BookStore #maven

Enterprise Application, Git, EJB, EAP/EAS, Logging, PostgreSQL/MySQL, JPA, Integration testing

Óbuda University, Java Enterprise Edition
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Lab 3

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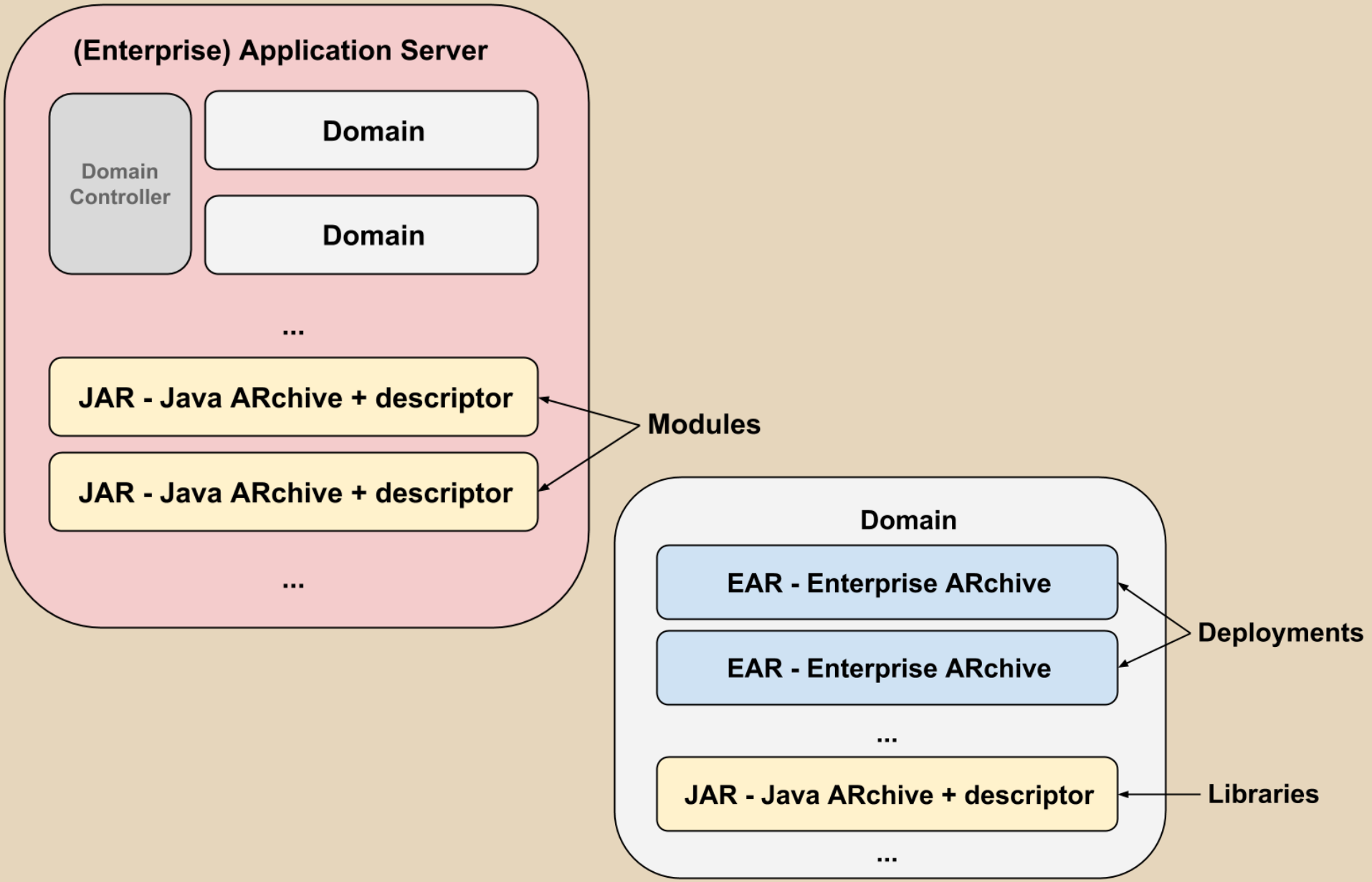
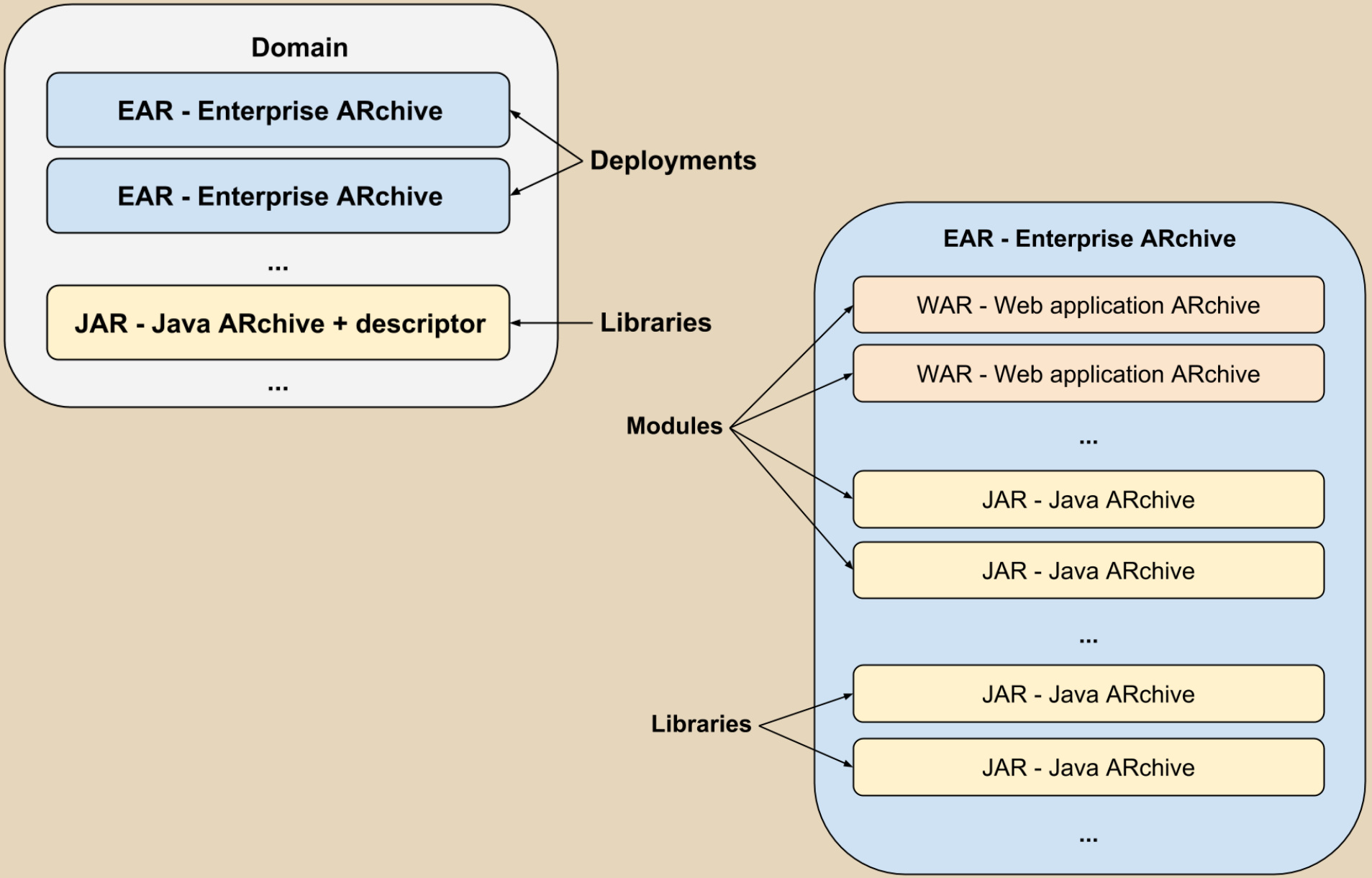
2018-01-17
v1.1

EAS - Domain structure



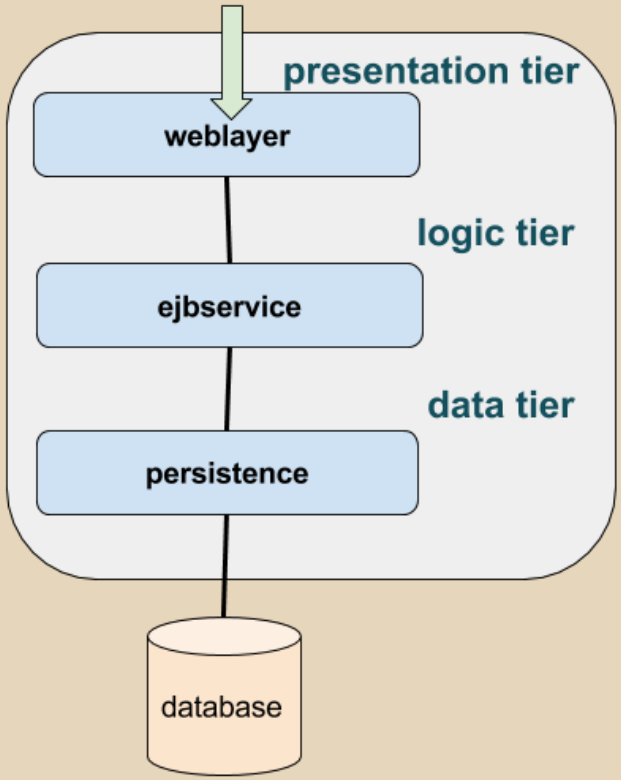
EAS - Deployment structure



Task: create an application which can list the books of a store..
We will implement the task in two parts. In the first round the persistence layer will be mocked/faked.

Applicable techniques:

- Java Enterprise Edition 6
  - EJB API 3.1
  - Servlet API 3.0.1
  - JPA 2.0
- JBoss 6.4 / WebLogic 12.1.3



In medias res

Test the development environment

```
> cd [GIT]\maven\jboss\booklight\
> mvn clean package
...
BUILD SUCCESS
```

New EAR artifact:
[GIT]\maven\jboss\booklight\build\libs\booklight.ear

```
> cd [JBOSS-HOME]\bin
> standalone.[bat|sh]
```

Copy the compiled **booklight.ear** file into the [JBOSS-HOME]\standalone\deployments directory.
http://localhost:8080/bl-weblayer/BookPing

```
BookStub [isbn=978-0441172719, author=Frank Herbert, title=Dune,
category=SCIFI, price=3500.0, numberOfPages=896]
```

- Create project hierarchy
- Basics of the **Enterprise JavaBean** (`ejb`) as **business layer**
- Simple servlet as **weblayer**
- Mocked data as **persistence layer**

Enterprise Application Servers (EAS)

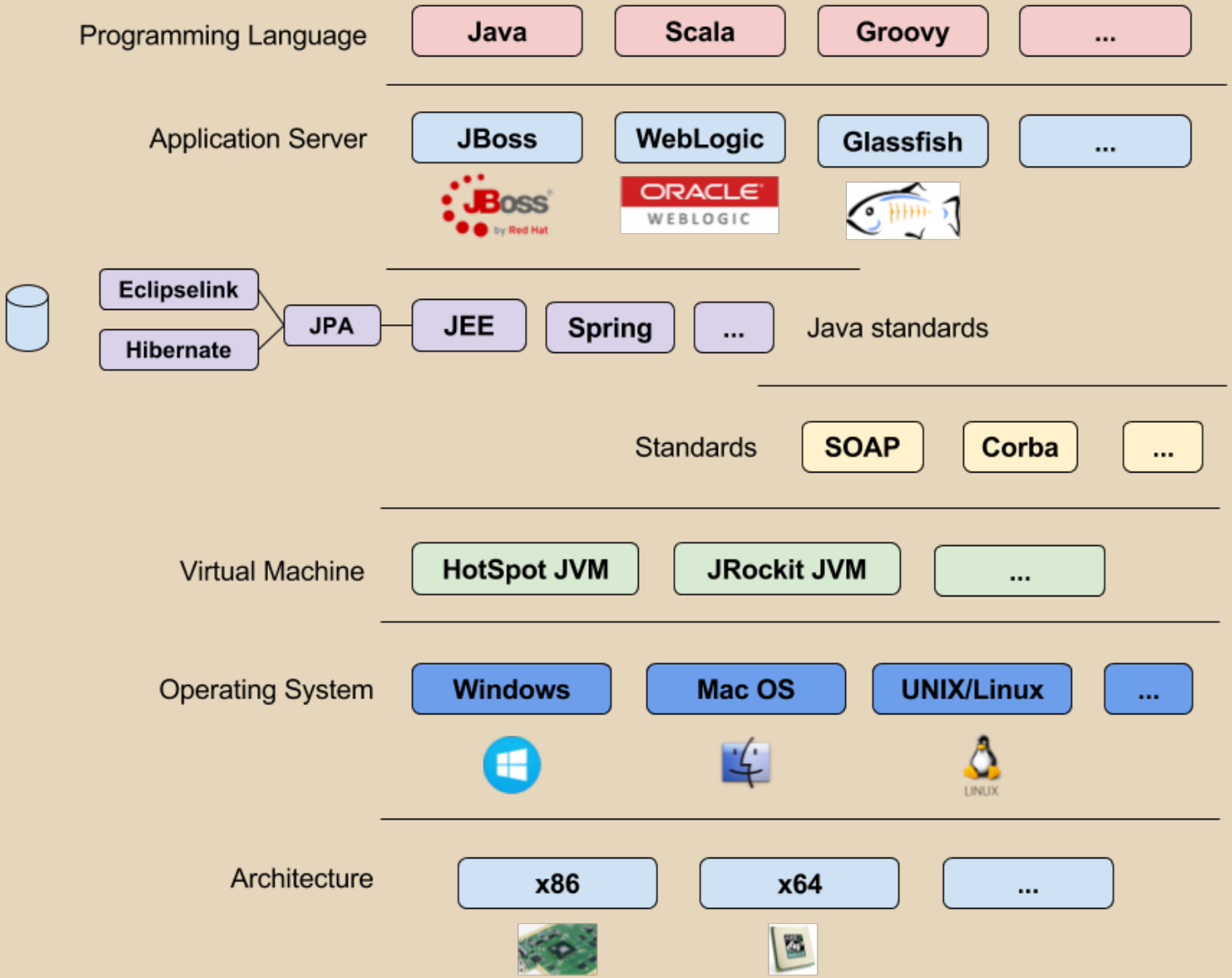
- RedHat JBoss 6.4
- Oracle WebLogic 12.1.3

Possibility to choose another EAS

A JavaEE application can be run any complient JavaEE application server which support the used JavaEE version. This interoperability further strengthens the **cross-platform** behavior of the Java ecosystem.

We will deploy the task in two different EAS(s).

Cross-Platform Java



Repository

`[gradle|maven]\jboss\booklight`

```
1 > mvn clean package
```

Note: package goal of maven will be executed in all modules (subprojects), consider the dependencies. All children modules will create its own artifacts.

Refreshing the blueprint repository (Git `pull`) could be necessary if the `origin/master` was changed. In case of that you have to discard all of your local changes.

Select working copy (in the root directory)

```
1 > git checkout .
```

Discard local changes

```
1 > git reset --hard
```

Discard new files

```
1 > git clean -fd
```

Get the new changes from **master**

```
1 > git pull
```

http://gitextensions.github.io/
https://github.com/gitextensions

Version: **2.50.02**
OS: **Windows** (Mono 5.0 is required in case of NIX)

It provides graphic interface for the `Git` commands. Not only a tool, it teaches the commands as well.
Using the Git it not always a linear use-case, the same goal can be accessible many different ways. Because of this using any tool could carry some risks. There is no risk for basic use-cases.

https://www.sourcetreeapp.com/

Version: **2.6.3a**
OS: **Windows / Mac OS**

Elegant, modern graphical interface. Sometimes it is a bit circumstantial (e.g. in case of git log/blame), but it could be an effective tool after all. It doesn't teach the git commands like the GitExtensions.

Git Commit and Push

Share new improvements and bug fixes

Check the status

```
1 > git status
```

Stage

```
1 > git add [FILENAME]
```

Commit (-a/–all, -m/–message)

```
1 > git commit -a -m "[COMMIT_MESSAGE]"
```

Send the new changes to the master

```
1 > git push
```

Enterprise Maven project

Hierarchical Multi-project

There are several Maven **Archetype**s (e.g.: `maven-archetype-j2ee-simple`) which generate the 'boilerplate' `pom.xml`s and directories for us. These can be used as a crutch but later the lot of unused and comlex XML elements could became annoying and unnecessary. We will not use any of these archetypes.

Multiple projects in hierarchy:

- Root Aggregator project
  - maven **pom** packaging → aggregator project
- WebLayer
  - maven **war** packaging → `war`
  - EAR **web module**
- EJBService
  - maven **ejb** packaging → `jar`
  - EAR **ejb module**
- EAR project
  - maven **ear** packaging → ear

Remember to know the jar packaging of Ma...

WAR - Web application ARchive

Directory structure

```
META-INF/
    MANIFEST.MF
WEB-INF/
    classes/
        hu/
            qwaevisz/
                demo/
                    Lorem.class
                    Ipsum.class
    lib/
        dummy.jar
    web.xml
index.html
logo.jpg
base.css
```

public resources (subdirectories are also possible)

```
1 <web-app version="3.0" xmlns="http://java.sun.com/xml/ns/javaee"
2         xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
3         xsi:schemaLocation="http://java.sun.com/xml/ns/javaee
              http://java.sun.c
4 [...]
5 </web-app>
```

web application deployment descriptor

web.xml

Directory structure

```
META-INF/
    MANIFEST.MF
    application.xml
lib/
    dummy.jar
xyz.jar
abc.war
```

3rd party library

```
1  <?xml version="1.0"?>
2  <application xmlns="http://java.sun.com/xml/ns/javaee"
       xsi:schemaLocation="http://java.sun.com/xml/ns/javaee
       http://java.sun.com/xml/ns/javaee/application_6.xsd"
       xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" version="6">
3    <display-name>sample</display-name>
4    <module>
5      <ejb>xyz.jar</ejb>
6    </module>
7    <module>
8      <web>
9        <web-uri>abc.war</web-uri>
10       <context-root>abcwebapp</context-root>
11     </web>
12   </module>
13   <library-directory>lib</library-directory>
14 </application>
```

application.xml

Directory structure

```
booklight/
    bl-ear/
        pom.xml
    bl-ejbservice/
        src/
            main/
                java/
                resources/
                    META-INF/
                        ejb-jar.xml
        pom.xml
    bl-weblayer/
        src/
            main/
                java/
                webapp/
                    WEB-INF/
                        web.xml
        pom.xml
pom.xml
```

EJB module - Deployment Descriptor

ejb-jar.xml

src | main | resources | META-INF | ejb-jar.xml

```
1 <ejb-jar xmlns="http://java.sun.com/xml/ns/javaee"
      xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
2   xsi:schemaLocation="http://java.sun.com/xml/ns/javaee
        http://java.sun.com/xml/ns/javaee/ejb-jar_3_0.xsd"
3   version="3.0">
4
5 </ejb-jar>
```

ejb-jar.xml

It is mandatory?

The deployment descriptor file of the EJB module is required for Maven even if this file is entirely empty (in a simple case we can describe almost everything via annotations, so the `ejb-jar.xml` file remains empty). The precedence of the descriptor file is always higher than the annotations.

Maven Aggregator project

Root project

```
1  <project [..]>
2    <modelVersion>4.0.0</modelVersion>
3    <groupId>hu.qwaevisz.booklight</groupId>
4    <artifactId>booklight</artifactId>
5    <version>1.0</version>
6    <packaging>pom</packaging>
7    <name>BookStore-Light Aggregator</name>
8
9    <modules>
10     <module>bl-ear</module>
11     <module>bl-ejbservice</module>
12     <module>bl-weblayer</module>
13   </modules>
14
15   <properties>
16     <project.build.sourceEncoding>UTF-8</project.build.sourceEncoding
17     <maven.compiler.source>1.8</maven.compiler.source>
18     <maven.compiler.target>1.8</maven.compiler.target>
19   </properties>
20 </project>
```

The **pom** packaging puts together modules. The listed modules are subdirectories of the aggregator project's level, and all of them are Maven project as well (the directories have its own pom.xml files).

pom.xml

Maven EJB Service project

Frame

```
1  <project [..]>
2    <modelVersion>4.0.0</modelVersion>
3    <groupId>hu.qwaevisz.booklight</groupId>
4    <artifactId>bl-ejbservice</artifactId>
5    <version>1.0</version>
6    <packaging>ejb</packaging>
7    <name>BookStore-Light EJB Services</name>
8
9    <parent>
10     <groupId>hu.qwaevisz.booklight</groupId>
11     <artifactId>booklight</artifactId>
12     <version>1.0</version>
13   </parent>
14
15   <dependencies>
16     [..]
17   </dependencies>
18   <build>
19     [..]
20   </build>
21 </project>
```

The **ejb** packaging produces a `JAR` file similar to the **jar** packaging. The existence of the `ejb-jar.xml` deployment descriptor is a must.
The sub Maven project refers to the parent project (via accurate artifact URL).

`pom.xml`

Maven EJB Service project

To be continued..

```
1  <project [..]>
2    [..]
3    <dependencies>
4      <dependency>
5        <groupId>javax</groupId>
6        <artifactId>javaee-api</artifactId>
7        <version>6.0</version>
8        <scope>provided</scope>
9      </dependency>
10   </dependencies>
11
12   <build>
13     <plugins>
14       <plugin>
15         <groupId>org.apache.maven.plugins</groupId>
16         <artifactId>maven-ejb-plugin</artifactId>
17         <version>2.5.1</version>
18       </plugin>
19     </plugins>
20   </build>
21 </project>
```

To compile the EJB service project we need the Java EE API 6.0. At runtime EAP/EAS will provide the implemenation of these API(s). That's way we use the **provided** scope here.

pom.xml

Maven WebLayer project

Frame

```
1  <project [..]>
2    <modelVersion>4.0.0</modelVersion>
3    <groupId>hu.qwaevisz.booklight</groupId>
4    <artifactId>bl-weblayer</artifactId>
5    <version>1.0</version>
6    <packaging>war</packaging>
7    <name>BookStore-Light Webapplication</name>
8
9    <parent>
10     <groupId>hu.qwaevisz.booklight</groupId>
11     <artifactId>booklight</artifactId>
12     <version>1.0</version>
13   </parent>
14
15   <dependencies>
16     [..]
17   </dependencies>
18 </project>
```

The **war** packaging produces a `WAR` file. The existence of the `web.xml` is mandatory.

pom.xml

Maven WebLayer project

To be continued..

```
<project [..]>
  [..]
  <dependencies>
    <dependency>
      <groupId>hu.qwaevisz.booklight</groupId>
      <artifactId>bl-ejbservice</artifactId>
      <version>1.0</version>
      <scope>provided</scope>
    </dependency>

    <dependency>
      <groupId>javax</groupId>
      <artifactId>javaee-api</artifactId>
      <version>6.0</version>
      <scope>provided</scope>
    </dependency>
  </dependencies>
</project>
```

The weblayer would like to call the EJB services which are located in the bl-ejbservice project. That's why we have to put this subproject into the classpath of the web layer.

pom.xml

```
1  <project [..]>
2    <modelVersion>4.0.0</modelVersion>
3    <groupId>hu.qwaevisz.booklight</groupId>
4    <artifactId>bl-ear</artifactId>
5    <version>1.0</version>
6    <packaging>ear</packaging>
7    <name>BookStore-Light EAR</name>
8
9    <parent>
10     <groupId>hu.qwaevisz.booklight</groupId>
11     <artifactId>booklight</artifactId>
12     <version>1.0</version>
13   </parent>
14
15   <dependencies>
16     [..]
17   </dependencies>
18   <build>
19     [..]
20   </build>
21 </project>
```

The **ear** packaging will produce an EAR file based on the listed dependencies. It will create the deployment descriptort file as well (`application.xml`).

pom.xml

Maven EAR project

To be continued..

```
<project [..]>
  [..]
  <dependencies>
    <dependency>
      <groupId>hu.qwaevisz.booklight</groupId>
      <artifactId>bl-ejbservice</artifactId>
      <version>1.0</version>
      <type>ejb</type>
    </dependency>
    <dependency>
      <groupId>hu.qwaevisz.booklight</groupId>
      <artifactId>bl-weblayer</artifactId>
      <version>1.0</version>
      <type>war</type>
    </dependency>
  </dependencies>
  <build>
    <plugins>
      <plugin>
        <groupId>org.apache.maven.plugins</groupId>
        <artifactId>maven-ear-plugin</artifactId>
        <version>2.10.1</version>
      </plugin>
    </plugins>
  </build>
</project>
```

The contents of the `application.xml` will be the listed dependencies according to the **type** value (ejb → ejb module, war → web module).

pom.xml

Enterprise JavaBeans

- Server side business components (back-end services)
- JSR19, JSR152, JSR220, JSR318, JSR345
- IBM (1997), later Sun Microsystems (1999)
- Kind of 'best-practice' in order to implement only the 'business value' instead of the typical 'decorations' (boilerplate codes).
  - Transaction management
  - Concurrency management
  - Asynchronous method call
  - Event management
  - ava Message Service integration (Message Driven Beans)
  - Persistence support integration (but the persistence is no longer part of the EJB specification)
- Verziók
  - EJB1.x: all "remote"
  - EJB2.x: very uncomfortable, overcomplicated
  - EJB3.x: re-thinking concept based on the experiences of the Spring framework and Hibernate (uses POJOs just like the Spring FW and breaks with the entity beans (supports but does not implement it))

EJB types

- **Session Beans**
  - **Stateless SB** (SLSB)
    - Stateless
  - **Stateful SB** (SFSB)
    - Statefull
    - Activation/Passivation
    - The serialization is important
  - **Singleton SB** (SSB)
    - Singleton
- **Message Driven Beans** (MDB)
  - Message driven
  - Primarily asynchronous processing
  - There is no client interface
- **Entity Beans**
  - Deprecated, JPA substitutes from EJB 3.x

Business Layer

Define some business methods:

- Based on the ISBN[1] select a Book from the catalog
  - `BookStub getBook ( String isbn )`
- Based on same criteria list the books which correspond to the conditions
  - `List<BookStub> getBooks ( BookCriteria criteria )`
- `FacadeException`: when the request cannot be executed

Define the required DTO[2]s:

- BookStub: isbn (`String`), author (`String`), title (`String`), category (`BookCategoryStub`), price (`double`), numberOfPages (`int`)
- BookCategoryStub: `SCIFI`, `LITERATURE`, `HISTORICAL`, `PHILOSOPHY`
- BookCriteria: author (`String`), title (`String`), minPrice (`int`), maxPrice (`int`)

[1] International Standard Book Number
[2] Data Transfer Object

Domain classes - Book categories

```java
package hu.qwaevisz.booklight.ejbservice.domain;
public enum BookCategoryStub {

  SCIFI("Sci-Fi"),
  LITERATURE("Literature"),
  HISTORICAL("Historical"),
  PHILOSOPHY("Philosophy");

  private final String label;

  private BookCategoryStub(String label) {
    this.label = label;
  }

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

BookCategoryStub.java

Domain classes - Book

```
1  package hu.qwaevisz.booklight.ejbservice.domain;
2  public class BookStub {
3    private String isbn;
4    private String author;
5    private String title;
6    private BookCategoryStub category;
7    private double price;
8    private int numberOfPages;
9
10   public BookStub(String isbn, String author, String title,
         BookCategoryStub category, double price, int numberOfPages)
         {
11     this.isbn = isbn;
12     this.author = author;
13     this.title = title;
14     this.category = category;
15     this.price = price;
16     this.numberOfPages = numberOfPages;
17   }
18   [...]
19 }
```

BookStub.java

Domain classes - Search criteria

```java
package hu.qwaevisz.booklight.ejbservice.domain;

public class BookCriteria {

  private String author;
  private String title;
  private BookCategoryStub category;
  private int minimumPrice;
  private int maximumPrice;

  public BookCriteria() {
  }

  [...]
}
```

BookCriteria.java

Domain classes - Throwable business exception

```java
package hu.qwaevisz.booklight.ejbservice.exception;

public class FacadeException extends Exception {

  private static final long serialVersionUID = 1L;

  public FacadeException(String message) {
    super(message);
  }

  public FacadeException(String message, Throwable cause) {
    super(message, cause);
  }

}
```

FacadeException.java

Stateless Session Bean

Local interface

```
1  package hu.qwaevisz.booklight.ejbservice.facade;
2
3  import java.util.List;
4  import javax.ejb.Local;
5  import hu.qwaevisz.booklight.ejbservice.domain.BookCriteria;
6  import hu.qwaevisz.booklight.ejbservice.domain.BookStub;
7  import hu.qwaevisz.booklight.ejbservice.exception.FacadeException;
8
9  @Local
10 public interface BookFacade {
11
12   BookStub getBook(String isbn) throws FacadeException;
13
14   List<BookStub> getBooks(BookCriteria criteria) throws FacadeException;
15 }
```

BookFacade.java

`@Remote`: expensive and slow (network usage, serialization), RMI, the original concept supported only this, currently we use it between different JVMs
`@Local`: cheap and fast, inside the same JVM (in the same EAR)

Stateless Session Bean

Implementation

```
1  package hu.qwaevisz.booklight.ejbservice.facade;
2
3  [...]
4
5  @Stateless(mappedName = "ejb/bookFacade")
6  public class BookFacadeImpl implements BookFacade {
7
8    @Override
9    public BookStub getBook(String isbn) throws FacadeException {
10     return new BookStub(isbn, "Frank Herbert", "Dune", BookCategoryStub.SCIFI, 3500,
           896);
11   }
12
13   @Override
14   public List<BookStub> getBooks(BookCriteria criteria) throws FacadeException {
15     List<BookStub> stubs = new ArrayList<BookStub>();
16     stubs.add(new BookStub("978-0441172719", "Frank Herbert", "Dune",
           BookCategoryStub.SCIFI, 3500, 896));
17     stubs.add(new BookStub("978-0684824710", "Daniel C. Dennett", "Darwin's dangerous
           idea", BookCategoryStub.PHILOSOPHY, 4500, 586));
18     return stubs;
19   }
20
21 }
```

Mock implementation (it gives us only literals)

BookFacadeImpl.java

`@Stateless`: Define Stateless Session Bean EJB type

- `name`: name of the ejb
  - used during JNDI lookup
  - the value is the *unqualified name* by default (e.g.: `BookFacadeImpl`)
- `mappedName`: global JNDI name
  - vendor specific
- `description`: description

Servlet

Only for testing the local EJB

```java
package hu.qwaevisz.booklight.weblayer.servlet;
[...]
@WebServlet("/BookPing")
public class BookPingServlet extends HttpServlet {

  @EJB
  private BookFacade facade;

  @Override
  protected void doGet(HttpServletRequest request, HttpServletResponse response) throws
       ServletException, IOException {
    response.setCharacterEncoding("UTF-8");
    final PrintWriter out = response.getWriter();
    try {
      final BookStub book = this.facade.getBook("978-0441172719");
      out.println(book.toString());
    } catch (final FacadeException e) {
      out.println(e.getLocalizedMessage());
    }
    out.close();
  }
}
```

BookPingServlet.java

Inject EJB proxy

@EJB annotation

`@EJB`: Inject Session Bean proxy

- Usable only inside the EJB 'context'
  - All EJBs
  - All Servlets (`@WebServlet`)
  - etc..
- `beanName` or `lookup`: to resolve the EJB implementation
  - Only one of them can be used at the same time
  - If only one implementation exsits, neither attributes should be used (the container resolves the implementation based on the type).
  - `beanName`: refers the `name` of the Session bean
  - `lookup`: refers the JNDI name of the Session bean

The "Modern programming languages" labs of the Óbuda University are necessary and sufficient preconditions of this lab (frontend development).

The lab unofficial site:
http://users.nik.uni-obuda.hu/bedok.david/jse.html

The lab official site:
http://users.nik.uni-obuda.hu/java/

http://www.jboss.org/

Install: unzip

Enterprise **J**ava**B**eans **O**pen **S**ource **S**oftware → EJBoss

→ JBoss (az EJB® Sun trademark volt)

JEE 7 compliant version: **v7.0.0** (2016.05.10.)

JEE 6 compliant version: **v6.4.0** (2015.04.15.)

Commercial product!

Standalone / Domain mode

Contains: https://access.redhat.com/articles/112673

- RESTEasy - 2.3.10.Final
- Hibernate Core - 4.2.18.Final
- Hibernate JPA 2.0 API - 1.0.1.Final
- JSF2 - 2.1.28.Final
- HornetQ - 2.3.25.Final (EAP 7.x → JBoss A-MQ)
- JBoss Logging - 3.1.4.GA
- JAXB - 2.2.5-redhat-9
- Apache Web Server - 2.2.26
- ...

http://wildfly.org/
Install: unzip
JEE 7 compliant version: **v11.0.0.Final** (2017.10.23.)
JEE 7 compliant version: **v10.1.0.Final** (2016.08.19.)
JEE 7 compliant version: **v8.0.0.Final** (2014.02.11.)
Free version of JBoss.
Standalone / Domain mode

JBoss vs. WildFly

The usage of the two application servers are almost the same.

Standalone mód ([JBOSS-HOME]\standalone):

- \configuration\standalone.xml
- \deployments
- logs\server.log

Start Standalone mode (standalone.xml):

```
1 > cd [JBOSS-HOME]\bin
2 > standalone.[bat|sh]
```

Start Standalone mode (use custom.xml):

```
1 > [JBOSS-HOME]\bin\standalone.[bat|sh] custom.xml
```

Stop Standalone server instance:

```
1 > [JBOSS-HOME]/bin/jboss-cli.[bat|sh] --connect command=:shutdown
```

http://www.oracle.com/technetwork/middleware/weblogic/

JEE 7 compliant version: **v12.2.1.3**
JEE 6 compliant version: **v12.1.3**
Commercial product!
It was **BEA**'s product before Oracle acquisition.

It supports the Spring Framework besides JavaEE (a simple *Apache Tomcat®* is enough for the SF in most of the case).

- Unzip (`wls1213_dev_update3.zip`)
  - e.g.: `c:\work\wls12130\`
- Environment variable:
  - **MW_HOME** → `c:\work\wls12130\`
- Run the installer (*Run as Administrator*)
  - `[MW_HOME]\configure.cmd`
  - Do you want to configure a new Domain? Yes (Y)
  - username: **weblogic**
  - password: **AlmafA1#**
- WebLogic Server Administration Console
  - `http://localhost:7001/console`

Start the domain:

```
1 > [MW_HOME]\user_projects\domains\mydomain\startWebLogic.cmd
```

Stop the domain:

- From the WebLogic Server Administration Console or terminate the console window (Ctrl+C)
  - Environment | Servers | Control tab
    - select "myserver" → Shutdown
      - When work completes or
      - Force Shutdown now

- WebLogic Server Administration Console
  - Deployments | Install..
    - Browse EAR
    - After that you can redeploy the application within a few clicks

The WebLogic creates rich statistics and monitors the running components. It is worth checking the opportunities.

Autodeploy directory:
`[MW_HOME]\user_projects\domains\mydomain\autodeploy\`

Note: the auto-deployed application cannot be deleted/redeployed via the `Deployments` page (we have to handle these operations from the autodeploy directory).

[gradle|maven]\jboss\booklight\build\libs\booklight.ear

Copy here: [JBOSS-HOME]\standalone\deployments\

```
09:14:13,505 INFO  [org.jboss.as.server.deployment] (MSC service thread 1-6)
JBAS015876: Starting deployment of "booklight.ear" (runtime-name: "booklight.ear")
09:14:13,533 INFO  [org.jboss.as.server.deployment] (MSC service thread 1-6)
JBAS015973: Starting subdeployment (runtime-name: "bl-ejbservice.jar")
09:14:13,534 INFO  [org.jboss.as.server.deployment] (MSC service thread 1-5)
JBAS015973: Starting subdeployment (runtime-name: "bl-weblayer.war")
09:14:13,577 INFO
[org.jboss.as.ejb3.deployment.processors.EjbJndiBindingsDeploymentUnitProcessor] (MSC
service thread 1-1) JNDI bindings for session bean named BookFacadeImpl in deployment
unit subdeployment "bl-ejbservice.jar" of deployment "booklight.ear" are as follows:
  java:global/booklight/bl-ejbservice/BookFacadeImpl!hu.qwaevisz.booklight.ejbservice.facad
  java:app/bl-ejbservice/BookFacadeImpl!hu.qwaevisz.booklight.ejbservice.facade.BookFacade
  java:module/BookFacadeImpl!hu.qwaevisz.booklight.ejbservice.facade.BookFacade
  java:global/booklight/bl-ejbservice/BookFacadeImpl
  java:app/bl-ejbservice/BookFacadeImpl
  java:module/BookFacadeImpl
09:14:13,646 INFO  [org.jboss.web] (ServerService Thread Pool -- 11) JBAS018210:
Register web context: /bl-weblayer
09:14:13,739 INFO  [org.jboss.as.server] (DeploymentScanner-threads - 2) JBAS015859:
Deployed "booklight.ear" (runtime-name : "booklight.ear")
```

server.log

http://localhost:8080/bl-weblayer/BookPing

```
BookStub [isbn=978-0441172719, author=Frank Herbert, title=Dune,
category=SCIFI, price=3500.0, numberOfPages=896]
```

The **BookStore** project contains the entire **BookLight** functionality, but for clarity the name of the packages are different.

`[gradle|maven]\jboss\bookstore`

The root of the **BookStore** can be easily assembled based on the **BookLight**, the development can be continued in the **BookStore** project.
The **BookStore** project will contain the *data tier* (persistence layer).

There might be some redundancies in the `pom.xml` files of the hierarchical Maven project. The XML by design a redundant format, of course we cannot do anything to avoid this.

Attention!

The build system has to be clear and transparent. Do not modify something which break the above mentioned rule.

Parent Aggregator project

Modify

We can define own properties which will be visible from the `modules` point of view (but you can't use these properities anywhere because of the Maven *lifecycle management*).

```
1  <project [..]>
2    [..]
3    <properties>
4      [..]
5
6      <version.javaee>6.0</version.javaee>
7      <version.plugin.ejb>2.5.1</version.plugin.ejb>
8      <version.plugin.ear>2.10.1</version.plugin.ear>
9
10   </properties>
11   [..]
12 </project>
```

pom.xml

Maven EJB Service project

Modification

```
1  <project [..]>
2    <modelVersion>4.0.0</modelVersion>
3    <artifactId>bs-ejbservice</artifactId>
4    <packaging>ejb</packaging>
5    <name>BookStore EJB Services</name>
6    <parent>[..]</parent>
7
8    <dependencies>
9      <dependency>
10       <groupId>javax</groupId>
11       <artifactId>javaee-api</artifactId>
12       <version>${version.javaee}</version>
13       <scope>provided</scope>
14     </dependency>
15   </dependencies>
16
17   <build>
18     [..]
19   </build>
20 </project>
```

You can omit the `groupId` and the `version` elements if these are identical with the *parent* project's same meta data.

Use the `${version.javaee}` property of the *parent* project!

pom.xml

Maven EJB Service project

To be continued..

```
<project [..]>
  [..]
  <build>
    <sourceDirectory>src/main/java</sourceDirectory>
    <testSourceDirectory>src/test/java</testSourceDirectory>
    <resources>
      <resource>
        <directory>src/main/resources</directory>
      </resource>
    </resources>
    <testResources>
      <testResource>
        <directory>src/test/resources</directory>
      </testResource>
    </testResources>
    <plugins>
      <plugin>
        <groupId>org.apache.maven.plugins</groupId>
        <artifactId>maven-ejb-plugin</artifactId>
        <version>${version.plugin.ejb}</version>
      </plugin>
    </plugins>
  </build>
</project>
```

These **source** folders are the defaults, but if we would like to customize these we can do it here.

pom.xml

Maven WebLayer project

Modification

If we omit the `version` information (and it will be inherited from the parent project), we can use this inherited property of the parent.

```
1  <project [..]>
2    [..]
3    <dependencies>
4      <dependency>
5        <groupId>hu.qwaevisz.bookstore</groupId>
6        <artifactId>bs-ejbservice</artifactId>
7        <version>${project.parent.version}</version>
8        <scope>provided</scope>
9      </dependency>
10
11     <dependency>
12       <groupId>javax</groupId>
13       <artifactId>javaee-api</artifa
14       <version>${version.javaee}</ve
15       <scope>provided</scope>
16     </dependency>
17   </dependencies>
18 </project>
```

In Maven using dots in the properties' name is a common thing (e.g.: `version.javaee`)), but this is not too smart, because the dot notation is a separator character as well (e.g.: `project.parant.version`).

pom.xml

Maven EAR project

Modification

Define the name of the output directory (default in Maven: `target`) and the name of the output file. This is also differ from the default (`bookstore-1.0.ear` is a better file name than `bs-ear-1.0.ear`).

```
1  <project [..]>
2    [..]
3    <build>
4      <directory>build</directory>
5      <finalName>${project.parent.artifactId}-${project.version}</fina
6      <plugins>
7        <plugin>
8          <groupId>org.apache.maven.plugins</groupId>
9          <artifactId>maven-ear-plugin</artifactId>
10         <version>${version.plugin.ear}</version>
11       </plugin>
12     </plugins>
13   </build>
14 </project>
```

pom.xml

http://logging.apache.org/log4j/2.x/
http://logging.apache.org/log4j/1.2/

Log4j2 version: **v2.9.1**
Log4j version: **v1.2.17**

For now JBoss 6.4 supports only the Log4j 1.2, WebLogic doesn't support it.

Standard?

Log4J is not part of the JavaEE, the standard uses the **JDK Logging** (of course this is supported by the JBoss and the WebLogic as well).

Simple Logging Facade for Java (**SLF4J**): it can hide the different logging solutions and it is able to handle the configuration dynamically (java.util.logging, logback, log4j).

- **Loggers**
  - It connects the Java package, the log level and the appenders (1 logger N appender)
  - So-called `Root Logger` always exists
- **Appenders**
  - It defines the pattern of the log message and the type of the logging (e.g.: file, rolling file, e-mail, jms message, etc.)

Configuration

In case of standalone application it can be configured by a **log4j(2).xml** or a **log4j(2).properties** file. In case of Jboss threre is a **Logging subsystem** which wraps it and it can be configured via the **standalone.xml**.

- **TRACE**
  - Very detailed data, you can use it sometimes in exceptional cases (e.g.: you need the log messages which were created in the body of a loop).
- **DEBUG**
  - In case of debugging or developping. These logs follows through the business workflows in all toched components. With these logs the user activity can be reproduced.
- **INFO**
  - These messages are 'always' appear in the log 'file' (we need the information which they deliver). Never use this for frequent events! This is rather a 'Hello, I'am here' type of messages instead of kind of workflow description (you cannot reproduce the user activity from this).
- **WARN**
  - Warning. In general case these are kind of bugs which can be handled by the application somehow (e.g.: the transaction performed with certain restrictions).
- **ERROR**
  - Fault. It contains as detailed description as it can be. This will be the information when you start to work in a trouble report. Based on this we may ask debug logs to reproduce the user activity.
- **FATAL**
  - Catastrophic fault, we use it very rare. The clients don't like to get even Errors, so we don't want to frighten them with Fatals.

```java
public class BookPingServlet extends HttpServlet {

  private static final Logger LOGGER =
      Logger.getLogger(BookPingServlet.class);

  @Override
  protected void doGet(HttpServletRequest request,
      HttpServletResponse response) throws ServletException,
      IOException {
    LOGGER.info("Get Book by user");
    [..]
  }
}
```

BookPingServlet.java

Apache Log4J

DEBUG log sample

```
1  public class BookFacadeImpl implements BookFacade {
2
3    private static final Logger LOGGER =
         Logger.getLogger(BookFacadeImpl.class);
4
5    @Override
6    public BookStub getBook(String isbn) {
7      if (LOGGER.isDebugEnabled()) {
8        LOGGER.debug("Get Book (isbn: " + isbn + ")");
9      }
10     [..]
11   }
12 }
```

alternate solution (less lines of source code):

```
LOGGER.debug(String.format("Get Book (isbn: %s)", isbn);
```

BookFacadeImpl.java

Important! In a production environment the DEBUG logs never allow to ruin the performance or the memory, because in general case we don't see that log messages 'production runtime'. The expense of the presented solution is a logical inspection. The alternate solution puts a String literal in the permspace (or metaspace in java 8). We try to avoid the String concatenation (the compiler will replace the concatenation to StringBuilder, but this unnecessary optimalization is very expensive here).

```
<server xmlns="urn:jboss:domain:1.7">
  <extensions>
    <extension module="org.jboss.as.logging"/>
    [..]
  </extensions>
  <management>[..]</management>
  <profile>
    <subsystem xmlns="urn:jboss:domain:logging:1.5">
      [APPENDERS DETAILS]
      [LOGGER DETAILS]
    </subsystem>
    [..]
  </profile>
  <interfaces>[..]</interfaces>
  <socket-binding-group>[..]</socket-binding-group>
</server>
```

standalone.xml

```
1  <console-handler name="CONSOLE">[..]</console-handler>
2  <periodic-rotating-file-handler
       name="FILE">[..]</periodic-rotating-file-handler>
3
4  <logger category="hu.qwaevisz">
5    <level name="DEBUG"/>
6  </logger>
7
8  <root-logger>
9    <level name="INFO"/>
10   <handlers>
11     <handler name="CONSOLE"/>
12     <handler name="FILE"/>
13   </handlers>
14 </root-logger>
15 <formatter name="PATTERN">[..]</formatter>
```

standalone.xml

There are separate steps how to setup *Log4J* in WebLogic.
Instead of that we will use **JDK Logging** (part of the JavaEE, java.util.logging.*

```
1 import java.util.logging.Level;
2 import java.util.logging.Logger;
3 [..]
4 private static final Logger LOGGER =
      Logger.getLogger(BookListController.class.getName());
5 [..]
6 LOGGER.info("Get All Books");
```

BookListController.java

JDK Logging vs Log4J

JDK Logging Level	Log4J Level	JDK Logging sample
FINEST	-	LOGGER.finest();
FINER	TRACE	LOGGER.finer();
FINE	DEBUG	LOGGER.fine();
CONFIG	-	LOGGER.config();
INFO	INFO	LOGGER.info();
WARNING	WARN	LOGGER.warning();
SEVERE	ERROR	LOGGER.severe();
-	ERROR	-

If we would like to add an exception beside the error (in case of Log4J there is an overload method):

```
1 LOGGER.log(Level.SEVERE, e.getMessage(), e);
```

```xml
<dependency>
  <groupId>log4j</groupId>
  <artifactId>log4j</artifactId>
  <version>1.2.17</version>
  <scope>provided</scope>
</dependency>
```

We have to share this dependency for all `modules`, that's why we have to modify all `pom.xml` files. The version number can be put into a properties, but 6 lines remains 6 lines..with a tiny modification in the parent's `pom.xml` we can reduce the 6 lines to 4 lines...

Parent Aggregator project

Modify

```
<project [..]>
  [..]
  <properties>
    [..]
    <version.log4j>1.2.17</version.log4j>
  </properties>

  <dependencyManagement>
    <dependencies>
      <dependency>
        <groupId>log4j</groupId>
        <artifactId>log4j</artifactId>
        <version>${version.log4j}</version>
        <scope>provided</scope>
      </dependency>
    </dependencies>
  </dependencyManagement>
</project>
```

The children of the dependencyManagement are able to see for the *modules*. A dependency may have complex configuration, so we can reduce more than 2 lines in an other case.

pom.xml

Module projects

Modify

```
<project [..]>
  [..]
  <dependencies>
    [..]
    <dependency>
      <groupId>log4j</groupId>
      <artifactId>log4j</artifactId>
    </dependency>
    [..]
  </dependencies>
</project>
```

The `groupId` and the `artifactId` identify the dependency (management) of the parent project. We can do the same transformation with the `javax:javaee-api` dependency as well.

Parent Aggregator project

Modification

```
<project [..]>
  [..]
  <build>
    <pluginManagement>
      <plugins>
        <plugin>
          <groupId>org.apache.maven.plugins</groupId>
          <artifactId>maven-ejb-plugin</artifactId>
          <version>${version.plugin.ejb}</version>
        </plugin>
      </plugins>
    </pluginManagement>
  </build>

</project>
```

The `pluginManagement` element is very similar than the `dependencyManagement` element (inside the `build` element). We can collect the configuration of the `plugins` here.

Module projects

Modifications

Now only the version information was disappeared, but later we will see that many other configuration can be omitted.

```
1  <project [..]>
2    [..]
3    <build>
4      <plugins>
5        <plugin>
6          <groupId>org.apache.maven.plugins</groupId>
7          <artifactId>maven-ejb-plugin</artifactId>
8        </plugin>
9      </plugins>
10   </build>
11 </project>
```

pom.xml

PostgreSQL

Professional open-source database manager

http://www.postgresql.org/

Version: **v10.0** (2017.10.05.)

Version: **v9.6.5** (2017.09.31.)

Install: installer

Default data: **5432** (port) és **postgres** (database)

Default user: **postgres** (user) és **root** (password)

Editor: **pgAdmin III** vagy **pgAdmin IV**

Environment variables:

- **PSQL_HOME** →`c:\ProgramFiles\PostgreSQL\9.4`
- Modify **Path** → `%Path%;%PSQL_HOME%\bin`

Professional tool

Besides that the PostgreSQL is as professional tool like the Oracle DB or the SAP Adaptive Server Enterprise (earlier Sybase ASE), there are active PostgreSQL systems in production environments that manage in excess of 4 terabytes of data.

Version information

```
1 > psql --version
2 psql (PostgreSQL) 9.4.1
```

Connect (CLI)

```
1 > psql -d postgres -h localhost -p 5432 -U postgres
```

Connect and execute commands from file

```
1 > psql -d postgres -h localhost -p 5432 -U postgres -f [FILENAME]
```

Oracle MySQL

The most popular open-source database manager

https://www.mysql.com/

Download: https://dev.mysql.com/downloads/

The Community version is free (GPL).

Version: **v5.7.20**

Default data: **3306** (port)

Default user: **root** (user) és - (password)

Editor: **MySQL Workbench**

Encironment variables:

- **MYSQL_HOME** →`c:\ProgramFiles\MySQL\5.7\bin`
- Modify **Path** → `%Path%;%MYSQL_HOME%\bin`

Popular tool

In the world of PHP development the MySQL is almost essential (almost all the Shared Hosting solution support the MySQl as persistence layer). MySQL contains several engines, all of them have advantages/disadvantages. Perhaps InnoDB could be a professional engine (but it has some know issues, and it has not supported *role*s yet). *role*-okat ez sem kezel még.

BookStore db scripts

Create Database, Role and User

[gradle|maven]\jboss\bookstore\database

```
1 CREATE DATABASE bookstoredb;
```

create-database.sql

```
1 CREATE ROLE bookstore_role WITH NOSUPERUSER NOCREATEDB
      NOCREATEROLE;
```

create-role.sql

```
1 CREATE USER bookstore_user;
2 ALTER USER bookstore_user PASSWORD '123topSECret321';
3 GRANT bookstore_role TO bookstore_user;
```

create-user.sql

Execute BookStore db scripts

Create Database, Role and User

```
1 > psql -d postgres -h localhost -p 5432 -U postgres -f
    create-database.sql
2
3 > psql -d postgres -h localhost -p 5432 -U postgres -f
    create-role.sql
4
5 > psql -d postgres -h localhost -p 5432 -U postgres -f
    create-user.sql
```

Connect the to **bookstoredb** database with the **bookstore_user** user

```
1 > psql -d bookstoredb -h localhost -p 5432 -U bookstore_user
```

BookStore db schema

Book and Book's category

```
1  CREATE TABLE bookcategory (
2    bookcategory_id INTEGER NOT NULL,
3    bookcategory_name CHARACTER VARYING(100) NOT NULL,
4    CONSTRAINT PK_BOOKCATEGORY_ID PRIMARY KEY (bookcategory_id)
5  );
6
7  ALTER TABLE bookcategory OWNER TO postgres;
8
9  CREATE TABLE book (
10   book_id SERIAL NOT NULL,
11   book_isbn CHARACTER VARYING(100) NOT NULL,
12   book_author CHARACTER VARYING(100) NOT NULL,
13   book_title CHARACTER VARYING(100) NOT NULL,
14   book_bookcategory_id INTEGER NOT NULL,
15   book_price REAL NOT NULL,
16   book_number_of_pages INTEGER NOT NULL,
17   CONSTRAINT PK_BOOK_ID PRIMARY KEY (book_id),
18   CONSTRAINT FK_BOOK_BOOKCATEGORY FOREIGN KEY (book_bookcategory_id)
19     REFERENCES bookcategory (bookcategory_id) MATCH SIMPLE ON UPDATE RESTRICT ON DELETE
           RESTRICT
20 );
21
22 ALTER TABLE book OWNER TO postgres;
23
24 CREATE UNIQUE INDEX UI_BOOK_ISBN ON book USING btree (book_isbn);
```

SERIAL: there will be a book_book_id_seq sequence in the database.

create-schema.sql

BookStore - grant

last step of database configuration

```
1 GRANT SELECT, INSERT, UPDATE, DELETE ON bookcategory, book TO
      bookstore_role;
2
3 GRANT USAGE, SELECT, UPDATE ON book_book_id_seq TO bookstore_role;
```

grant-access.sql

```
1 > psql -d bookstoredb -h localhost -p 5432 -U postgres -f
      create-schema.sql
2
3 > psql -d bookstoredb -h localhost -p 5432 -U postgres -f
      grant-access.sql
```

BookStore - Data loading

Create initial data

```
1 INSERT INTO bookcategory (bookcategory_id, bookcategory_name)
      VALUES (0, 'SCIFI');
2 INSERT INTO bookcategory (bookcategory_id, bookcategory_name)
      VALUES (1, 'LITERATURE');
3 INSERT INTO bookcategory (bookcategory_id, bookcategory_name)
      VALUES (2, 'HISTORICAL');
4 INSERT INTO bookcategory (bookcategory_id, bookcategory_name)
      VALUES (3, 'PHILOSOPHY');
5
6 INSERT INTO book (book_isbn, book_author, book_title,
      book_bookcategory_id, book_price, book_number_of_pages)
      VALUES ('978-0441172719', 'Frank Herbert', 'Dune', 0, 3500,
      896);
7 [..]
```

initial-data.sql

```
1 > psql -d bookstoredb -h localhost -p 5432 -U postgres -f
      initial-data.sql
```

Access database in Java

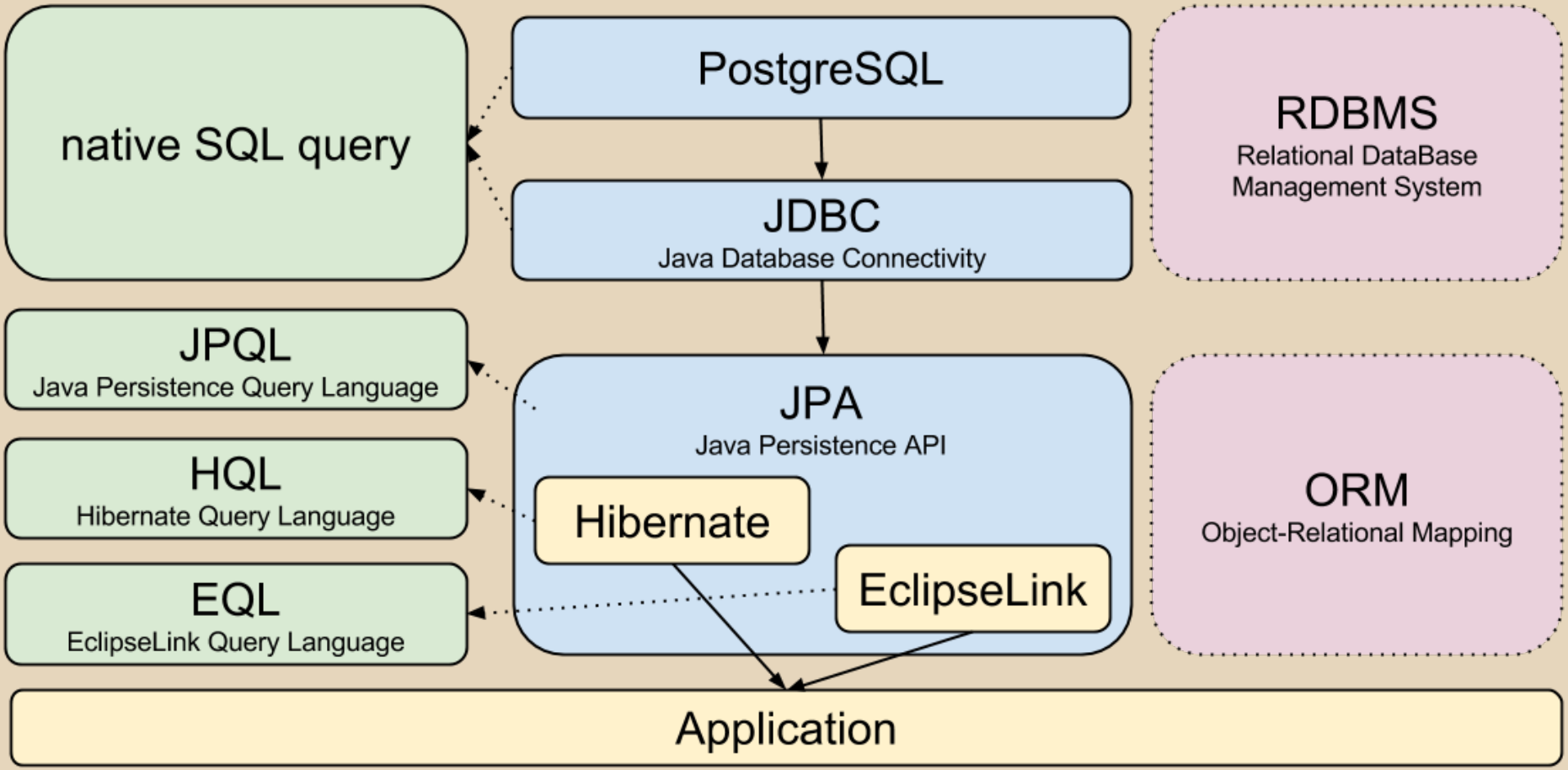
JDBC

This is a Java SE topic in practice, we have to use the `java.sql` package to reach that goal. Besides we need the **JDBC driver** of the choosen database engine (**Java DataBase Connectivity**, typically it is a `jar` file) (this is the Java version of the ODBC (Open Database Connectivity)).

```
1  Class.forName("org.postgresql.Driver");
2  Connection connection =
       DriverManager.getConnection("jdbc:postgresql://localhost:5432/boo
       "bookstore_user", "123topSECret321");
3
4  Statement statement = connection.createStatement();
5  ResultSet rs = statement.executeQuery("SELECT book_id, book_title
       FROM book");
6  while (rs.next()) {
7    long id = rs.getLong("book_id");
8    String title = rs.getString("book_title");
9  }
10 rs.close();
11 statement.close();
12
13 connection.close();
```

This sample code completely ignores the error handling. Real example can be found in the `shopping` project. The greatest disadvantage of the native JDBC driver usage is the **non type-safe** behavior.

Java Persistence API



- Create **new module**: **PostgreSQL JDBC driver**
- **Regsiter module** for the `standalone domain`
- **Register database driver** inside the `standalone domain`
- **Create datasource** for the **bookstoredb** inside the `standalone domain`

environment\modules\org\postgresql\main\

Directory structure

[JBOSS_HOME]/modules/
- org/ → *name directory*
  - postgresql/ → *name directory*
    - main/ → *slot directory*
      - module.xml → *descriptor*
      - postgresql-42.1.4.jar → *JDBC driver* https://jdbc.postgresql.org/

```
1 <module xmlns="urn:jboss:module:1.1" name="org.postgresql">
2     <resources>
3         <resource-root path="postgresql-42.1.4.jar"/>
4     </resources>
5   <dependencies>
6     <module name="javax.api"/>
7     <module name="javax.transaction.api"/>
8   </dependencies>
9 </module>
```

module.xml

[JBOSS_HOME] | standalone | configuration | standalone.xml

```
1 <subsystem xmlns="urn:jboss:domain:ee:1.2">
2   <global-modules>
3     <module name="org.postgresql" slot="main"/>
4   </global-modules>
5   [..]
6 </subsystem>
```

standalone.xml

JBoss - Register database driver

Standalone domain

[JBOSS_HOME] | standalone | configuration | standalone.xml

```
1  <subsystem xmlns="urn:jboss:domain:datasources:1.2">
2    <datasources>
3      [..]
4      <drivers>
5        [..]
6        <driver name="postgresql" module="org.postgresql">
7          <xa-datasource-class>org.postgresql.xa.PGXADataSource</xa-da
8        </driver>
9      </drivers>
10   </datasources>
11 </subsystem>
```

standalone.xml

JBoss - Create datasource

For the PostgreSQL bookstoredb database

[JBOSS_HOME] | standalone | configuration | standalone.xml

```
1  <subsystem xmlns="urn:jboss:domain:datasources:1.2">
2    <datasources>
3      [..]
4      <datasource jndi-name="java:jboss/datasources/bookstoreds"
           pool-name="BookStoreDSPool" enabled="true" use-java-context="true">
5        <connection-url>jdbc:postgresql://localhost:5432/bookstoredb</connection
6        <driver>postgresql</driver>
7        <security>
8          <user-name>bookstore_user</user-name>
9          <password>123topSECret321</password>
10       </security>
11     </datasource>
12     [..]
13   </datasources>
14 </subsystem>
```

standalone.xml

JNDI name: java:jboss/datasources/bookstoreds
JDBC url: jdbc:postgresql://localhost:5432/bookstoredb

JBoss - Connection validation after DB restart

Modify the configuration of the BookStore datasource

[JBOSS_HOME] | standalone | configuration | standalone.xml

```
1  <subsystem xmlns="urn:jboss:domain:datasources:1.2">
2    <datasources>
3      <datasource jndi-name="java:jboss/datasources/bookstoreds"
           pool-name="BookStoreDSPool" enabled="true" use-java-context="true">
4        [..]
5        <validation>
6          <check-valid-connection-sql>SELECT 1</check-valid-connection-sql>
7          <validate-on-match>true</validate-on-match>
8          <background-validation>false</background-validation>
9        </validation>
10       <statement>
11         <share-prepared-statements>false</share-prepared-statements>
12       </statement>
13     </datasource>
14     [..]
15   </datasources>
16 </subsystem>
```

standalone.xml

Configure WebLogic DataSource

Via Server Administration Console

- Add PostgreSQL JDBC library into the domain's classpath
  - Copy JDBC driver (e.g.: `postgresql-9.4-1201.jdbc41.jar`) here: `[MW\_HOME]\user\_projects\domains\mydomain\lib\`
  - Restart server instance
- WebLogic Server Administration Console
  - Services | Data Sources | Configuration tab
    - New → Generic Data Source
      * Name: **bookstoreds**
      * JNDI name: `jdbc/datasource/bookstoreds`
      * Target: "myserver"
      * Database type: PostgreSQL
    - Next, Next..
      * Database name: **bookstoredb**
      * Host name: **localhost**
      * Port: **5432** (default)
      * Database user name: **bookstore_user**
      * Password: **123topSECret321**
    - It is worth testing the connection through the administration console

Directory structure

```
bookstore/
   [..]
   bs-persistence/
      src/
         main/
            java/
            resources/
               META-INF/
                  ejb-jar.xml
                  persistence.xml
      pom.xml
[..]
```

Maven Aggregator project - Persistence module

Modification

```
<project [..]>
  [..]
  <modules>
    [..]
    <module>bs-persistence</module>
  </modules>
  [..]
</project>
```

pom.xml

Persistence module

Frame

```
<project [..]>
  <modelVersion>4.0.0</modelVersion>
  <artifactId>bs-persistence</artifactId>
  <packaging>ejb</packaging>
  <name>BookStore Persistence Services</name>

  <parent>
    <groupId>hu.qwaevisz.bookstore</groupId>
    <artifactId>bookstore</artifactId>
    <version>1.0</version>
  </parent>

  <dependencies>
    [..]
  </dependencies>
  <build>
    [..]
  </build>
</project>
```

pom.xml

Persistence module

To be continued..

```
1  <project [..]>
2    [..]
3    <dependencies>
4      <dependency>
5        <groupId>javax</groupId>
6        <artifactId>javaee-api</artifactId>
7      </dependency>
8      <dependency>
9        <groupId>log4j</groupId>
10       <artifactId>log4j</artifactId>
11     </dependency>
12   </dependencies>
13   <build>
14     <plugins>
15       <plugin>
16         <groupId>org.apache.maven.plugins</groupId>
17         <artifactId>maven-ejb-plugin</artifactId>
18       </plugin>
19     </plugins>
20   </build>
21 </project>
```

All three *artifacts* are defined in the parent project's `pom.xml`.

The JBoss 6.4 uses the **Hibernate 4.3.10.Final** at runtime as a JPA implementation, but we would like to use only the JPA API during development, so we don't need this dependency:
`'org.hibernate:hibernate-core:4.3.10.Final'`

`pom.xml`

Maven EJB Service project

Modification

```
<project [..]>
  [..]
  <dependencies>
    <dependency>
      <groupId>hu.qwaevisz.bookstore</groupId>
      <artifactId>bs-persistence</artifactId>
      <version>${project.parent.version}</version>
      <scope>provided</scope>
    </dependency>
    [..]
  </dependencies>

  <build>
    [..]
  </build>
</project>
```

The bs-weblayer uses the bs-ejbservice to reach the *BookFacade* EJB.
The bs-ejbservice uses the bs-persistence to reach the *BookService* EJB.

pom.xml

JPA Persistence

Deployment descriptor

hibernate.dialect: not mandatoy, but recommended (is we set it the Hibernate is able to generate PostgreSQL specific native queries too. If we omit in this example, everything will remain fine (ANSI SQL is enough at this time).

src | main | resources | META-INF | persistence.xml

```
1  <persistence xmlns="http://java.sun.com/xml/ns/persistence"
2           xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
3           xsi:schemaLocation="http://java.sun.com/xml/ns/persistence
               http://java.sun.com/xml/ns/persistence/persistence_2_0.xs
4           version="2.0">
5    <persistence-unit name="bs-persistence-unit"
         transaction-type="JTA">
6      <jta-data-source>java:jboss/datasources/bookstoreds</jta-data-so
7      <properties>
8        <property name="hibernate.dialect"
             value="org.hibernate.dialect.PostgreSQLDialect"/>
9        <property name="hibernate.show_sql" value="true"/>
10       <property name="hibernate.format_sql" value="true"/>
11     </properties>
12   </persistence-unit>
13 </persistence>
```

Name of the **persistence unit**: bs-persistence-unit
JNDI name: java:jboss/datasources/bookstoreds

JPA Persistence

Deployment descriptor

src | main | resources | META-INF | persistence.xml

```
1  <?xml version="1.0"?>
2  <persistence xmlns="http://xmlns.jcp.org/xml/ns/persistence"
3      xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
4      xsi:schemaLocation="http://xmlns.jcp.org/xml/ns/persistence
           http://xmlns.jcp.org/xml/ns/persistence/persistence_2_1.xsd"
5      version="2.1">
6    <persistence-unit name="bs-persistence-unit"
         transaction-type="JTA">
7      <provider>org.eclipse.persistence.jpa.PersistenceProvider</provi
8      <jta-data-source>jdbc/datasource/bookstoreds</jta-data-source>
9      <class>hu.qwaevisz.bookstore.persistence.entity.Book</class>
10     <properties>
11       <property name="
12     </properties>
13   </persistence-unit>
14 </persistence>
```

The Oracle WebLogic uses **EclipseLink** (TopLink) as JPA Provider. In the world of JavaEE we can freely move among servers, our 'only' task is change/fine-tune the descriptors.

persistence.xml

Book entity

Identification field

If we do not set the `@SequenceGenerator` and the `@GeneratedValue` annotations, we will get an `org.hibernate.id.IdentifierGenerationException` during insert: `"ids for this class must be manually assigned before calling save()"`.

```
1  package hu.qwaevisz.persistence.entity;
2
3  @Entity
4  @Table(name = "book")
5  public class Book implements Serializable {
6
7    @Id
8    @SequenceGenerator(name = "generatorBook", sequenceName =
         "book_book_id_seq", allocationSize = 1)
9    @GeneratedValue(strategy = GenerationType.SEQUENCE, generator =
         "generatorBook")
10   @Column(name = "book_id", nullable = false)
11   private Long id;
12
13   [..]
14 }
```

Database **table name**: book

Database **sequence name**: book_book_id_seq

Database **column name**: book_id

Book.java

Book entity

Further fields

```
1  @Column(name = "book_isbn", nullable = false)
2  private String isbn;
3
4  @Column(name = "book_author", nullable = false)
5  private String author;
6
7  @Column(name = "book_title", nullable = false)
8  private String title;
9
10
11 @Enumerated(EnumType.ORDINAL)
12 @Column(name = "book_bookcategory_id", nullable = false)
13 private BookCategory category;
14
15 @Column(name = "book_price", nullable = false)
16 private Double price;
17
18 @Column(name = "book_number_of_pages", nullable = false)
19 private Integer numberOfPages;
```

In the level of the database the **bookcategory** is a table, but in ORM it will be an `enum` (CRUD operations are not allowed on it).

Book.java

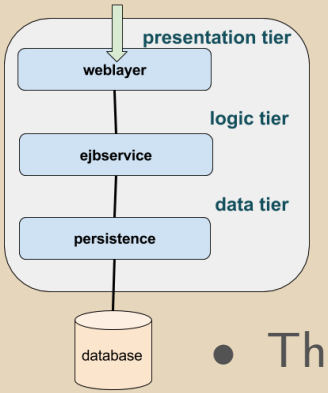
BookCategory

enum in the level of ORM

```java
package hu.qwaevisz.bookstore.persistence.entity.trunk;

public enum BookCategory {

  SCIFI,
  LITERATURE,
  HISTORICAL,
  PHILOSOPHY;

}
```

BookCategory.java

- The **BookStore** application defines services in two different levels.
  - The EJB services of the `bs-ejbservice` project's level support the 'customer' needs.



    - The methods of the interface serve business *use-case*s.
    - The types used by the interface are **stub**s. These are open to the public in technical level.
    - The exceptions used by the interface are open to the public or these can be converted into public error messages. Its rarely contain technical details (security).
  - The EJB services of the `bs-persistence` project's level serve the 'developers' needs (primarily formed by technical requirements and decisions).
    - The methods of the interface serve the developers who try to keep the balance among the redundancy free, maintainable, clean and sometimes future-proof requirements.
    - The types used by the interface are ofter **entities** or internal DTOs. These are not open to the public.
    - The exceptions used by the interface can contain detailed technical information. Most of the time these will not appear in the 'client' side.

BookService - Persistence SLSB

Local interface

```
1  package hu.qwaevisz.bookstore.persistence.service;
2  [..]
3  @Local
4  public interface BookService {
5    [..]
6    Book read(String isbn) throws PersistenceServiceException;
7
8    List<Book> readAll() throws PersistenceServiceException;
9    [..]
10 }
```

BookService.java

BookService - Persistence SLSB

Implementation

```
1  @Stateless(mappedName = "ejb/bookService")
2  @TransactionManagement(TransactionManagementType.CONTAINER)
3  @TransactionAttribute(TransactionAttributeType.REQUIRES_NEW)
4  public class BookServiceImpl implements BookService {
5
6    @PersistenceContext(unitName = "bs-persistence-unit")
7    private EntityManager entityManager;
8
9    @Override
10   public Book read(final String isbn) throws PersistenceServiceException {
11     Book result = null;
12     try {
13       result = this.entityManager.createNamedQuery(Book.GET_BY_ISBN,
               Book.class).setParameter("isbn", isbn).getSingleResult();
14     } catch (final Exception e) {
15       throw new PersistenceServiceException("Unknown error when fetching Book by ISBN
               (" + isbn + ")! " + e.getLocalizedMessage(), e);
16     }
17     return result;
18   }
19   [..
20 }
```

JPA **Named Query**: `Book.GET_BY_ISBN` (`"Book.getByIsbn"`)
Name of the parameter: `isbn`
`getSingleResult()`: exactly one record exists (otherwise it will be thrown an exception)
`getResultList()`: `List<Book>` will be the result value

JPA Named Query

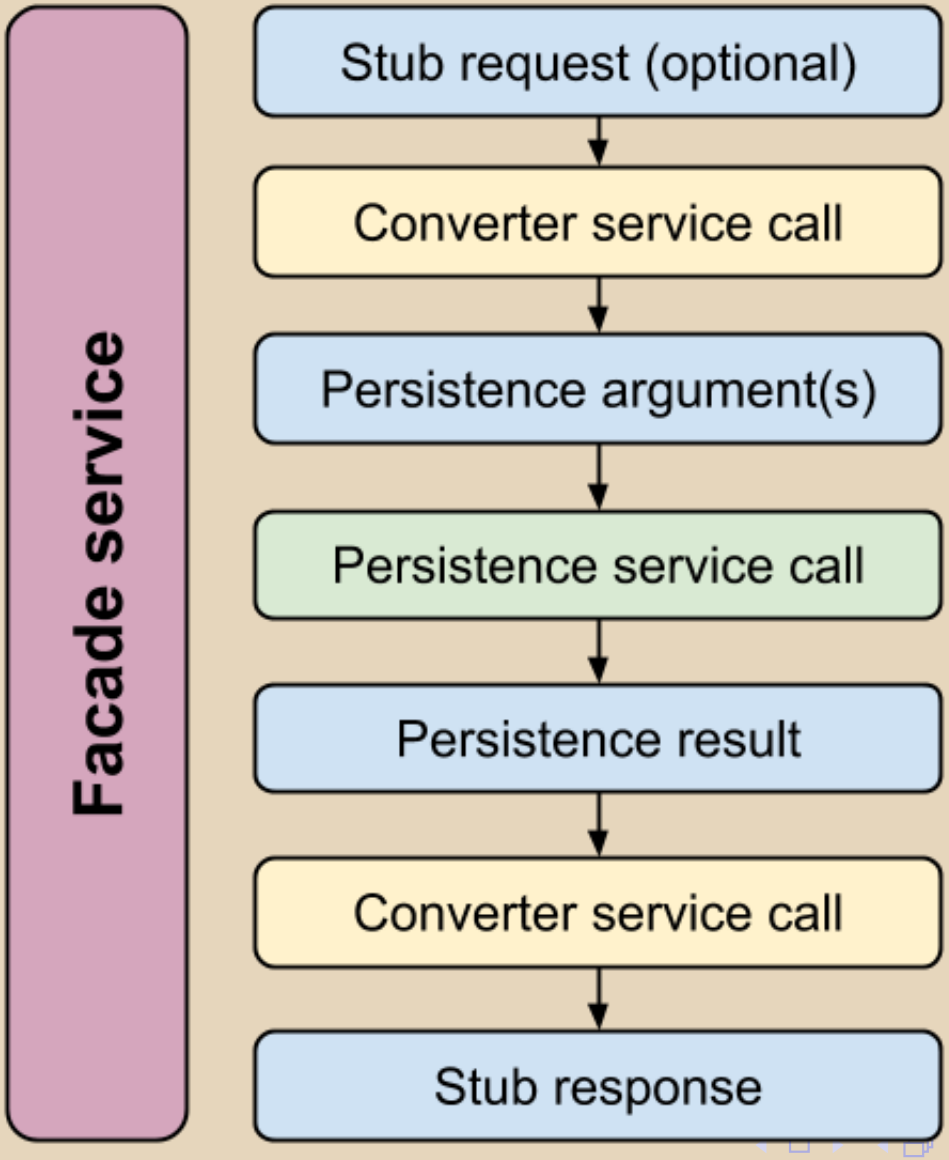
JPQL syntax

```
1  @Entity
2  @Table(name = "book")
3  @NamedQueries(value = { //
4      @NamedQuery(name = Book.GET_BY_ISBN, query = "SELECT b FROM
           Book b WHERE b.isbn=:isbn"),
5      @NamedQuery(name = Book.GET_ALL, query = "SELECT b FROM Book
           b ORDER BY b.title"),
6      [..]
7  })
8  public class Book implements Serializable {
9
10   public static final String GET_BY_ISBN = "Book.getByIsbn";
11   public static final String GET_ALL = "Book.getAll";
12
13   [..]
14 }
```

Book.java

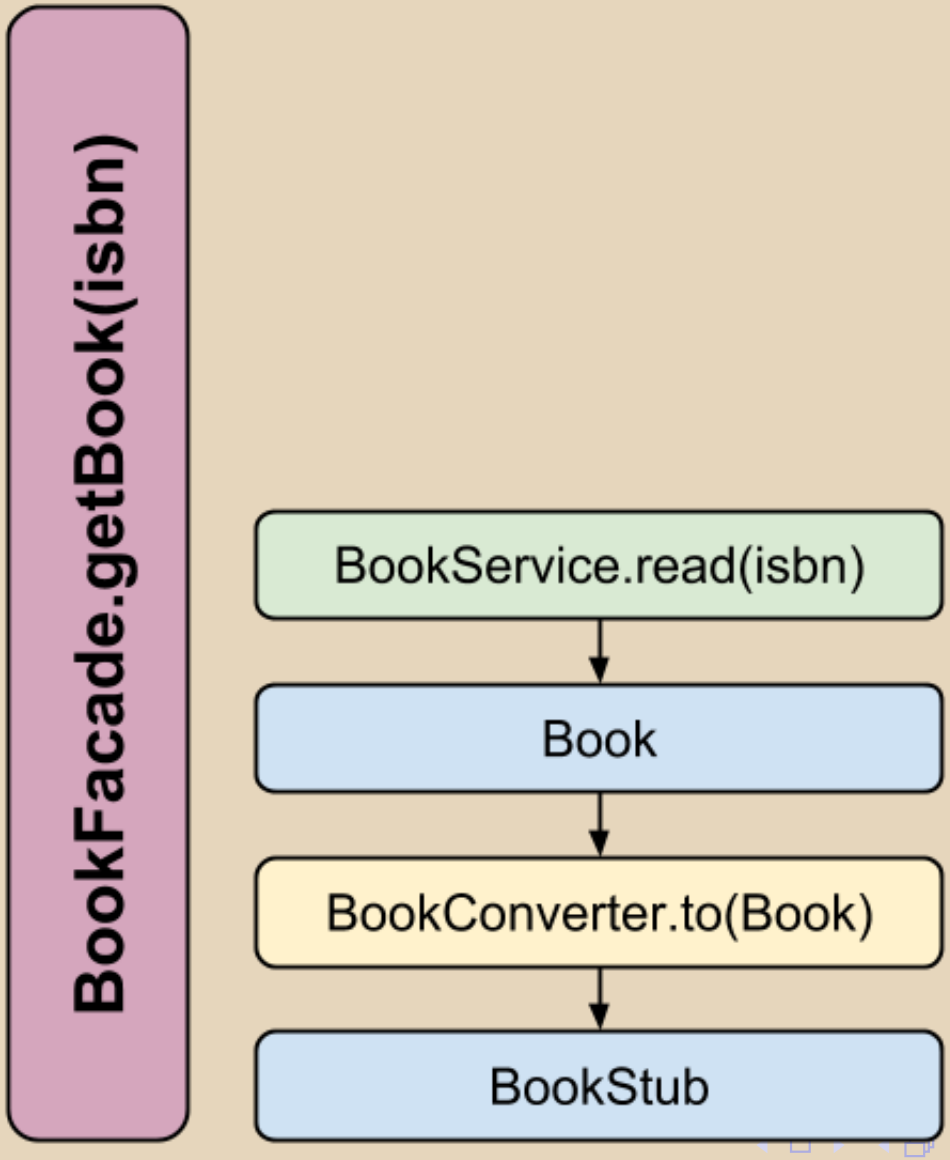
Responsibility of the Facade layer

EJB Service project (`bs-ejbservice`)



Query the Book via ISBN

EJB Service project (`bs-ejbservice`)



BookConverter

EJB Service project (bs-ejbservice)

```java
@Local
public interface BookConverter {
  BookStub to(Book book);
  List<BookStub> to(List<Book> books);
}
```

BookConverter.java

Very good 3rd party libraries exists for conversions, e.g.: **MapStruct** (http://mapstruct.org/).

```java
@Stateless
public class BookConverterImpl implements BookConverter {

  @Override
  public BookStub to(Book book) {
    final BookCategoryStub category =
        BookCategoryStub.valueOf(book.getCategory().toString());
    return new BookStub(book.getIsbn(), book.getAuthor(), book.getTitle(), category,
        book.getPrice(), book.getNumberOfPages());
  }
  [..]
}
```

BookConverterImpl.java

BookFacade modification

EJB Service project (bs-ejbservice)

```java
@Stateless(mappedName = "ejb/bookFacade")
public class BookFacadeImpl implements BookFacade {

  @EJB
  private BookService service;

  @EJB
  private BookConverter converter;

  @Override
  public BookStub getBook(String isbn) throws FacadeException {
    try {
      final BookStub stub = this.converter.to(this.service.read(isbn));
      if (LOGGER.isDebugEnabled()) {
        LOGGER.debug("Get Book by isbn (" + isbn + ") --> " + stub);
      }
      return stub;
    } catch (final PersistenceServiceException e) {
      LOGGER.error(e, e);
      throw new FacadeException(e.getLocalizedMessage());
    }
  }
  [..]
}
```

BookFacadeImpl.java

Improve the presentation layer

bs-weblayer project

Earlier we had only one test servlet (`BookPingServlet`) to call a local EJB service. Create the followings based on the *Modell-View-Controller* design.

- **BookController** servlet which get the ISBN number as an URI parameter then fetches the `BookStub` instance and puts it in the `HttpServletReq` and *forward*s the request to a *JSP*.
- **book.jsp** which gets the `BookStub` instance from the `HttpServletReques` and builds an XHTML output.

BookController

Weblayer project (bs-weblayer)

```
1  package hu.qwaevisz.bookstore.weblayer.servlet;
2  [..]
3  @WebServlet("/Book")
4  public class BookController extends HttpServlet {
5    [..]
6    @EJB
7    private BookFacade facade;
8
9    @Override
10   protected void doGet(HttpServletRequest request, HttpServletResponse response) throws
         ServletException, IOException {
11     String isbn = request.getParameter("isbn");
12     [..]
13     try {
14       BookStub book = this.facade.getBook(isbn);
15       request.setAttribute("book", book);
16     } catch (final FacadeException e) {
17       LOGGER.error(e, e);
18     }
19     RequestDispatcher view = request.getRequestDispatcher("book.jsp");
20     view.forward(request, response);
21   }
22   [..]
23 }
```

BookController.java

book.jsp

Weblayer project (bs-weblayer)

```
1  <%@ page language="java" contentType="text/html; charset=UTF-8" pageEncoding="UTF-8" %>
2  <%@ page import="hu.qwaevisz.bookstore.ejbservice.domain.BookStub" %>
3  <!DOCTYPE html>
4  <html>
5  <head>
6  <meta http-equiv="Content-Type" content="text/html; charset=UTF-8">
7  <title>:: Book ::</title>
8  </head>
9  <body>
10   <jsp:useBean id="book" class="hu.qwaevisz.bookstore.ejbservice.domain.BookStub"
         scope="request" />
11   <h1>
12     <jsp:getProperty name="book" property="author" />:
13     <jsp:getProperty name="book" property="title" />
14   </h1>
15   <div>
16     <label>ISBN: </label>
17     <span><jsp:getProperty name="book" property="isbn" /></span>
18   </div>
19   <div>
20     <label>Number of pages: </label>
21     <span><jsp:getProperty name="book" property="numberOfPages" /></span>
22   </div>
23   [..]
24 </body>
25 </html>
```

book.jsp

http://localhost:8080/bs-weblayer/Book?isbn=978-0441172719

Further tasks:

- List all of the books(JPA query, persistence service, facade service, converter ejb)
  - Filter the books via Criteria (optional)
- `list.jsp` and `BookListController` servlet realization
- Bind `list.jsp` and `book.jsp` (link the controller servlets)
- Create a `page.css` file for the webpages
- ...

The **BookStore** application contains the full of CRUD operations in addition to queries. The technical details of this will be coverd later.

The next few slides presents the affected persistence operations. The solutions lack transaction- and error handling. Later we will cover this during the **school** project.

```java
@Stateless(mappedName = "ejb/bookService")
public class BookServiceImpl implements BookService {
  [..]
  @PersistenceContext(unitName = "bs-persistence-unit")
  private EntityManager entityManager;

  @Override
  public Book create(final String isbn, final String author, final String title, final
       int numberOfPages, final double price, final BookCategory category)
      throws PersistenceServiceException {
    [..]
    final Book book = new Book(isbn, author, title, numberOfPages, price, category);
    this.entityManager.persist(book);
    [..]
    return book;
  }
  [..]
}
```

BookServiceImpl.java

```
1  @Stateless(mappedName = "ejb/bookService")
2  public class BookServiceImpl implements BookService {
3    [..]
4    @PersistenceContext(unitName = "bs-persistence-unit")
5    private EntityManager entityManager;
6
7    @Override
8    public Book update(final String isbn, final String author, final String title, final
         int numberOfPages, final double price, final BookCategory category)
9        throws PersistenceServiceException {
10     final Book book = this.read(isbn);
11     book.setAuthor(author);
12     book.setTitle(title);
13     book.setNumberOfPages(numberOfPages);
14     book.setPrice(price);
15     book.setCategory(category);
16     [..]
17     return this.entityManager.merge(book);
18   }
19   [..]
20 }
```

BookServiceImpl.java

```
1  @Stateless(mappedName = "ejb/bookService")
2  public class BookServiceImpl implements BookService {
3    [..]
4    @PersistenceContext(unitName = "bs-persistence-unit")
5    private EntityManager entityManager;
6
7    @Override
8    public void delete(final String isbn) throws PersistenceServiceException {
9      this.entityManager.createNamedQuery(Book.REMOVE_BY_ISBN).setParameter("isbn",
           isbn).executeUpdate();
10     [..]
11   }
12   [..]
13 }
```

BookServiceImpl.java

The referred **JPQL**:

```
DELETE FROM Book b WHERE b.isbn=:isbn
```

The unit-testing is always part of the coding development process. This lab does not cover the unit-testing during implementation, because this is outside the main scope.

- **unit** or component test: in an object-oriented application one class (one responsibility) is an independent part of the system and we have to verify its behavior without any internal and external dependencies. The main goal of this testing is to find program faults quickly, and supports the refactoring (if the *coverage* is enough high).
- **integration** test: if we test some components together it could accelerate the development. We have to decide which dependencies of the environment is mocked/skipped and which does not.
- **system** test: tipically the highest level of testing which are created by the developers. The system or a standalone part of the system will be tested in a close to the real environment (there will be simulators also).
- **end-to-end** test: in a well-functioning team/company this level of testing are handled by a separate test team (integration and verification team). If there are engineers/-developers inside that team, automated test cases will be created (e.g.: *Selenium* tests in case of a webapplication), but the manual test cases are common too.

Testing the persistence layer

- It is cumbersome enough to deploy the application just for testing that a named query is fine or not (but: easy to make a mistake during named query creation).
- Database operations and `named query` testing is not a unit-test responsibility.
- JPA API can be used in a *standalone* Java application too. This could be a way to test the named queries, but it could be inconvenient also and this is not an automatic solution.
- Propable the most elegant way to create **integration test**s for the persistence layer. The written named queries and entity manager operations are really executed on the database, the efficiency and performance could be measured and checked, but we don't need to use the application server at all.
- In general the integration and the unit test do not run at the same time. We have to find a way how to separate these tests (there are many different solutions).
- The classes of the persistence layer (where it is meaningful and not boilerplate algorithms are affected) have to cover by unit-tests of course. We will learn about EJB services' unit-testing later in the **school** project.

Standalone Persistence Unit for the integration tests

src | main | resources | META-INF | persistence.xml

```
1  <persistence [..]>
2    [..]
3    <persistence-unit name="bs-persistence-test-unit" transaction-type="RESOURCE_LOCAL">
4      <provider>org.hibernate.jpa.HibernatePersistenceProvider</provider>
5      <class>hu.qwaevisz.bookstore.persistence.entity.Book</class>
6      <properties>
7        <property name="javax.persistence.jdbc.url"
               value="jdbc:postgresql://localhost:5432/bookstoredb" />
8        <property name="javax.persistence.jdbc.user" value="bookstore_user" />
9        <property name="javax.persistence.jdbc.password" value="123topSECret321" />
10       <property name="javax.persistence.jdbc.driver" value="org.postgresql.Driver" />
11
12       <property name="hibernate.dialect"
               value="org.hibernate.dialect.PostgreSQLDialect"/>
13       <property name="hibernate.show_sql" value="true"/>
14       <property name="hibernate.format_sql" value="true"/>
15
16       <prope
17     </proper
18   </persiste
19 </persistenc
```

The JPA reads the `persistence.xml` from a fix path of the classpath. That's way we add the new persistent unit in the same configuration file, and that's way we have to use the `jboss.as.jpa.managed` value (`false`). JBoss will ignore that standalone `persistence unit` (it causes ClassNotFound error). We have to set the **provider** class and the connection details instead of the JNDI name. And finally we have to list the entities because there is no container who looks through the classes of the classpath (to find @Entity annotations).
Name of the **persistence unit**: `bs-persistence-test-unit`

Classpath of the integration tests

The integration tests run without the JavaEE container (e.g.: gradle/maven/eclipse's JVM runs those), so we need not only the interfaces/enums of the JavaEE. Beneficial using the JavaEE dependency of the target environment, but we can choose anything else too.

Required runtime dependencies:

- **PostgreSQL**
  - `org.postgresql:postgresql:9.4+`
- **Hibernate**
  - `org.hibernate:hibernate-core:4.3.10.Final`
  - `org.hibernate:hibernate-entitymanager:4.3.10.Final`
- **JavaEE 6.0 implementation**
  - `org.jboss.spec:jboss-javaee-6.0:3.0.3.Final`
  - **Important!** We cannot add the JavaEE 6.0 API into the classpath at the same time:
    - `javax:javaee-api:6.0`

Maven Aggregator project

Modification

```
<project [..]>
  [..]
  <properties>
    [..]
    <version.plugin.surefire>2.19.1</version.plugin.surefire>
    <version.testng>6.11</version.testng>
    <version.postgresql>9.4.1212</version.postgresql>
    <version.hibernate>4.3.10.Final</version.hibernate>
    <version.jbossjavaee>3.0.3.Final</version.jbossjavaee>
  </properties>
  <dependencyManagement>
    <dependencies>
      [..]
      <dependency>
        <groupId>org.testng</groupId>
        <artifactId>testng</artifactId>
        <version>${version.testng}</version>
        <scope>test</scope>
      </dependency>
    </dependencies>
  </dependencyManagement>
  [..]
</project>
```

pom.xml

Maven Persistence project

Modification

```
<dependencies>
  [..]
  <dependency>
    <groupId>org.testng</groupId><artifactId>testng</artifactId>
  </dependency>
  <dependency>
    <groupId>org.postgresql</groupId><artifactId>postgresql</artifactId>
    <version>${version.postgresql}</version><scope>test</scope>
  </dependency>
  <dependency>
    <groupId>org.hibernate</groupId><artifactId>hibernate-core</artifactId>
    <version>${version.hibernate}</version><scope>test</scope>
  </dependency>
  <dependency>
    <groupId>org.hibernate</groupId><artifactId>hibernate-entitymanager</artifactId>
    <version>${version.hibernate}</version><scope>test</scope>
  </dependency>
  <dependency>
    <groupId>org.jboss.spec</groupId><artifactId>jboss-javaee-all-6.0</artifactId>
    <version>${version.jbossjavaee}</version><scope>test</scope>
  </dependency>
</dependencies>
```

Beside `testng` we put the listed dependencies to the classpath of the tests (**test** scope).

`pom.xml`

Maven Surefire Plugin

Test goal configuration

To configure the **test** phase and generate report(s). For now:

- we can exlude artifacts from the classpath at the test phase
- we can configure TestNG `suite.xml` to separate the integration and the unit tests

```
<build>
  [..]
  <plugins>
    <plugin>
      <groupId>org.apache.maven.plugins</groupId>
      <artifactId>maven-surefire-plugin</artifactId>
      <version>2.19.1</version>
      <configuration>
        [..]
      </configuration>
    </plugin>
  </plugins>
</build>
```

Maven Persistence project

Surefire plugin configuration

To exlude an artifact: set the *artifact* URI at the appropriate element.

```
<build>
  [..]
  <plugins>
    <plugin>
      <groupId>org.apache.maven.plugins</groupId>
      <artifactId>maven-surefire-plugin</artifactId>
      <version>${version.plugin.surefire}</version>
      <configuration>
        <classpathDependencyExcludes>
          <classpathDependencyExclude>javax:javaee-api</classpathDepe
        </classpathDependencyExcludes>
        <suiteXmlFiles>
          <suiteXmlFile>src/test/resources/testng-integration.xml</su
        </suiteXmlFiles>
      </configuration>
    </plugin>
  </plugins>
</build>
```

pom.xml

src | test | resources | log4j.xml

```
1  <?xml version="1.0" encoding="UTF-8" ?>
2  <!DOCTYPE log4j:configuration SYSTEM "log4j.dtd">
3  <log4j:configuration debug="true"
4    xmlns:log4j='http://jakarta.apache.org/log4j/'>
5
6    <appender name="console" class="org.apache.log4j.ConsoleAppender">
7        <layout class="org.apache.log4j.PatternLayout">
8      <param name="ConversionPattern"
9        value="%d{yyyy-MM-dd HH:mm:ss} %-5p %c{1}:%L - %m%n" />
10       </layout>
11   </appender>
12
13   <root>
14     <level value="DEBUG" />
15     <appender-ref ref="console" />
16   </root>
17
18 </log4j:configuration>
```

log4j.xml

The detailed logs are very useful during implementation and testing. During the integration test running there is no JavaEE container which initialize the logging, we have to do that instead.

Integration test

Preparations

```
1  package hu.qwaevisz.bookstore.persistence.service;
2  [..]
3  public class BookServiceImplIntegrationTest {
4
5    private static final String PERSISTENCE_UNIT = "bs-persistence-test-unit";
6
7    private BookServiceImpl object;
8
9    @BeforeClass
10   private void setUp() {
11     final EntityManagerFactory factory =
           Persistence.createEntityManagerFactory(PERSISTENCE_UNIT);
12     final EntityManager entityManager = factory.createEntityManager();
13
14     this.object = new BookServiceImpl();
15     this.object.setEntityManager(entityManager);
16   }
17
18   [..]
19
20   @AfterClass
21   private void tearDown() {
22     this.object.getEntityManager().close();
23   }
24 }
```

We have to create a default/protected setEntitymanager() mutator method in the production source to "inject" the local entityManager :(

BookServiceImplIntegrationTest.java

Integration test

Test the query behind the `read()` method

We have to differentiate the integration test methods with the `integration` group.

```
1  public class BookServiceImplIntegrationTest {
2    [..]
3    @Test(groups = "integration")
4    private void readSampleBookFromDatabase() throws PersistenceServiceException {
5      final Book book = this.object.read("978-0441172719");
6      this.assertBook(book, "978-0441172719", "Frank Herbert", "Dune",
           BookCategory.SCIFI, 896, 3500d);
7    }
8
9    private void assertBook(final Book book, final String isbn, final String author,
         final String title, final BookCategory category,
10       final Integer numberOfPages, final double price) {
11     Assert.assertEquals(book.getIsbn(), isbn);
12     Assert.assertEquals(book.getAuthor(), author);
13     Assert.assertEquals(book.getTitle(), title);
14     Assert.assertEquals(book.getCategory(), category);
15     Assert.assertEquals(book.getNumberOfPages(), numberOfPages);
16     Assert.assertEquals(book.getPrice(), price);
17   }
18   [..]
19 }
```

BookServiceImplIntegrationTest.java

Integration test

Data manipulation in transaction

```
1  public class BookServiceImplIntegrationTest {
2    [..]
3    private static final String NEW_BOOK_ISBN = "42-NEW-BOOK-ISBN";
4
5    @Test(groups = "integration")
6    private void createABook() throws PersistenceServiceException {
7      if (this.object.exists(NEW_BOOK_ISBN)) {
8        this.object.getEntityManager().getTransaction().begin();
9        this.object.delete(NEW_BOOK_ISBN);
10       this.object.getEntityManager().getTransaction().commit();
11     }
12
13     this.object.getEntityManager().getTransaction().begin();
14     this.object.create(NEW_BOOK_ISBN, "Lorem Ipsum", "Sample book", 142, 999,
           BookCategory.HISTORICAL);
15     this.object.getEntityManager().getTransaction().commit();
16
17     final Book book = this.object.read(NEW_BOOK_ISBN);
18     this.assertBook(book, NEW_BOOK_ISBN, "Lorem Ipsum", "Sample book",
           BookCategory.HISTORICAL, 142, 999);
19   }
20   [..]
21 }
```

There is no EJB container which can handle the transactions. We have to manage that in case of data manipulation. It would be good if the test will be *rerunable* as well.

BookServiceImplIntegrationTest.java

Integration TestNG suites

src | test | **resources** | testng-*.xml

```xml
<!DOCTYPE suite SYSTEM "http://testng.org/testng-1.0.dtd" >
<suite name="integration-test-suite" verbose="1" >
  <test name="bookservice">
    <classes>
      <class name="hu.[..].service.BookServiceImplIntegrationTest" />
      <class name="hu.[..].service.BookSearchImplIntegrationTest" />
    </classes>
  </test>
</suite>
```

testng-integration.xml

```xml
<!DOCTYPE suite SYSTEM "http://testng.org/testng-1.0.dtd" >
<suite name="unit-test-suite" verbose="1">
  <test name="bookservice">
    <groups>
      <run>
        <exclude name="integration" />
      </run>
    </groups>
    <packages>
      <package name="hu.[..].service.*" />
    </packages>
  </test>
</suite>
```

All the methods which located in the named package are unit tests, except which belongs to the integration group.

testng-unit.xml