Design Patterns and Frameworks	**Exercise Sheet No. 12**
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OSGi and Design Patterns

Task 1: The OSGi Framework

Download Eclipse Classic 3.7.1 from http://www.eclipse.org and install the ObjectTeams Development Tooling (OTDT) and the ObjectTeams Equinox Integration (OT/Equinox) via the update manager of Eclipse.

Object Teams is part of the Indigo simultaneous release. This means, no further URL must be configured for installing the OTDT and OT/Equinox, simply select the Indigo - http://download.eclipse.org/releases/indigo software site and open the *Programming Languages* category.

To improve your understanding on OSGi in Eclipse read the tutorial of Lars Vogel[1].

1a)

Now create a new OT Plug-in Project `dpf.osgi` for the OSGi framework Equinox. Make sure you add `org.eclipse.core.runtime` to the plug-in dependencies.

Create the following plugin.xml in the plug-in's root folder.

```
<?xml version="1.0" encoding="UTF-8"?>
<?eclipse version="3.7"?>
<plugin>
  <extension
    id="app"
    point="org.eclipse.core.runtime.applications">

    <application
      cardinality="singleton-global"
      thread="any"
      visible="true">
      <run
        class="dpf.osgi.Apparat">
      </run>
    </application>
  </extension>
</plugin>
```

Implement an application using the following code.

```
import org.eclipse.equinox.app.IApplication;
import org.eclipse.equinox.app.IApplicationContext;

public class Apparat implements IApplication {

  @Override
  public Object start(IApplicationContext context) throws Exception {
    Person hans = new Person("Hans");
```

[1] http://www.vogella.de/articles/OSGi/article.html

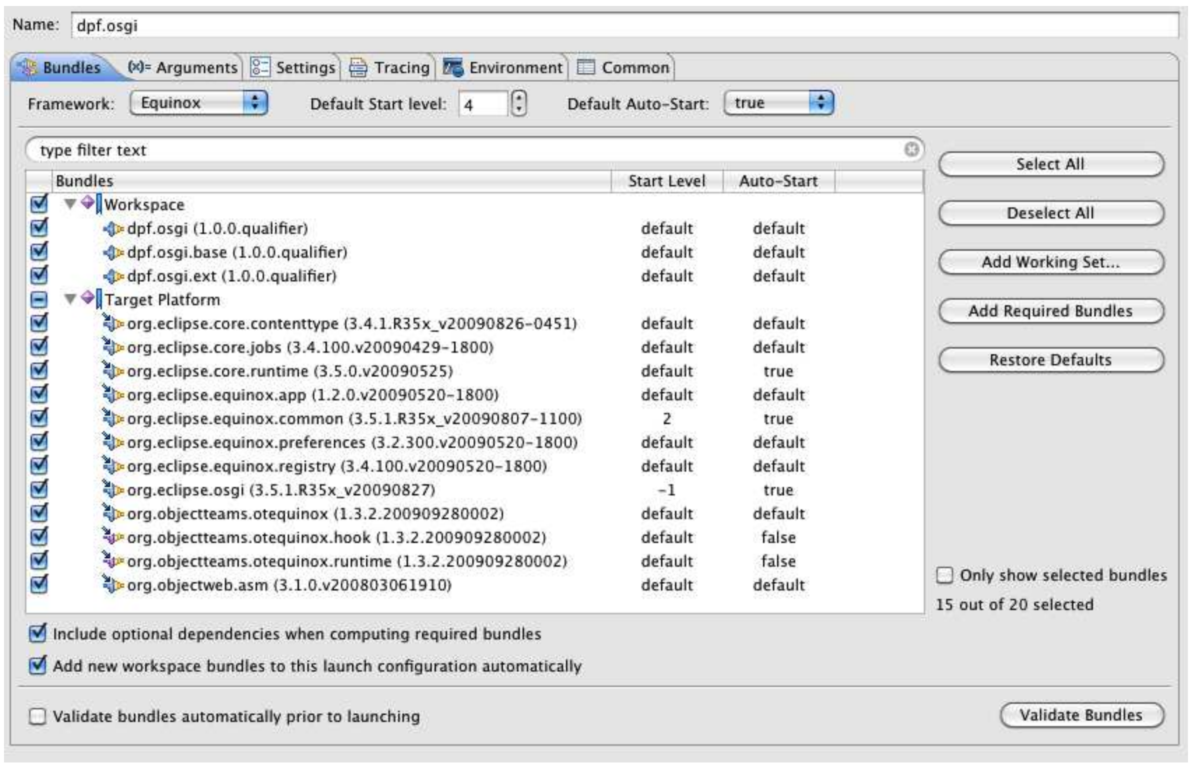
```
    Person karl = new Person("Karl");

    hans.identify();
    karl.identify();

    return null;
  }

  @Override
  public void stop() { }
}
```

Now create a second OT Plug-in Project `dpf.osgi.base` without generating an `Activator` and which only consists of the `Person` class outlined below.

```
public class Person {

  public String name;

  public Person(String name) {
    this.name = name;
  }

  public String getName() {
    return name;
  }

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

  public void identify() {
    System.out.println(name);
  }
}
```

Now create a new OSGi run configuration, deactivate all bundles, enable the `dpf.osgi.*` bundles and click *Add Required Bundles*. Then click *Validate Bundles* to ensure that no bundles are missing or conflicting.

Enable the `Enable OT/Equinox` setting.



Name: dpf.osgi

Framework: Equinox   Default Start level: 4   Default Auto-Start: true

	Bundles	Start Level	Auto-Start
☑	Workspace		
☑	dpf.osgi (1.0.0.qualifier)	default	default
☑	dpf.osgi.base (1.0.0.qualifier)	default	default
☑	dpf.osgi.ext (1.0.0.qualifier)	default	default
⊟	Target Platform		
☑	org.eclipse.core.contenttype (3.4.1.R35x_v20090826-0451)	default	default
☑	org.eclipse.core.jobs (3.4.100.v20090429-1800)	default	default
☑	org.eclipse.core.runtime (3.5.0.v20090525)	default	true
☑	org.eclipse.equinox.app (1.2.0.v20090520-1800)	default	default
☑	org.eclipse.equinox.common (3.5.1.R35x_v20090807-1100)	2	true
☑	org.eclipse.equinox.preferences (3.2.300.v20090520-1800)	default	default
☑	org.eclipse.equinox.registry (3.4.100.v20090520-1800)	default	default
☑	org.eclipse.osgi (3.5.1.R35x_v20090827)	-1	true
☑	org.objectteams.otequinox (1.3.2.200909280002)	default	default
☑	org.objectteams.otequinox.hook (1.3.2.200909280002)	default	false
☑	org.objectteams.otequinox.runtime (1.3.2.200909280002)	default	false
☑	org.objectweb.asm (3.1.0.v200803061910)	default	default

☐ Only show selected bundles

15 out of 20 selected

☑ Include optional dependencies when computing required bundles

☑ Add new workspace bundles to this launch configuration automatically

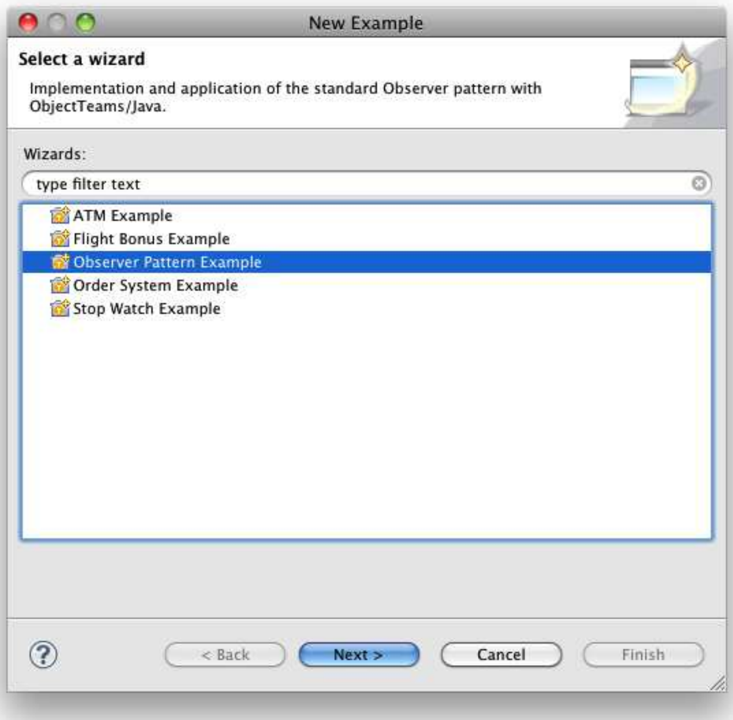
☐ Validate bundles automatically prior to launching

Run the application. The commands `help`, `apps` and `startApp` on the OSGi console should get you started.

Task 2: ObjectTeams and OT/Equinox

2a)

Try out and understand the ObjectTeams Observer pattern example which can be found under File ⇒ New. . . ⇒ Examples. . .


New Example

Select a wizard

Implementation and application of the standard Observer pattern with ObjectTeams/Java.

Wizards:

type filter text

- ATM Example
- Flight Bonus Example
- Observer Pattern Example
- Order System Example
- Stop Watch Example

The ObjectTeams Language Reference[2] provides detailed explanation on roles in ObjectTeams.

2b)

In this subtask we are going to extend the example of Task 1. Create an ObjectTeams Plug-in Project `dpf.osgi.ext` (without generating an `Activator`).

Add `org.eclipse.objectteams.otequinox` to the dependencies via `dpf.osgi.ext`'s MANIFEST.MF.

Import the exported package of `dpf.osgi.base` at `dpf.osgi.ext` and the packages of `dpf.osgi.base` and `dpf.osgi.ext` at `dpf.osgi`.

Now integrate the Team below in the new plug-in and change the implementation of `IApplication` in the `dpf.osgi` plug-in.

```
public team class University {

  public void register(Person as Student ersti, int matrikel) {
    ersti.matrikel = matrikel;
  }

  public class Student playedBy Person {

    studentIdentify <- before identify;

    public int matrikel;

    public void studentIdentify() {
      System.out.println("Matrikel: "+matrikel);
    }
  }
}
```

[2]http://wiki.eclipse.org/OTJ

```
import org.eclipse.equinox.app.IApplication;
import org.eclipse.equinox.app.IApplicationContext;

public class Apparat implements IApplication {

  @Override
  public Object start(IApplicationContext context) throws Exception {
    Person hans = new Person("Hans");
    Person karl = new Person("Karl");

    System.out.println("--No context--");
    hans.identify();
    karl.identify();

    University u = new University();
    u.activate();

    u.register(hans, 123);
    u.register(karl, 345);

    System.out.println("--Uni active-----");
    hans.identify();
    karl.identify();

    u.deactivate();

    System.out.println("--Uni inactive---");
    hans.identify();
    karl.identify();

    return null;
  }

  @Override
  public void stop() { }
}
```

To start this application some changes need to be integrated in the Eclipse run configuration.

First, register the extension point `org.eclipse.objectteams.otequinox.aspectBindings` in the plugin.xml.[3] It should look like this:

```
<extension point="org.objectteams.otequinox.aspectBindings">
  <aspectBinding
    icon="platform:/plugin/org.eclipse.objectteams.otdt.ui/icons/ot/calloutbinding_obj.gif">
    <basePlugin
      icon="platform:/plugin/org.eclipse.pde.ui/icons/obj16/plugin_obj.gif"
      id="dpf.osgi.base">
    </basePlugin>
    <team
      activation="ALL_THREADS"
      class="dpf.osgi.ext.University"
      icon="platform:/plugin/org.eclipse.objectteams.otdt.ui/icons/ot/team_obj.gif">
     </team>
   </aspectBinding>
</extension>
```

2c)

Extend the previous solutions with the role `professor`. A professor can be identified through his group membership.

[3]http://wiki.eclipse.org/OTEquinox/Aspect_Binding

```
---Uni inactive---
...
---Uni active-----
Matrikel: 123
Hans
Matrikel: 345
Anja
Peter is professor of the database group
---Uni inactive---
...
```

2d)

Extend the solution with lectures, which are held by professors and attended by students. Implement a method which returns all lectures attended by a student.