Hibernate JPA 2 Metamodel Generator

Reference Guide

1.0.0.Final

by Hardy Ferentschik

Introduction

1.1. What is it about?

JPA 2 defines a new typesafe `Criteria` API which allows criteria queries to be constructed in a strongly-typed manner, using metamodel objects to provide type safety. For developers it is important that the task of the metamodel generation can be automated. Hibernate Static Metamodel Generator is an annotation processor based on the [*Pluggable Annotation Processing API*] with the task of creating JPA 2 static metamodel classes. The following example show two JPA 2 entities `Order` and `Item`, together with the metamodel class `Order_` and a typesafe query.

Example 1.1. JPA 2 annotated entities `Order` and `Item`

```
@Entity
public class Order {
    @Id
    @GeneratedValue
    Integer id;

    @ManyToOne
    Customer customer;

    @OneToMany
    Set<Item> items;
    BigDecimal totalCost;

    // standard setter/getter methods
    ...
}

@Entity
public class Item {
    @Id
    @GeneratedValue
      Integer id;

      int quantity;

    @ManyToOne
    Order order;

    // standard setter/getter methods
    ...
}
```

Example 1.2. Metamodel class `Order_`

```
@StaticMetamodel(Order.class)
public class Order_ {
    public static volatile SingularAttribute<Order, Integer> id;
    public static volatile SingularAttribute<Order, Customer> customer;
    public static volatile SetAttribute<Order, Item> items;
    public static volatile SingularAttribute<Order, BigDecimal> totalCost;
}
```

Example 1.3. Typesafe citeria query

```
CriteriaBuilder cb = entityManager.getCriteriaBuilder();
CriteriaQuery<Order> cq = cb.createQuery(Order.class);
SetJoin<Order, Item> itemNode = cq.from(Order.class).join(Order_.items);
cq.where( cb.equal(itemNode.get(Item_.id), 5 ) ).distinct(true);
```

1.2. Canonical Metamodel

The structure of the metamodel classes is described in the [*JPA 2 Specification*], but for completeness the definition is repeated in the following paragraphs. Feel free to skip ahead to *Chapter 2, Usage* if you are not interested into the gory details.

The annotation processor produces for every managed class in the persistence unit a metamodel class based on these rules:

- For each managed class `X` in package p, a metamodel class `X_` in package p is created.
- The name of the metamodel class is derived from the name of the managed class by appending "_" to the name of the managed class.
- The metamodel class `X_` must be annotated with the `javax.persistence.StaticMetamodel` annotation.
- If class `X` extends another class `S`, where `S` is the most derived managed class (i.e., entity or mapped superclass) extended by `X`, then class `X_` must extend class `S_`, where `S_` is the metamodel class created for `S`.

- For every persistent non-collection-valued attribute y declared by class X, where the type of y is Y, the metamodel class must contain a declaration as follows:

```
public static volatile SingularAttribute<X, Y> y;
```

- For every persistent collection-valued attribute z declared by class X, where the element type of z is Z, the metamodel class must contain a declaration as follows:
  - if the collection type of z is java.util.Collection, then

  ```
  public static volatile CollectionAttribute<X, Z> z;
  ```

  - if the collection type of z is java.util.Set, then

  ```
  public static volatile SetAttribute<X, Z> z;
  ```

  - if the collection type of z is java.util.List, then

  ```
  public static volatile ListAttribute<X, Z> z;
  ```

  - if the collection type of z is java.util.Map, then

  ```
  public static volatile MapAttribute<X, K, Z> z;
  ```

  where K is the type of the key of the map in class X

Import statements must be included for the needed `javax.persistence.metamodel` types as appropriate and all classes X, Y, Z, and K.

Usage

The jar file for the annotation processor can be found in the *JBoss Maven repository* [http://repository.jboss.com/] using *Example 2.1, “Maven dependency ”*.

Example 2.1. Maven dependency

```
<dependency>
    <groupId>org.hibernate</groupId>
    <artifactId>hibernate-jpamodelgen</artifactId>
    <version>1.0.0</version>
</dependency>
```

Alternatively, a full distribution package can be downloaded from *SourceForge* [http://sourceforge.net/projects/hibernate/files/hibernate-jpamodelgen].

In most cases the annotation processor will automatically run provided the processor jar is added to the classpath and a JDK 6 is used. This happens due to *Java's Service Provider* [http://java.sun.com/j2se/1.4.2/docs/guide/jar/jar.html#Service%20Provider] contract and the fact the the Hibernate Static Metamodel Generator jar files contains the file `javax.annotation.processing.Processor` in the `META-INF/services` directory. The fully qualified name of the processor itself is: `org.hibernate.jpamodelgen.JPAMetaModelEntityProcessor`.

Note

The use of a Java 6 compiler is a prerequisite.

2.1. Usage from the command line

2.1.1. Usage with Ant

As mentioned before, the annotation processor will run automatically each time the Java compiler is called, provided the jar file is on the classpath. Sometimes, however, it is useful to control the annotation processing in more detail, for example if you exclusively want to run the processor without compiling any other source files. *Example 2.2, “Javac Task configuration”* shows how Ant's *Javac Task* [http://ant.apache.org/manual/CoreTasks/javac.html] can be configured to just run annotation processing.

Example 2.2. Javac Task configuration

```
<javac srcdir="${src.dir}"
    destdir="${target.dir}"
    failonerror="false"
    fork="true"
    classpath="${classpath}">
    <compilerarg value="-proc:only"/>
</javac>
```

The option *-proc:only* instructs the compiler to just run the annotation processing. You can also completely disable processing by specifying *-proc:none*.

> **Tip**
>
> Run `'javac -help'` to see which other annotation processor relevant options can be specified.

2.1.2. Usage with Maven

There are several ways of running the annotation processor as part of a Maven build. Again, it will automatically run if you are using a JDK 6 compiler and the annotation processor jar is on the classpath. In case you have more than one annotation processors on your classpath you can explicitly pass the processor option to the compiler plugin:

Example 2.3. Maven compiler plugin configuration - direct execution

```
<plugin>
    <artifactId>maven-compiler-plugin</artifactId>
    <configuration>
        <source>1.6</source>
        <target>1.6</target>
        <compilerArguments>
            <processor>org.hibernate.jpamodelgen.JPAMetaModelEntityProcessor</processor>
        </compilerArguments>
    </configuration>
</plugin>
```

The maven-compiler-plugin approach has the disadvantage that the maven compiler plugin does currently not allow to specify multiple compiler arguments (*MCOMPILER-62* [http://jira.codehaus.org/browse/MCOMPILER-62]) and that messages from the Messenger API are suppressed (*MCOMPILER-66* [http://jira.codehaus.org/browse/MCOMPILER-66]). A better approach is to disable annotation processing for the compiler plugin as seen in *Example 2.4, “Maven compiler plugin configuration - indirect execution”*.

Example 2.4. Maven compiler plugin configuration - indirect execution

```
<plugin>
   <artifactId>maven-compiler-plugin</artifactId>
   <configuration>
      <source>1.6</source>
      <target>1.6</target>
      <compilerArgument>-proc:none</compilerArgument>
   </configuration>
</plugin>
```

Once disabled, the *maven-annotation-plugin* [http://code.google.com/p/maven-annotation-plugin/] for annotation processing (you will need the following additional maven repositories: *maven-annotation-plugin* [http://maven-annotation-plugin.googlecode.com/svn/trunk/mavenrepo] and *jfrog* [http://www.jfrog.org/artifactory/plugins-releases]) can be used. The configuration can be seen in *Example 2.5, “Configuration with maven-annotation-plugin”*.

Example 2.5. Configuration with maven-annotation-plugin

```
<plugin>
   <groupId>org.bsc.maven</groupId>
   <artifactId>maven-processor-plugin</artifactId>
   <executions>
      <execution>
         <id>process</id>
         <goals>
            <goal>process</goal>
         </goals>
         <phase>generate-sources</phase>
         <configuration>
            <!-- source output directory -->
            <outputDirectory>target/metamodel</outputDirectory>
         </configuration>
      </execution>
   </executions>
</plugin>
<plugin>
   <groupId>org.codehaus.mojo</groupId>
   <artifactId>build-helper-maven-plugin</artifactId>
```

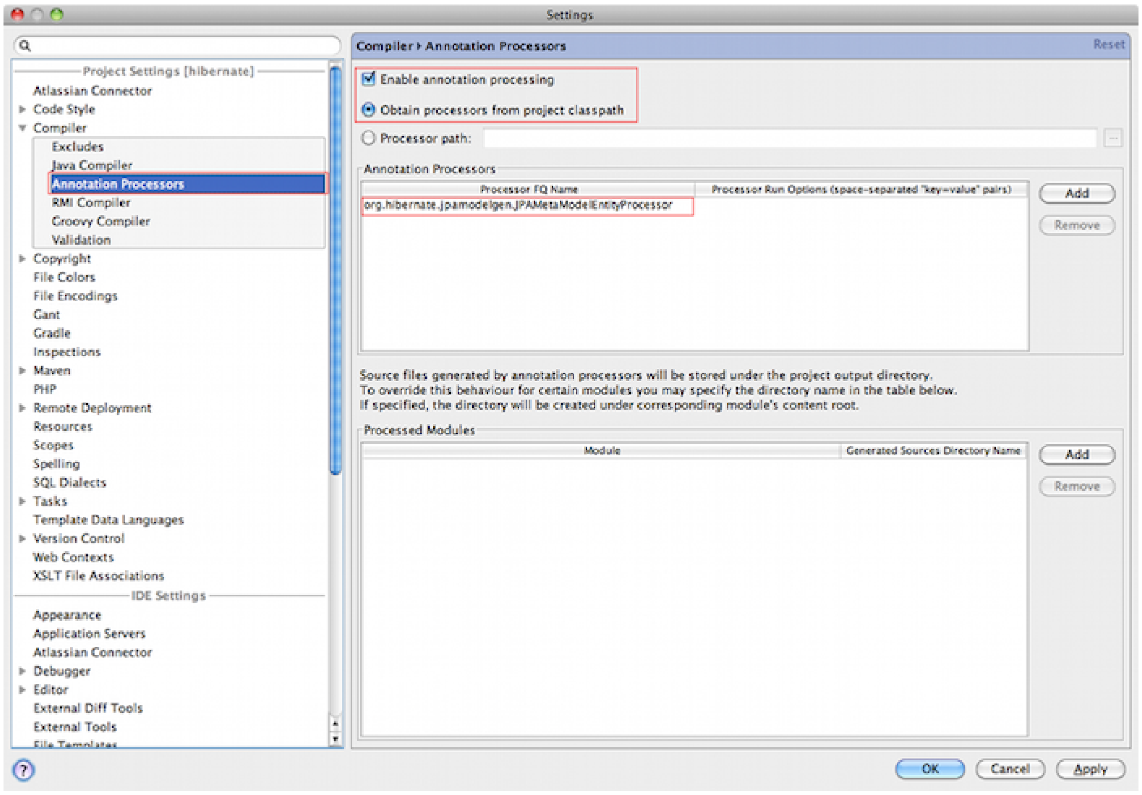
```
    <version>1.3</version>
    <executions>
        <execution>
            <id>add-source</id>
            <phase>generate-sources</phase>
            <goals>
                <goal>add-source</goal>
            </goals>
            <configuration>
                <sources>
                    <source>target/metamodel</source>
                </sources>
            </configuration>
        </execution>
    </executions>
</plugin>
```

2.2. Usage within the IDE

Of course you also want to have annotation processing available in your favorite IDE. The following paragraphs and screenshots show you how to enable the Hibernate Static Metamodel Generator within your IDE.

2.2.1. Idea

Intellij Idea contains from version 9.x onwards a specifc configuration section for annotation processing under the project settings window. The screenshots show you how to configure the Hibernate Static Metamodel Generator.



[✓] Enable annotation processing

[● Obtain processors from project classpath]

○ Processor path:

Annotation Processors

Processor FQ Name	Processor Run Options (space-separated "key=value" pairs)
org.hibernate.jpamodelgen.JPAMetaModelEntityProcessor	

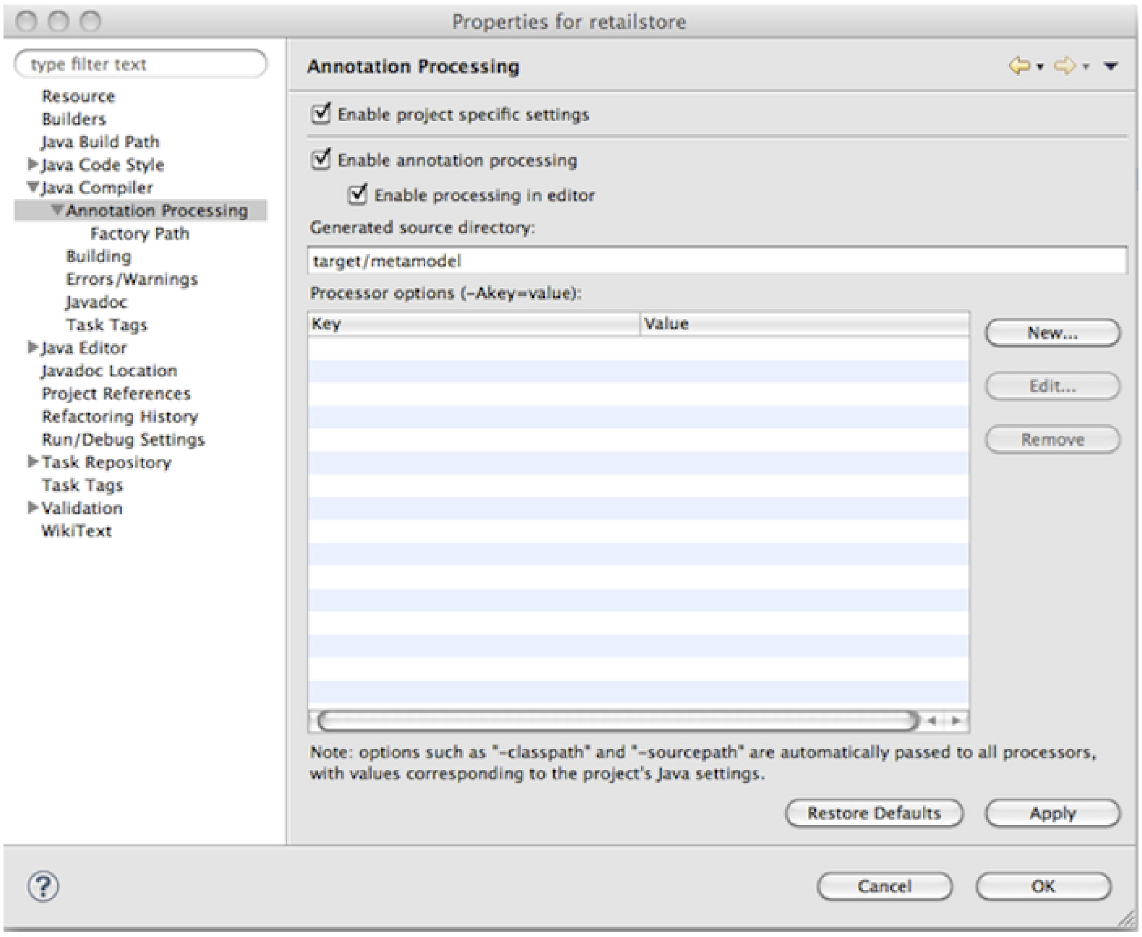
Source files generated by annotation processors will be stored under the project output directory.
To override this behaviour for certain modules you may specify the directory name in the table below.
If specified, the directory will be created under corresponding module's content root.

Processed Modules

Module	Generated Sources Directory Name

2.2.2. Eclipse

In Eclipse, from the Galileo release onwards, exists an additional configuration section under Java Compiler. There you can configure all kinds of aspects of annotation processing. Just check the "Enable annotation processing" option, configure the directory for the generated sources and finally add the Hibernate Static Metamodel Generator and JPA 2 jar files to the factory path.


Properties for retailstore

Annotation Processing

☑ Enable project specific settings

☑ Enable annotation processing

☑ Enable processing in editor

Generated source directory: target/metamodel

Processor options (-Akey=value):

Key	Value

Note: options such as "-classpath" and "-sourcepath" are automatically passed to all processors, with values corresponding to the project's Java settings.

2.2.3. NetBeans

Netbeans support for annotation processors is at the time of this wrinting still in the making. Refer to NetBeans issues *111065* [http://www.netbeans.org/issues/show_bug.cgi?id=111065], *111293* [http://www.netbeans.org/issues/show_bug.cgi?id=111293] and *111294* [http://www.netbeans.org/issues/show_bug.cgi?id=111294].

2.3. Processor specific options

The Hibernate Static Metamodel Generator accepts a series of custom options which can be passed to the processor in the format `-A[property]=[value]`. The supported properties are:

Table 2.1. Annotation processor options (passed via -A[property]=[value])

Option name	Option value and usage
debug	if set to `true` additional trace information will be outputted by the processor
persistenceXml	Per default the processor looks in `/META-INF` for persistence.xml. Specifying this option a

	`persitence.xml` file from a different location can be specified (has to be on the classpath)
ormXml	Allows to specify additional entity mapping files. The specified value for this option is a comma separated string of mapping file names. Even when this option is specified `/META-INF/orm.xml` is implicit.
lazyXmlParsing	Possible values are `true` or `false`. If set to `true` the annotation processor tries to determine whether any of the xml files has changed between invocations and if unchanged skips the xml parsing. This feature is experimental and contains the risk of wron results in some cases of mixed mode configurations. To determine wether a file has been modified a temporary file `Hibernate-Static-Metamodel-Generator.tmp` is used. This file gets created in the `java.io.tmpdir` directory.

Appendix A. Further information

For further usage question or problems consult the *Hibernate Forum* [https://forum.hibernate.org/viewforum.php?f=9]. For bug reports use the *METAGEN* [http://opensource.atlassian.com/projects/hibernate/browse/METAGEN] project in the Hibernate Jira instance. Feedback is always welcome.

References

[Pluggable Annotation Processing API] *JSR 269: Pluggable Annotation Processing API*. Copyright © 2006 SUN MICROSYSTEMS, INC.. `<jsr-269-feedback@sun.com>` *JSR 269 JCP Page* [http://jcp.org/en/jsr/detail?id=269] .

[JPA 2 Specification] *JSR 317: Java™ Persistence API, Version 2.0* . Java Persistence 2.0 Expert Group. . Copyright © 2009 SUN MICROSYSTEMS, INC.. `<jsr-317-feedback@sun.com>` *JSR 317 JCP Page* [http://jcp.org/en/jsr/detail?id=317] .