

# Using AOP in templates

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## Introduction

This example shows how to use aspect oriented programming techniques in Xpand templates. It is applicable to EMF based and Classic systems. However, we explain the idea based on the *emfExample* – hence you should read that before.

## The problem

There are many circumstances when template-AOP is useful. Here are two examples:

**Scenario 1:** Assume you have a nice generator that generates certain artefacts. The generator (or cartridge) might be a third-party product, delivered in a single JAR file. Still you might want to adapt certain aspects of the generation process – *without modifying the original generator*.

**Scenario 2:** You are building a family of generators that can generate variations of the generate code, e.g. implementations for different embedded platforms. In such a scenario, you need to be able to express those differences (variabilities) sensibly without creating a non-understandable chaos of *if* statements in the templates.

## Example

To illustrate the idea of extending a generator without „touching“ it, let's create a new project called *oaw4.demo.emf.datamodel.generator-aop*. The idea is that it will „extend“ the original *oaw4.demo.emf.datamodel.generator* project introduced in the *emfExample*. So this new project needs to have a project dependency to the former one.

## Templates

An AO system always needs to define a joinpoint model; this is, you have to define, at which locations of a (template) program you can add additional (template) code. In Xpand, the joinpoints are simply templates (i.e. *DEFINE .. ENDDEFINE*) blocks. An „aspect template“ can be declared *AROUND* previously existing templates.

If you take a look at the *oaw4.demo.emf.datamodel.generator* project's source folder, you can find the *Root.xpt* template file. Inside, you can find a template called *Impl* that generates the implementation of the Java Bean.

```
<<DEFINE Entity FOR data::Entity>>
  <<FILE baseClassName() >>
    // generated at <<timestamp()>>
    public abstract class <<baseClassName()>> {
      <<EXPAND Impl>>
    }
  <<ENDFILE>>
```

```

«ENDDFINE»

«DEFINE Impl FOR data::Entity»
    «EXPAND GettersAndSetters»
«ENDDFINE»

«DEFINE Impl FOR data::PersistentEntity»
    «EXPAND GettersAndSetters»
    public void save() {

    }
«ENDDFINE»

```

What we now want to do is as follows: Whenever the *Impl* template is executed, we want to run an additional template that generates additional code (for example, some kind of meta information for frameworks ... the specific code is not important for the example here).

So, in our new project, we define the following template file:

```

«AROUND Impl FOR data::Entity»
    «FOREACH attribute AS a»
        public static final AttrInfo «a.name»Info = new AttrInfo(
            "«a.name»", «a.type».class );
    «ENDFOREACH»
    «targetDef.proceed()»
«ENDAROUND»

```

So, this new template „wraps around“ the exiting template called *Impl*. It first generates additional code and then forwards the execution to the original template using *targetDef.proceed()*. So, in effect, this is a *BEFORE* advice. Moving the *proceed* statement to the beginning makes it an *AFTER* advice, ommitting it makes it an override.

## Workflow File

Let's take a look at the workflow file to run this generator.

```

<?xml version="1.0" encoding="windows-1252"?>
<workflow>

    <cartridge file="workflow.oaw"/>

    <component adviceTarget="generator"
        id="reflectionAdvice"
        class="oaw.xpand2.GeneratorAdvice">
        <advices value="templates::Advices"/>
    </component>
</workflow>

```

Mainly what we do here is to call the original workflow file. It is available from the classpath. After this cartridge call, we define an additional workflow component, a so-called advice component. It specifies *generator* as it's *adviceTarget*. That means that all the properties we define inside this advice component will instead be added to the component referenced by name in the *adviceTarget*, in our case the generator. So, in effect, we add the `<advices value="templates::Advices"/>` to the original generator component (without invasively modifying its own definition! This contributes the advice templates to the generator.

## Running the new generator

Running the generator produces the following code:

```
public abstract class PersonImplBase {
    public static final AttrInfo
        nameInfo = new AttrInfo("name", String.class);
    public static final AttrInfo
        name2Info = new AttrInfo("name2", String.class);
    private String name;
    private String name2;

    public void setName(String value) {
        this.name = value;
    }

    public String getName() {
        return this.name;
    }

    public void setName2(String value) {
        this.name2 = value;
    }

    public String getName2() {
        return this.name2;
    }
}
```

## More AO

In general, the syntax for the *AROUND* construct is as follows:

```
<<AROUND fullyQualifiedDefinitionNameWithWildcards
    (Paramlist (*)?) FOR TypeName>>
do Stuff
<<ENDAROUND>>
```

Here are some examples:

```
<<AROUND *(*) FOR Object>>
```

matches all templates

```
<<AROUND *define(*) FOR Object>>
```

matches all templates with *define* at the end of it's name and any number of parameters

```
<<AROUND org::oaw::* FOR Entity>>
```

matches all templates with namespace *org::oaw::* that do not have any parameters and whose type is *Entity* or a subclass

```
<<AROUND *(String s) FOR Object>>
```

matches all templates that have exactly one *String* parameter

```
<<AROUND *(String s,*) FOR Object>>
```

matches all templates that have at least one *String* parameter hat

```
<<AROUND my::Template::definition(String s) FOR Entity>>
```

matches exactly this single definition

Inside an *AROUND*, there's the variable *targetDef*, which has the type *xpand2::Definition*. On this variable you can call *proceed*, and also query a number of other things:

```
<<AROUND my::Template::definition(String s) FOR String>>  
  log('invoking '+<<targetDef.name>>+' with '+this)  
  <<targetDef.proceed()>>  
<<ENDAROUND>>
```

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