
git push origin master --force
```

If this doesn't work, it may be that the remote repo has disabled this feature. There are other hacks to get around this, see for example here.

7.10. If you've accidentally worked on `master` branch

If at any time the `git pull` from your upstream fails, it most likely means that you must have made commits on the `master` branch. You can use `gitk --all` to confirm; at some point in time both `master` and `origin\master` will have a common ancestor.

You can retrospectively create a topic branch for the work you've accidentally done on `master`.

First, create a branch for your current commit:

```
git branch <i>newbranch</i>
```

Next, make sure you have no outstanding edits. If you do, you should commit them or stash them:

```
git stash
```

Finally, locate the shaId of the commit you want to roll back to (easily obtained in `gitk -all`), and wind `master` branch back to that commit:

```
git checkout master
git reset --hard <i>shaId</i>      # move master branch shaId of common ancestor
```

7.11. If you've forgotten to prefix your commits (but not pushed)

One of our committers, Alexander Krasnukhin, has put together some git scripts to help his workflow. Using one of these, `git prefix`, you can just commit with proper message without bothering about prefix and add prefix only in the end **before** the final push.

For example, to prefix all not yet prefixed commits `master..isis/666` with `ISIS-666` prefix, use:

```
git prefix ISIS-666 master..isis/666
```

You can grab this utility, and others, from this repo.

Chapter 8. Appendix: Working with Many Repos

Applications built with Apache Isis often (should) consist of multiple modules. For example, there are the various modules that make up the (non-ASF) Incode Platform that provide various technical/cross-cutting concerns and generic business functionality.

In addition, your own application may well be structured as a number of distinct modules (probably with the entities in each module being mapped to a different schema), and using such techniques as the event bus and mixins so that these modules are decoupled from each other.

All of which is a preamble to say that you will likely have multiple directories on your local development computer, for each such git repository that you contribute to.

In this appendix we provide some simple but useful bash scripts to help you manage each such.

8.1. Prerequisites

We recommend that you adopt a convention for your directories. For example, open source repositories (such as Apache Isis itself or the Incode Platform) reside in github.com, while your own proprietary code might reside in some other service, eg bitbucket. For example:

```
/users/home/me/
    BITBUCKET/
        mycompany/
            myapp/
            otherapp/
    GITHUB/
        apache/
            isis/
        incodehq/
            incode-platform/
```

8.2. `_repos.txt`

Create a file `_repos.txt` that catalogues the repositories, eg:

```
#
# our code
#
/users/home/me/BITBUCKET/mycompany/myapp
/users/home/me/BITBUCKET/mycompany/otherapp
#
# open source modules
#
/users/home/me/GITHUB/apache/isis
/users/home/me/GITHUB/incodehq/incode-platform
```

8.3. Bash functions

The `.bash_functions` file (downloadable from this gist) provides the following two functions:

- `repo`

  Switches (using `pushd`) to the specified directory (as listed in the `_repos.txt` file).

- `foreach`

  Runs the specified command for all (or matching) repositories (as listed in `_repos.txt` file).

For example,

```
repo plat
```

would switch to `/users/home/me/GITHUB/incodehq/incode-platform`, the first module that matches the fragment.

Meanwhile:

```
foreach git status
```

would perform a `git status` on every git repository, while

```
foreach -g plat git fetch
```

would perform a `git fetch` but only to those repositories which match "plat" (`-g` flag standing for `grep`).

To load the functions into your profile (`.bashrc` or `.profile` or similar), use:

```
. ~/.bash_functions
```

Chapter 9. Appendix: Asciidoc Syntax

This appendix describes the main syntax conventions when writing Asciidoctor/Asciidoc.

For more info, see:

- asciidoc-syntax-quick-reference.pdf
- asciidoc-writers-guide.pdf
- online cheat sheet
- asciidoctor online user manual
- asciidoc online user manual

9.1. Headings

The number of preceding = signs indicates the heading level.

Syntax	Meaning
`= Level 1`	There can only be one level 1 per .adoc (at the very top). The paragraph immediately following the heading is the "preamble", and is rendered in a larger font. It's therefore a good place to summarize the content of the document.
`== Level 2`	Level 2
`=== Level 3`	Level 3
`==== Level 4`	Level 4

9.2. Paragraphs

Syntax	Example

`Paragraphs are separated by one or more blank lines.`
 	
`So, this is a separate paragraph.`
	Paragraphs are separated by one or more blank lines.
	
	So, this is a separate paragraph.

`All consecutive sentences are rendered in the same paragraph.`
`This is another sentence in the para.`
`And another one.`
`Yet another.`
	Sentences without a blank line are in the same paragraph. Don't worry about word wrapping, just start the next sentence on the next line.

In general, there's no need to indent paragraphs; keep things left-aligned. Let the markup specify the logical indentation.

Start each sentence on a new line

Don't worry about wrapping sentences at 80 characters, just start each new sentence on a new line. Asciidoc will take care of the rendering.

This simple tip has a number of other benefits:

1. when the document is edited (eg correct a typo or insert a missing word), then only a single line in the file is changed.

   This will reduce change of merge conflicts, too.

2. You can easily see if a sentence is too long, and should be split
3. You can easily see if all sentences are the same length: good writing should vary the length of sentences
4. You can easily see if successive sentences start with the same phrase (that might be a good thing, or a bad thing, depending).

9.3. Bulleted lists

Syntax	Example

`The blank line after this para is required:`
 	
`* Bullet 1 +`
`+`
`Indented paragraph (note the '+' to to chain this para with the bullet)`
 	
`* Bullet 2`
 	
`** Child bullets +`
`+`
`More indenting`
 	
`** Another child bullet`
 	
`* Bullet 3`
	The blank line after this para is required:
	• Bullet 1
	Indented paragraph (note the '+' to chain this para with the bullet)
	• Bullet 2
	◦ Child bullets
	More indenting
	◦ Another child bullet
	• Bullet 3

9.4. Numbered lists

There's no need to keep track of numbers, just use '1' or 'a' etc:

Syntax	Example

`The blank line after this para is required:`
 	
`1. Bullet 1 +`
`+`
`Indented paragraph`
 	
`2. Bullet 2`
 	
`a. Child bullets +`
`+`
`More indenting`
 	
`b. Another child bullet`
 	
`3. Bullet 3`
	The blank line after this para is required:
	1. Bullet 1
	Indented paragraph
	2. Bullet 2
	a. Child bullets
	More indenting
	b. Another child bullet
	3. Bullet 3

While it isn't necessary to maintain the ordering manually (could just use '1' for all bullets), this does generate warnings when the document is built.

9.5. Links and Cross-references

Syntax	Example	Purpose
`link:http://ciserver:8080[CI Server]`	CI Server	Link to an external hyperlink
`link:http://ciserver:8080[CI Server^]`	CI Server	Link to an external hyperlink, with `target=blank`
`xref:dg.adoc#__dg_asciidoc_links-and-xrefs#[background]`	background	Cross-reference to section in same asciidoc document
`xref:../ugfun/ugfun.adoc#[Fundamentals]`	Fundamentals	Cross-reference to top-level of different asciidoc document
`xref:../ugfun/ugfun.adoc#_ugfun_core-concepts[Core Concepts]`	Core Concepts	Cross-reference to section within different asciidoc document

9.6. Tables

```
.Some table
[cols="3a,2a", options="header"]
|===

| Header col 1
| Header col 2

| Row 1 col 1
| Row 1 col 2

| Row 2 col 1
| Row 2 col 2

|===
```

renders as:

Table 1. Some table

Header col 1	Header col 2
Row 1 col 1	Row 1 col 2
Row 2 col 1	Row 2 col 2

where:

- the `cols` attribute says how many columns there are and their respective widths.
- the "a" suffix indicates that the contents is parsed as Asciidoc

9.6.1. Column Attributes

Other options are (credit):

- e: emphasized
- a: Asciidoc markup
- m: monospace
- h: header style, all column values are styled as header
- s: strong
- l: literal, text is shown in monospace font and line breaks are kept
- d: default
- v: verse, keeps line breaks

For example:

```
.Table with column style e,a,m
[cols="e,a,m"]
|===
| Emphasized (e) | Asciidoc (a) | Monospaced (m)

| Asciidoctor
| NOTE: *Awesome* way to write documentation
| It is just code

|===
```

renders as

Table 2. Table with column style e,a,m

Emphasized (e)	Asciidoc (a)	Monospaced (m)
Asciidoctor	 **Awesome** way to write documentation	`It is just code`

and:

```
.Table with column style h,s,l
[cols="h,s,l"]
|===
| Header (h) | Strong (s) | Literal (l)

| Asciidoctor
| Awesome way to write documentation
| It is
just code

|===
```

renders as

Table 3. Table with column style h,s,l

Header (h)	Strong (s)	Literal (l)
Asciidoctor	**Awesome way to write documentation**	`It is` `just code`

and:

```
.Table with column style d,v
[cols="d,v"]
|===
| Default (d) | Verse (v)

| Asciidoctor
| Awesome way
to write
documentation

|===
```

renders as

Table 4. Table with column style d,v

Default (d)	Verse (v)
Asciidoctor	Awesome way to write documentation

9.6.2. Column Alignment

This can be combined with alignment markers (credit):

- <: top align values (default)
- >: bottom align values
- ^: center values

For example:

```
[cols="^.>,<.<,>.^", options="header"]
|===

| Name
| Description
| Version

| Asciidoctor
| Awesome way to write documentation
| 1.5.0
|===
```

renders as:

Name	Description	Version
Asciidoctor	Awesome way to write documentation	1.5.0

where:

- the first column is centered and bottom aligned,
- the second column is left and top aligned and
- the third column is right aligned and centered vertically.

9.6.3. Column/Row Spanning

We can also have columns or rows spanning multiple cells (credit):

For example:

```
.Cell spans columns
|===
| Name | Description

| Asciidoctor
| Awesome way to write documentation

2+| The statements above say it all

|===
```

renders as:

Table 5. Cell spans columns

Name	Description
Asciidoctor	Awesome way to write documentation
The statements above say it all	

The `N+` sign notation tells Asciidoctor to span this cell over N columns.

while:

```
.Cell spans rows
|===
| Name | Description

.2+| Asciidoctor
| Awesome way to write documentation

| Works on the JVM

|===
```

renders as:

Table 6. Cell spans rows

Name	Description
Asciidoctor	Awesome way to write documentation
	Works on the JVM

The `.N+` notation tells Asciidoctor to span this cell over N rows.

and:

```
.Cell spans both rows and columns
|===

| Row 1, Col 1 | Row 1, Col 2 | Row 1, Col 3

2.2+| Cell spans 2 cols, 2 rows
| Row 2, Col 3
| Row 3, Col 3

|===
```

renders as:

Table 7. Cell spans both rows and columns

Row 1, Col 1	Row 1, Col 2	Row 1, Col 3
Cell spans 2 cols, 2 rows		Row 2, Col 3
		Row 3, Col 3

The `N.M+` notation tells Asciidoctor to span this cell over N columns and M rows.

9.7. Admonitions

Callout or highlight content of particular note.

Syntax	Example
`NOTE: the entire note must be a single sentence.`	 the entire note must be a single sentence.

`[NOTE]`
`====`
`the note is multiple paragraphs, and can have all the usual styling,`
`* eg bullet points:`
`* etc etc`
`====`
	 the note is multiple paragraphs, and can have all the usual styling,
	• eg bullet points:
	• etc etc

`[TIP]`
`====`
`Here's something worth knowing...`
`====`
	 Here's something worth knowing...

Syntax	Example

`[WARNING]`
`====`
`Be careful...`
`====`
	 Be careful...

`[IMPORTANT]`
`====`
`Don't forget...`
`====`
	 Don’t forget...

9.8. Source code

Use `[source]` macro to specify source content:

```
[source,powershell]
----
get-command -module BomiArtifact
----
```

will render as:

```
get-command -module BomiArtifact
```

Some languages support syntax highlighting. For example:

```
[source,java]
----
public class SomeClass extends SomeOtherClass {
    ...
}
----
```

will render as:

```
public class SomeClass extends SomeOtherClass {
    ...
}
```

Callouts can also be added using an appropriate comment syntax. For example:

```
[source,java]
----
public class SomeClass
                extends SomeOtherClass {        // <1>
    public static void main(String[] args) {    // <2>
        ...
    }
}
----
<1> inherits from `SomeOtherClass`
<2> entry point into the program
```

will render as:

```
public class SomeClass
                extends SomeOtherClass {        ①
    public static void main(String[] args) {    ②
        ...
    }
}
```

① inherits from `SomeOtherClass`

② entry point into the program

and

```
[source,xml]
----
<a>
    <b c="foo">     <!--1-->
</a>
----
<1> some comment
```

renders as:

```
<a>
    <b c="foo">     ①
</a>
```

① some comment

It's also possible to include source code snippets; see the guides linked previously

9.9. Images

Use the `image:` macro to reference images. For example:

```
image:_images/vscode.png[]
```

To make the image clickable, add in the `link` attribute:

```
image:_images/vscode.png[link="_images/vscode.png"]
```

It's also possible to specify the width using `scaledwidth` (for PDF/HTML) or `width` and `height` (for HTML only).

For example:

```
image:_images/vscode.png[link="_images/vscode.png",width="800px"]
```

9.10. Child Documents

Use the `include:` macro to break up a document into multiple sections.

For example, this developers' guide document is broken into several files:

```
dg.adoc
_dg_ide.adoc
_dg_hints-and-tips.adoc
_dg_building-isis.adoc
...
```

and so on.

These are included using:

```
include::_dg_ide.adoc[leveloffset=+1]
include::_dg_hints-and-tips.adoc[leveloffset=+1]
include::_dg_building-isis.adoc[leveloffset=+1]
...
```

The `leveloffset=+1` means that each included file's heading levels are automatically adjusted. The net effect is that all documents can and should use heading 1 as their top-level.

Child documents should have '_' as prefix. This ensures that they are ignored by the build; only .html and PDF files are created for the top-level parent documents.

The CI/documentation platform also supports the "Improve this doc" button, allowing any document to be edited via the TFS portal; very useful for small fixes. To make this work, it relies upon the following naming conventions:

- every document should have an id anchor for its level heading corresponding to its file name
- every child document's name should be an '_ followed by the name of its parent.

For example, `dg.adoc` is:

```
[[dg]]
= Developers' Guide
...
```

while its child document `_dg_ide.adoc` starts with:

```
[[_dg_ide]]
= Using an IDE
...
```

In general, we use '_' to separate out the logical hierarchy:

```
xxx-xxx/xxx-xxx.adoc
        _xxx-xxx_ppp-ppp.adoc
        _xxx-xxx_qqq-qqq.adoc
        _xxx-xxx_qqq-qqq_mmm-mmm.adoc
        _xxx-xxx_qqq-qqq_nnn-nnn.adoc
```

Any referenced images should be in subdirectories of the `_images` directory:

```
xxx-xxx/_images/.
              /ppp-ppp/.
              /qqq-qqq/.
                       /mmm-mmm
                       /nnn-nnn
```

9.11. Metadata

The top-level document must include the `_basedir` attribute; this points to the parent directory `src/main/asciidoc`. This attribute is set immediately after the top-level heading.

In addition, the `:toc:` adds a table of contents.

For example, the `setting-up/concepts/concepts.adoc` file starts:

```
[[concepts]]
= Concepts
:_basedir: ../../
:toc: right
...
```

9.12. UML diagrams

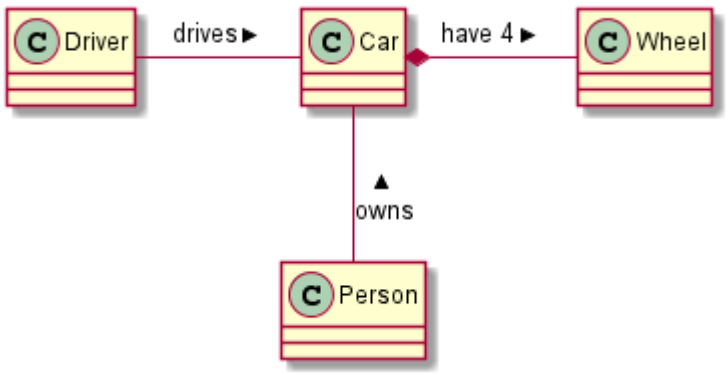
Asciidoctor includes support for the plantuml, allowing simple UML diagrams to be easily sketched.

For example:

```
[plantuml,images/asciidoctor/plantuml-demo,png]
--
class Car

Driver - Car : drives >
Car *- Wheel : have 4 >
Car -- Person : < owns
--
```

renders as:



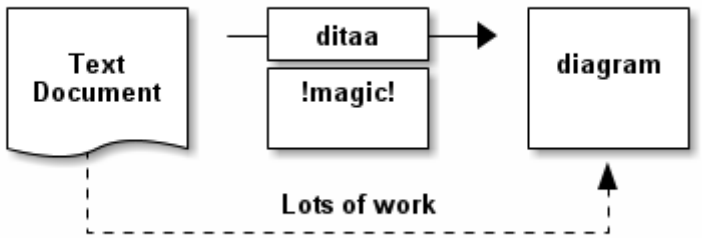
9.13. Ditaa diagrams

Asciidoctor includes support for the ditaa, allowing boxes-and-lines diagrams to be easily sketched.

For example:

```
[ditaa,images/asciidoctor/ditaa-demo,png]
----
    +--------+   +-------+    +-------+
    |        | --+ ditaa +--> |       |
    |  Text  |   +-------+    |diagram|
    |Document|   |!magic!|    |       |
    |     {d}|   |       |    |       |
    +---+----+   +-------+    +-------+
        :                         ^
        |       Lots of work      |
        +-------------------------+
----
```

renders as:



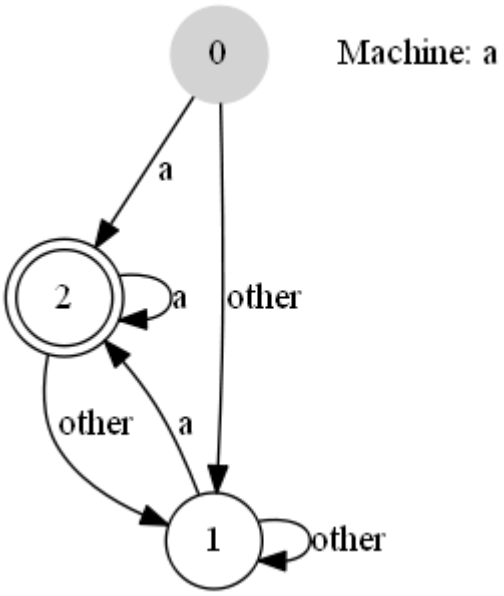
9.14. Graphviz diagrams

Asciidoctor includes support for the ditaa, allowing boxes-and-lines diagrams to be easily sketched.

For example:

```
[graphviz,images/asciidoctor/graphviz-demo,png]
----
digraph automata_0 {
  size ="8.5, 11";
  node [shape = circle];
  0 [ style = filled, color=lightgrey ];
  2 [ shape = doublecircle ];
  0 -> 2 [ label = "a " ];
  0 -> 1 [ label = "other " ];
  1 -> 2 [ label = "a " ];
  1 -> 1 [ label = "other " ];
  2 -> 2 [ label = "a " ];
  2 -> 1 [ label = "other " ];
  "Machine: a" [ shape = plaintext ];
}
----
```

renders as:



This requires graphviz to be installed and the `dot.exe` on the PATH. Alternatively, specify the location, eg using:

```
:graphvizdot: c:\Program Files (x86)\Graphviz2.38\bin\dot.exe
```

Chapter 10. Appendix: Asciidoc Templates

This appendix lists the (IntelliJ) live templates available for writing documentation using Asciidoc. Instructions for installing the templates can be found here.

In the examples below the text xxx, yyy, zzz are correspond to template variables (ie placeholders).

10.1. Admonitions (Callouts)

Abbrev.	Produces	Example

adadmimportant	`[IMPORTANT]`
	`====`
	`xxx`
	`====`
		 xxx

adadmnote	`[NOTE]`
	`====`
	`xxx`
	`====`
		 xxx

adadmtip	`[TIP]`
	`====`
	`xxx`
	`====`
		 xxx

adadmwarning	`[WARNING]`
	`====`
	`xxx`
	`====`
		 xxx

10.2. TODO notes

Add as a placeholder for documentation still to be written or which is work-in-progress.

Abbrev.	Produces	Example
adtodo	`NOTE: TODO`	 TODO

Abbrev.	Produces	Example
adwip	`NOTE: WIP - xxx` where: • xxx is additional explanatory text	 WIP - cool new feature

10.3. Xref to Guides

Cross-references (links) to the various guides

Abbrev.	Produces	Example
adcgcom	xref:../cgcom/cgcom.adoc#xxx[ttt] a hyperlink to a bookmark within the committers' guide, where: • xxx is the bookmark's anchor • ttt is the text to display as the hyperlink for example: \xref:../dg/dg.adoc#_cgcom_cutting-a-release[Cutting a release\]	addg

Abbrev.	Produces	Example

`xref:../dg/dg.adoc#xxx[ttt]`
 	
a hyperlink to a bookmark within the developers' guide, where:
 	
* `xxx` is the bookmark's anchor * `ttt` is the text to display as the hyperlink
 	
for example:
 	
`\xref:../dg/dg.adoc#_dg_asciidoc-templates[Asciidoc templates\]`
	Asciidoc templates	`adrgant`

Abbrev.	Produces	Example

`xref:../rgant/rgant.adoc#xxx[ttt]`
 	
a hyperlink to a bookmark within the reference guide for annotations, where:
 	
* `xxx` is the bookmark * `ttt` is the text to display as the hyperlink
 	
for example:
 	
`xref:../rgant/rgant.adoc#_rgant_aaa_main[Core annotations]`
	Core annotations	`adrgcfg`

Abbrev.	Produces	Example

`xref:../rgcfg/rgcfg.adoc#xxx[ttt]`
 	
a hyperlink to a bookmark within the reference guide for configuration properties guide, where:
 	
* `xxx` is the bookmark * `ttt` is the text to display as the hyperlink
 	
for example:
 	
`xref:../rgcfg/rgcfg.adoc#_rgcfg_configuring-core[Configuring Core]`
	Configuring Core	`adrgcms`

Abbrev.	Produces	Example
xref:../rgcms/rgcms.adoc#xxx[ttt] a hyperlink to a bookmark within the reference guide for classes, methods and schema, where: * xxx is the bookmark * ttt is the text to display as the hyperlink for example: xref:../rgcms/rgcms.adoc#_rgcms_classes_super_AbstractService[`AbstractService`]	AbstractService	adrgsvc

Abbrev.	Produces	Example

`xref:../rgsvc/rgsvc.adoc#xxx[ttt]`
 	
a hyperlink to a bookmark within the reference guide for domain services, where:
 	
* `xxx` is the bookmark * `ttt` is the text to display as the hyperlink
 	
for example:
 	
`xref:../rgcms/rgcms.adoc#_rgcms_classes_AppManifest-bootstrapping[`AppManifest` bootstrapping]`
	`AppManifest` bootstrapping	`adrgmvn`

Abbrev.	Produces	Example

`xref:../rgmvn/rgmvn.adoc#xxx[ttt]`
 	
a hyperlink to a bookmark within the reference guide for the maven plugin, where:
 	
* `xxx` is the bookmark * `ttt` is the text to display as the hyperlink
 	
for example:
 	
`xref:../rgmvn/rgmvn.adoc#_rgmvn_validate[validate goal]`
	validate goal	`adrgna`

Abbrev.	Produces	Example
xref:../rgant/rgant.adoc#_rgant-xxx[@xxx`]` a hyperlink to the "man page" for an annotation within the reference guide for annotations, where: * xxx is the annotation type (eg @Action) for example: xref:../rgant/rgant.adoc#_rgant-Action[@Action`]`	@Action	adrgnt

Abbrev.	Produces	Example
xref:../rgant/rgant.adoc#_rgant-xxx_ttt[@xxx#ttt()] a hyperlink to the "man page" for the specific attribute (field) of an annotation within the reference guide for annotations, where: * xxx is the annotation type (eg @Action) * ttt is the attribute (eg @semantics) for example: xref:../rgant/rgant.adoc#_rgant-Action_semantics[@Action#semantics()]	@Action#semantics()	adrgsa

Abbrev.	Produces	Example
xref:../rgsvc/rgsvc.adoc#_rgsvc_api_xxx[`xxx`] a hyperlink to the "man page" for an (API) domain service within the reference guide for domain services, where: * `xxx` is the domain service (eg `RepositoryService`) for example: xref:../rgsvc/rgsvc.adoc#_rgsvc_core-domain-api_RepositoryService[`RepositoryService`]	`RepositoryService`	`adrgss`

Abbrev.	Produces	Example
xref:../rgsvc/rgsvc.adoc#_rgsvc_spi_xxx[`xxx`] a hyperlink to the "man page" for an (SPI) domain service within the reference guide for domain services, where: * `xxx` is the domain service (eg `ContentMappingService`) for example: xref:../rgsvc/rgsvc.adoc#_rgsvc_presentation-layer-spi_ContentMappingService[`ContentMappingService`]	`ContentMappingService`	`adugfun`

Abbrev.	Produces	Example

`xref:../ugfun/ugfun.adoc#xxx[ttt]`
 	
a hyperlink to a bookmark within the fundamentals users' guide, where:
 	
* `xxx` is the bookmark's anchor * `ttt` is the text to display as the hyperlink
 	
for example:
 	
`xref:../ugfun/ugfun.adoc#_ugfun_core-concepts[Core concepts]`
	Core concepts	`adugvw`

Abbrev.	Produces	Example

`xref:../ugvw/ugvw.adoc#xxx[ttt]`
 	
A hyperlink to a bookmark within the Wicket viewer guide, where:
 	
* `xxx` is the bookmark's anchor * `ttt` is the text to display as the hyperlink.
 	
for example:
 	
`xref:../ugvw/ugvw.adoc#_ugvw_customisation[Customisation]`
	Customisation	`adugvro`

Abbrev.	Produces	Example

`xref:../ugvro/ugvro.adoc#xxx[ttt]`
 	
A hyperlink to a bookmark within the Restful Objects viewer guide, where:
 	
* `xxx` is the bookmark's anchor * `ttt` is the text to display as the hyperlink.
 	
for example:
 	
`xref:../ugvro/ugvro.adoc#_ugvro_ro-spec[RestfulObjects specification]`
	RestfulObjects specification	`adugsec`

Abbrev.	Produces	Example

`xref:../ugsec/ugsec.adoc#xxx[ttt]`
 	
A hyperlink to a bookmark within the Secrurity guide, where:
 	
* `xxx` is the bookmark's anchor * `ttt` is the text to display as the hyperlink.
 	
for example:
 	
`xref:../ugsec/ugsec.adoc#_ugsec_hints-and-tips_shiro-caching[Caching and other Shiro Features]`
	Caching and other Shiro Features	`adugtst`

Abbrev.	Produces	Example

`xref:../ugtst/ugtst.adoc#xxx[ttt]`
 	
A hyperlink to a bookmark within the Testing guide, where:
 	
* `xxx` is the bookmark's anchor * `ttt` is the text to display as the hyperlink.
 	
for example:
 	
`xref:../ugtst/ugtst.adoc#_ugtst_bdd-spec-support[BDD Spec Support]`
	BDD Spec Support	`adugbtb`

10.4. Source code

Abbrev.	Produces	Example

`adsrcjava`	`[source,java]`
	`----`
	`xxx`
	`----`
	
	where:
	
	• `xxx` is the source code snippet.
		`public class Foo {`
		`  ...`
		`}`

`adsrcjavac`	as for `adsrcjava`, but with a caption above	

Abbrev.	Produces	Example

adsrcjavascript	`[source,javascript]`
	`----`
	`xxx`
	`----`
	
	where:
	• `xxx` is the source code snippet.
		`$(document).ready(function() {`
		`  ...`
		`});`

adsrcjavascriptc	as for `adsrcjavascript`, but with a caption above	

adsrcother	`[source,nnn]`
	`----`
	`xxx`
	`---`
	
	where:
	• `nnn` is the programming language
	• `xxx` is the source code snippet.	

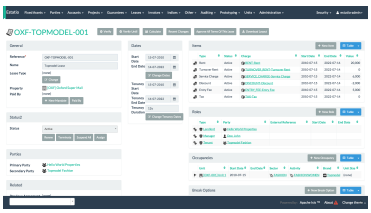
adsrcotherc	as for `adsrcother`, but with a caption above	

adsrcxml	`[source,javascript]`
	`----`
	`xxx`
	`----`
	
	where:
	• `xxx` is the source code snippet.
		`<html>`
		`  <title>`
		`  hello world!`
		`  </title>`
		`</html>`

adsrcxmlc	as for `adsrcxml`, but with a caption above	

10.5. Images

Abbrev.	Produces	Example

`adimgfile`	`image:images/xxx/yyy.png[width="WWWpx",link="images/xxx/yyy.png"]`
	
	embeds specified image, where:
	
	• `xxx` is the subdirectory under the `images/` directory
	• `yyy` is the image
	• `WWW` is the width, in pixels.
	
	for example:
	
	`image:images/layouts/estatio-Lease.png[width="300px",link="images/layouts/estatio-Lease.png"]`
		

`adimgfilec`	as for `adimgfile`, but with a caption above	
`adimgurl`	`image:xxx[width="WWWpx",link="xxx"]` embeds image from specified URL, where: • `xxx` is the URL to the image • `WWW` is the width, in pixels.	
`adimgurlc`	as for `adimgurl`, but with a caption above	

10.6. YouTube (screencasts)

Embedded youtube screencasts. (Don't use these in guides, as they cannot be rendered as PDF).

Abbrev.	Produces	Example

`adyoutube`	`video:xxx[youtube,width="WWWpx",height="HHHpx"]`
	
	where:
	
	• `xxx` is the youtube reference
	• `WWW` is the width, in pixels
	• `HHH` is the height, in pixels
	
	for example:
	
	`video::bj8735nBRR4[youtube,width="210px",height="118px"]`
		▶ https://www.youtube.co

Abbrev.	Produces	Example
`adyoutubec`	as for `youtube`, but with a caption above	

10.7. Tables

Abbrev.	Produces	Example
`adtbl3`	Table with 3 columns, 3 rows.	

10.8. Misc.

Abbrev.	Produces	Example
`adai`	`Apache Isis` That is, the literal text "Apache Isis".	Apache Isis

`adlink`	`link:xxx[ttt]`
	
	, where:
	
	• `xxx` is
	• `ttt` is the text to display as the hyperlink
	
	for example:
	
	`link:http://isis.apache.org[Apache Isis website]`
		Apache Isis website

`adanchany`	`= anchor:[xxx]`
	
	defines an inline anchor to any heading, where:
	
	• `xxx` is the anchor text.
	
	For example:
	
	`= anchor:[_ugfun_i18n] Internationalization`
	
	An alternative (more commonly used in our documentation) is to use the `[[…]]` directly above the heading:
	
	`[[_ugfun_i18n]]`
	`= Internationalization`	

Abbrev.	Produces	Example
`adxrefany`	`\xref:[xxx]` cross-reference to any document/anchor, where: • `xxx` is the fully qualified document with optional anchor	
`adfootnote`	`footnote:[xxx]` defines a footnote	[2: this is a footnote]

Chapter 11. Appendix: Project Lombok

Project Lombok is an open source project to reduce the amount of boilerplate in your code.

For example, rather than write:

```
private String name;
public String getName() {
    return name;
}
public void setName(String name) {
    this.name = name;
}
```

you can instead write simply:

```
@Getter @Setter
private String name;
```

Under the covers it is implemented as an annotation processor; it basically hooks into the Java compiler so that it can emit additional bytecode (eg for the getter and setter). See here for details of setting up in IntelliJ (Eclipse has very similar support).

Apache Isis supports Project Lombok, in that the annotations that would normally be placed on the getter (namely `Property`, `@PropertyLayout`, `@Collection`, `@CollectionLayout` and `@MemberOrder`) can be placed on the field instead.

There are plugins for Lombok for maven; it's just a matter of adding the required dependency. To compile the code within your IDE (eg so that its compiler "knows" that there is, actually, a getter and setter) will require an Lombok plugin appropriate to that IDE. See the Lombok download page for more information.

11.1. Future thoughts

In the future we might extend/fork Lombok so that it understands Isis' own annotations (ie `@Property` and `@Collection`) rather than Lombok's own `@Getter` and `@Setter.

It might also be possible to use Lombok to generate the domain event classes for each member.

Chapter 12. Appendix: AgileJ

This material does not constitute an endorsement; AgileJ Structure Views is not affiliated to Apache Software Foundation in any way. AgileJ has however provided a complimentary copy of its software to Apache Isis committers.

AgileJ Structure Views is a commercial product to reverse engineer and visualize Java classes from source code.

The key to using the tool is in developing a suitable filter script, a DSL. You can use the following script as a starting point for visualizing Apache Isis domain models:

```
// use CTRL+SPACE for completion suggestions
hide all fields
hide setter methods
hide private methods
hide methods named compareTo
hide methods named toString
hide methods named inject*
hide methods named disable*
hide methods named default*
hide methods named hide*
hide methods named autoComplete*
hide methods named choices*
hide methods named title
hide methods named iconName
hide methods named validate*
hide methods named modify*
hide protected methods
hide types annotated as DomainService
hide types named Constants
hide types named InvoicingInterval
hide enums
hide constructors
hide inner types named *Event
hide inner types named *Functions
hide inner types named *Predicates
show getter methods in green
show methods annotated as Programmatic in orange
show methods annotated as Action in largest
hide dependency lines
hide call lines
hide method lines
```

For more information on AgileJ, see Paul Wells' 8-part tutorial series on Youtube; the first can be found here (view the "show more" comments to click through to other parts).