JPA Static Metamodel Generator

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What is it about?

JPA 2 defines a typesafe Criteria API which allows Criteria queries to be constructed in a strongly-typed manner, utilizing so called static metamodel classes. 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 JSR_269 (http://jcp.org/en/jsr/detail?id=269) with the task of creating JPA 2 static metamodel classes. The following example shows two JPA 2 entities Order and Item, together with the metamodel class Order_ and a typesafe query.

Example 1. JPA 2 annotated entities Order and Item

```java
@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 2. Metamodel class Order_*

```java
@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 3. Typesafe citeria query

```java
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);
```

Hibernate Static Metamodel Generator also takes into consideration xml configuration specified in orm.xml or mapping files specified in persistence.xml. However, if XML is your only configuration source, you need to add in at least on of the mapping file the following persistence unit metadata:

```xml
<persistence-unit-metadata>
  <xml-mapping-metadata-complete/>
</persistence-unit-metadata>
```

Canonical Metamodel

The structure of the metamodel classes is described in the JPA 2 (JSR 317) specification (http://jcp.org/en/jsr/detail?id=317), but for completeness the definition is repeated in the following paragraphs. Feel free to skip ahead to the usage chapter, if you are not interested into the gory details.

The annotation processor produces for every managed entity 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/) under:

```xml
<dependency>
    <groupId>org.hibernate</groupId>
    <artifactId>hibernate-jpamodelgen</artifactId>
    <version>CURRENT-VERSION</version>
</dependency>
```

Alternatively, it can be found in the ORM distribution bundle on SourceForge (http://sourceforge.net/projects/hibernate/files/hibernate4).

In most cases the annotation processor will automatically run provided the processor jar is added to the build classpath and a JDK >6 is used. This happens due to Java's Service Provider 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.

Usage from the command line

Usage with Ant

As mentioned above, 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. The Javac task configuration below shows how Ant can be configured to just run annotation processing.

Example 4. Javac Task configuration

```xml
<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*.

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

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 compiling with a JDK >6. In case you have more than one annotation processor on your classpath you can explicitly pass the processor option to the compiler plugin:

Example 5. Maven compiler plugin configuration - direct execution

```xml
<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 below.

Example 6. Maven compiler plugin configuration - indirect execution

```xml
<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-processor-plugin (http://code.google.com/p/maven-annotation-plugin) for annotation processing can be used:

Example 7. Configuration with maven-processor-plugin

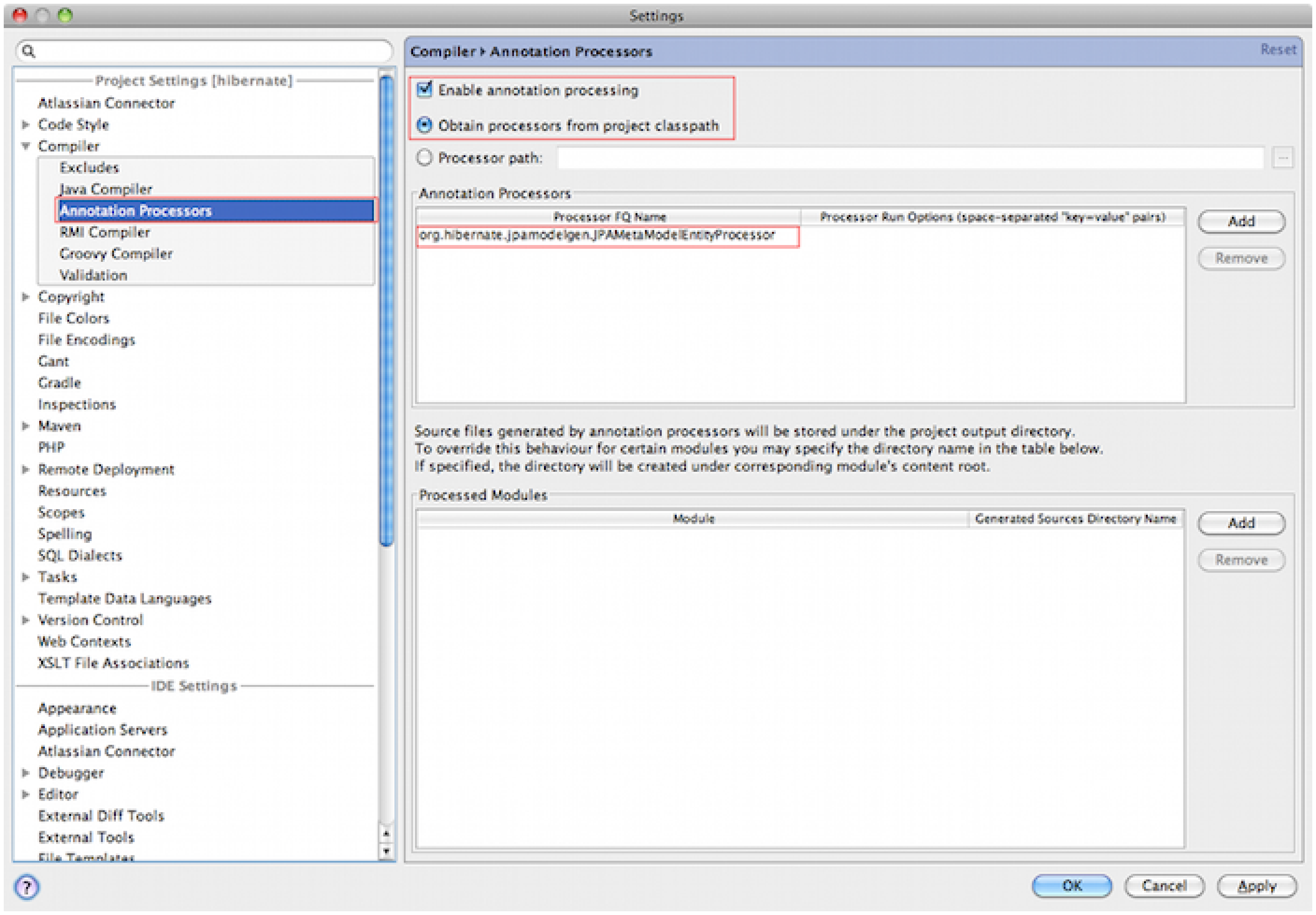
```xml
<plugin>
    <groupId>org.bsc.maven</groupId>
    <artifactId>maven-processor-plugin</artifactId>
    <version>2.0.5</version>
    <executions>
        <execution>
            <id>process</id>
            <goals>
                <goal>process</goal>
            </goals>
            <phase>generate-sources</phase>
            <configuration>
                <processors>

<processor>org.hibernate.jpamodelgen.JPAMetaModelEntityProcessor</processor>
                </processors>
            </configuration>
        </execution>
    </executions>
    <dependencies>
        <dependency>
            <groupId>org.hibernate</groupId>
            <artifactId>hibernate-jpamodelgen</artifactId>
            <version>WORKING</version>
        </dependency>
    </dependencies>
</plugin>
```

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.

Idea

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



Compiler ▸ Annotation Processors

☑ 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.

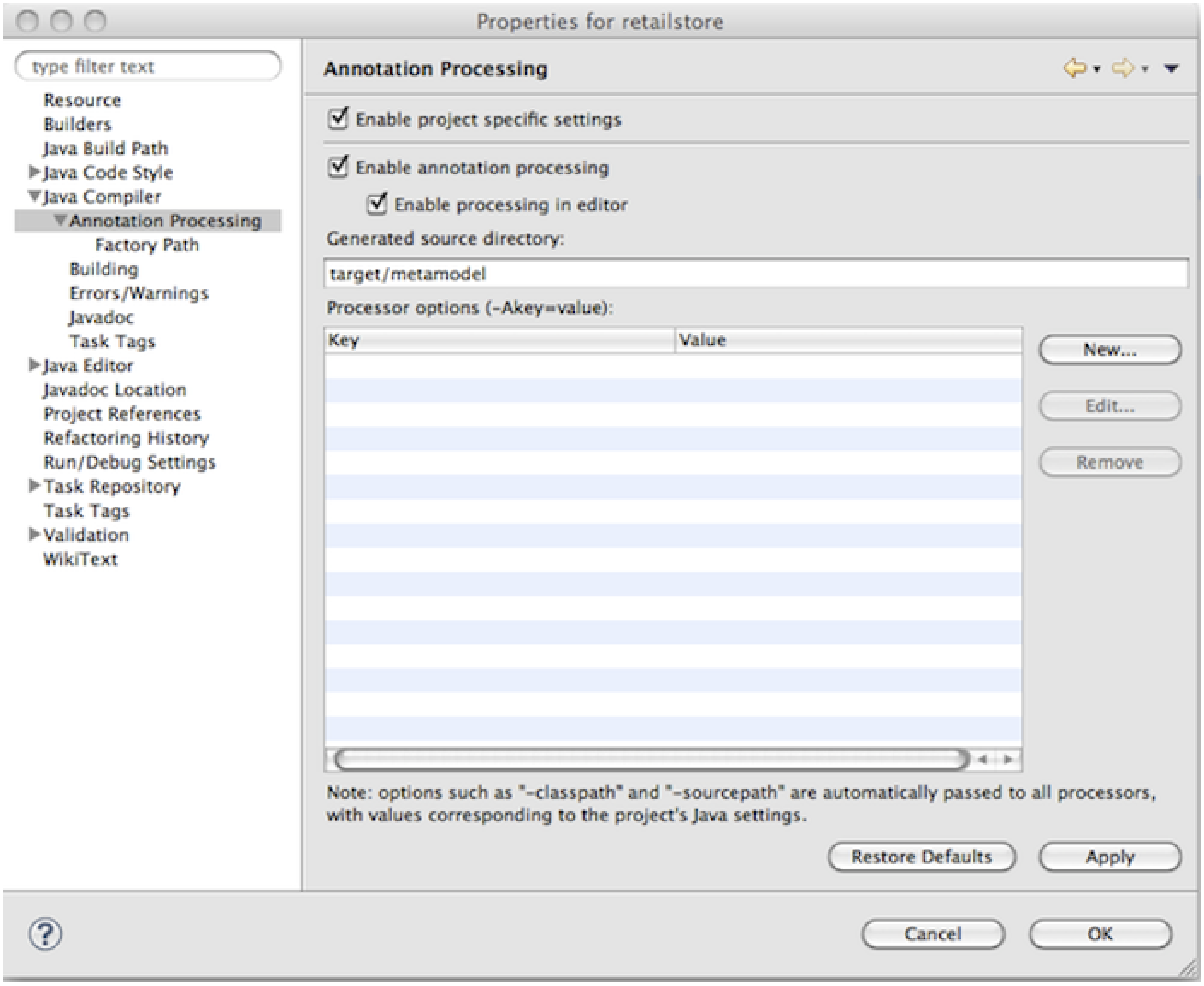
Processed Modules

Module	Generated Sources Directory Name

In the annotation processor configuration, enable annotation processing and select obtain from project classpath. Add the annotation processor name org.hibernate.jpamodelgen.JPAMetaModelEntityProcessor (and optionally the annotation processor options). Select the module(s) containing your entities. If you have configured Maven as recommended, it is best to select the same output directory for the generated classes. At the time of writing, it is *target/generated-sources/apt*. That way, the generated classes will be available in IntelliJ Idea.

Eclipse

In Eclipse exists also 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.



☑ 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.

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 can be found in the table below:

Table 1. Hibernate Static Metamodel Generator options

Option name	Option value and usage
debug	If set to true additional trace information will be outputted by the processor

Option name	Option value and usage
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 wrong 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.
fullyAnnotationConfigured	If set to true the processor will ignore orm.xml and persistence.xml.
addGeneratedAnnotation	If set to true the processor will add the @Generated to the generated Java source file. Adding this annotation using JDK 5 will cause a compilation error. In this case set the flag to false. The default for this option is true
addGenerationDate	If set to true the generation date of the metamodel class will be inserted in the date parameter of the @Generated annotation. The default is false. This parameter is ignored if *addGeneratedAnnotation* is set to *false*.

Option name	Option value and usage
addSuppressWarningsAnnotation	If set to true the processor will add @SuppressWarnings("all")+ to the generated Java source file. Per default this annotation is not generated. See also METAGEN-50 (https://hibernate.onjira.com/browse/METAGEN-50).

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