UNIVERSITÀ DI PISA

AI-DII

Hands-on session 6: JMS

Distributed Systems and Middleware Technologies

2023/2024

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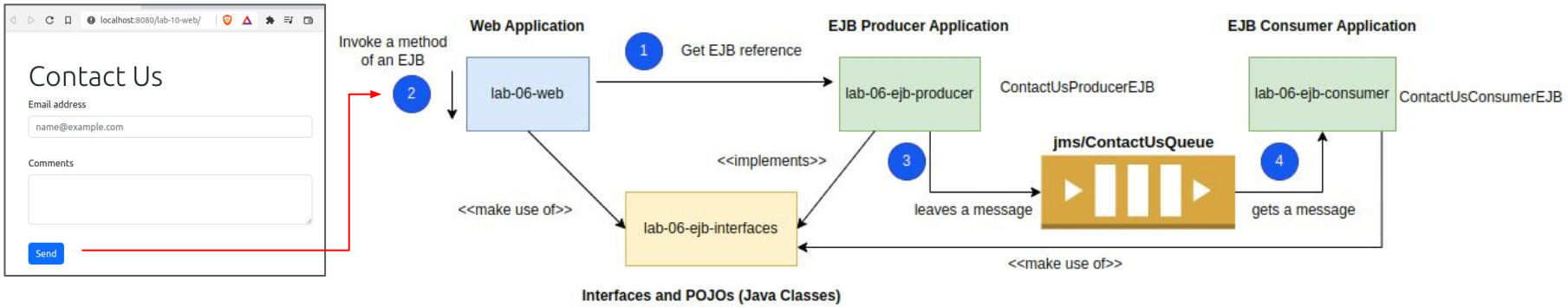
Agenda

1. Java Enterprise Application - JMS Project
2. Step 1: creating a queue in Glassfish
3. Step 2: defining the interfaces - pojos project
4. Step 3: defining the EJB Consumer Application project
5. Step 4: defining the EJB Producer Application project
6. Step 5: defining the Web Application project
7. Step 6: deployment in Glassfish
8. Exercises

Java Enterprise Application Project



Projects description:

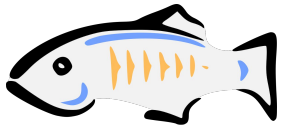
lab-06-web: It defines JSP, static resources, Servlets, etc.

lab-06-ejb-producer: It defines EJB (Our Business Logic). An EJB in this project will leave messages into a queue.

lab-06-ejb-interfaces: It defines the method signatures and data types to be used in the EJBs definition.

lab-06-ejb-consumer: An EJB in this project receives messages asynchronously from a queue.

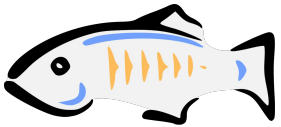
Exercise 01: Project creation



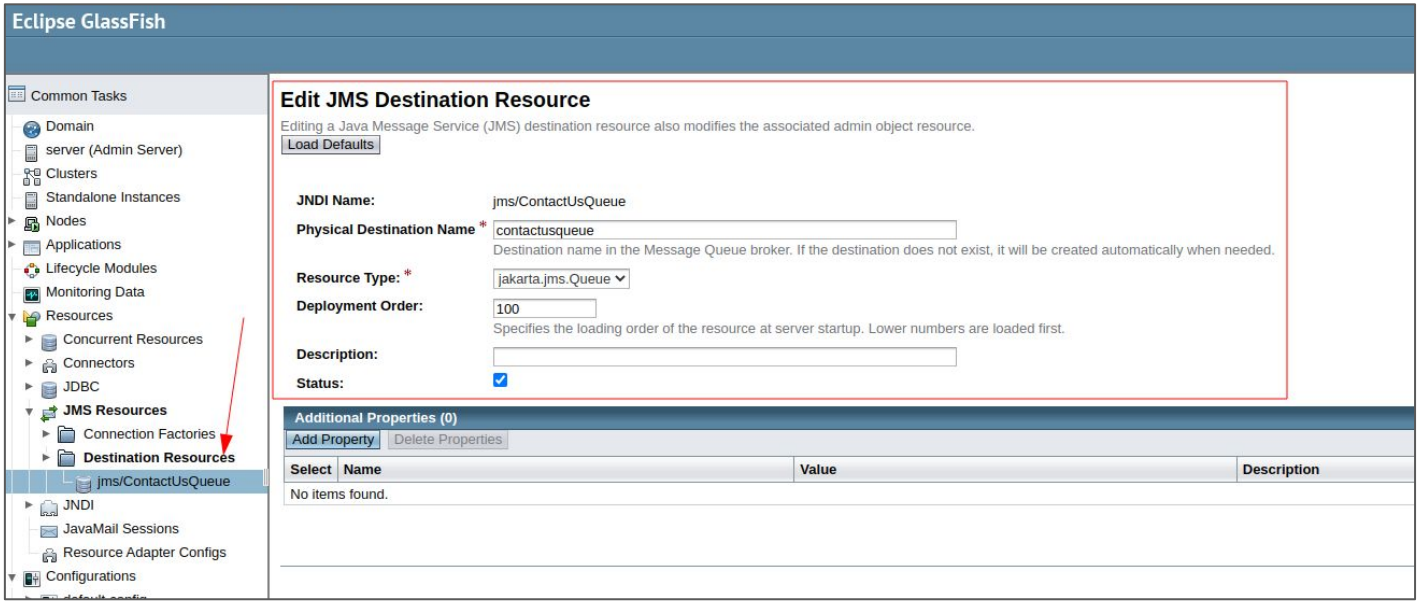
For this exercise, it is required to define and create a project with some modules.

You are free to propose a project organization.

Step 1: creating a queue in Glassfish



Open the Glassfish Administration console and navigate to the Resources -> JMS Resources -> Destination Resources option in the navigation menu. The JMS Destination Resources will be displayed and there click on the button **New…** and fill in the information of the next page as it is shown in the screenshot below:

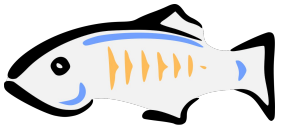


Do not use special characters (+,-,/,_,@, etc) in the Physical Destination Name field.

Exercise 02: JMS Queue Creation

For this exercise, it is required to create the Queue ContactUsQueue as it was shown in the previous slide.

Step 2: defining the interfaces - pojos project



As first step, we have to define a project with the interfaces and pojos (Java classes) to interact with the EBJs.
Project: lab-06-ejb-interfaces. After every code update in this project, run the "install" lifecycle.
Important: If you define POJOs, make sure they implement the interface Serializable.

```xml
<project xmlns="http://maven.apache.org/POM/4.0.0"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
 xsi:schemaLocation="http://maven.apache.org/POM/4.0.0
http://maven.apache.org/xsd/maven-4.0.0.xsd">
 <modelVersion>4.0.0</modelVersion>
 <groupId>it.unipi.dsmt.jakartaee</groupId>
 <artifactId>lab-06-ejb-interfaces</artifactId>
 <version>1.0.0-SNAPSHOT</version>
 <packaging>jar</packaging>
 <name>${artifactId}</name>
 <properties>
   <project.build.sourceEncoding>UTF-8</project.build.sourceEncoding>
   <maven.compiler.source>11</maven.compiler.source>
   <maven.compiler.target>11</maven.compiler.target>
 </properties>
 <dependencies>
   <dependency>
     <groupId>jakarta.platform</groupId>
     <artifactId>jakarta.jakartaee-api</artifactId>
     <version>10.0.0</version>
     <scope>provided</scope>
   </dependency>
 </dependencies>
</project>
```

pom.xml

```java
package it.unipi.dsmt.jakartaee.lab_10_ejb_interfaces.interfaces ;

import it.unipi.dsmt.jakartaee.lab_10_ejb_interfaces.dto.ContactUsDTO ;
import jakarta.ejb.Remote;

@Remote
public interface ContactUsEJB {
   void processContactUsDTO (ContactUsDTO contactUsDTO);
}
```

ContactUsEJB.java

Step 3: defining the EJB Consumer Application project (1)

Next, we have to define a project which implements the interfaces defined in the step 1. **Project: lab-06-ejb-consumer**

```
<groupId>it.unipi.dsmt.jakartaee</groupId>
<artifactId>lab-06-ejb-consumer</artifactId>
<version>1.0.0-SNAPSHOT</version>
<packaging>jar</packaging>
<name>${artifactId}</name>
<properties>

<project.build.sourceEncoding>UTF-8</project.build.sourceEncodi
ng>
 <maven.compiler.source>11</maven.compiler.source>
 <maven.compiler.target>11</maven.compiler.target>
</properties>
<dependencies>
 <dependency>
   <groupId>it.unipi.dsmt.jakartaee</groupId>
   <artifactId>lab-06-ejb-interfaces</artifactId>
   <version>1.0.0-SNAPSHOT</version>
 </dependency>
 <dependency>
   <groupId>jakarta.platform</groupId>
   <artifactId>jakarta.jakartaee-api</artifactId>
   <version>10.0.0</version>
   <scope>provided</scope>
 </dependency>
</dependencies>
```

Piece of pom.xml

Step 3: defining the EJB Consumer Application project (2)

Next, we have to define a project receives messages from the defined Queue. **Project: lab-06-ejb-consumer**

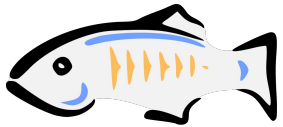
```
package it.unipi.dsmt.jakartaee.lab_10_ejb.consumer;

import it.unipi.dsmt.jakartaee.lab_10_ejb_interfaces.dto.ContactUsDTO;
import jakarta.ejb.ActivationConfigProperty;
import jakarta.ejb.MessageDriven;
import jakarta.jms.JMSException;
import jakarta.jms.Message;
import jakarta.jms.MessageListener;

@MessageDriven(name = "ConsumerEJB",
        activationConfig = {
                @ActivationConfigProperty(propertyName = "destinationLookup", propertyValue = "jms/ContactUsQueue"),
                @ActivationConfigProperty(propertyName = "destinationType", propertyValue = "jakarta.jms.Queue")
        })
public class ContactUsConsumerEJB implements MessageListener {
        @Override
        public void onMessage(Message message) {
                ContactUsDTO contactUsDTO= null;
                try {
                        contactUsDTO = message.getBody(ContactUsDTO.class);
                        System.out.println("Message on consumer: "+ contactUsDTO);
                } catch (JMSException e) {
                        e.printStackTrace();
                }
        }
}
```

ContactUsConsumerEJB.java

Exercise 03: EJB consumer implementation and deployment

For this exercise, it is required to implement and deploy the lab-06-ejb-consumer module in Glassfish.

Step 4: defining the EJB Producer Application project (1)



Next, we have to define a project which implements the interfaces defined in the step 1. **Project: lab-06-ejb-producer**

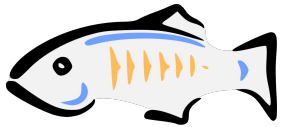
```xml
<project xmlns="http://maven.apache.org/POM/4.0.0"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
 xsi:schemaLocation="http://maven.apache.org/POM/4.0.0
http://maven.apache.org/xsd/maven-4.0.0.xsd">
 <modelVersion>4.0.0</modelVersion>
 <groupId>it.unipi.dsmt.jakartaee</groupId>
 <artifactId>lab-06-ejb-producer</artifactId>
 <version>1.0.0-SNAPSHOT</version>
 <packaging>jar</packaging>
 <name>${artifactId}</name>
 <properties>
   <project.build.sourceEncoding>UTF-8</project.build.sourceEncoding>
   <maven.compiler.source>11</maven.compiler.source>
   <maven.compiler.target>11</maven.compiler.target>
 </properties>
 <dependencies>
   <dependency>
     <groupId>it.unipi.dsmt.jakartaee</groupId>
     <artifactId>lab-06-ejb-interfaces</artifactId>
     <version>1.0.0-SNAPSHOT</version>
   </dependency>
   <dependency>
     <groupId>jakarta.platform</groupId>
     <artifactId>jakarta.jakartaee-api</artifactId>
     <version>10.0.0</version>
     <scope>provided</scope>
   </dependency>
 </dependencies>
</project>
```

pom.xml

```java
@Stateless(mappedName = "ContactUsProducerEJB" )
public class ContactUsProducerEJB implements ContactUsEJB {
   static final String QC_FACTORY_NAME = "jms/  defaultConnectionFactory" ;
   static final String QUEUE_NAME = "jms/ContactUsQueue" ;
   private Queue queue;
   private JMSContext jmsContext;

   public ContactUsProducerEJB () {
       try{
           Context ic = new InitialContext();
           queue = (Queue) ic.lookup(QUEUE_NAME);
           QueueConnectionFactory qcf =
(QueueConnectionFactory )ic.lookup(QC_FACTORY_NAME);
           jmsContext = qcf.createContext();
       }
       catch (NamingException e) {
           System.err.println("Unable to initialize ContactUsProducerEJB EJB." );
           e.printStackTrace();
       }
   }
   @Override
   public void processContactUsDTO (ContactUsDTO contactUsDTO) {
       System.out.println("call ContactUsProducerEJB.processContactUsDTO" );
       jmsContext.createProducer().send( queue, contactUsDTO);
   }
}
```

Piece of ContactUsProducerEJB.java

Step 4: defining the EJB Producer Application project (2)



From JMS 2.0 we can simplified the configuration by injecting a JMSContext instance. This is a new object that combines Connection and Session capabilities. **Project: lab-06-ejb-producer**

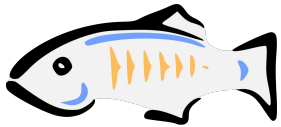
```xml
<project xmlns="http://maven.apache.org/POM/4.0.0"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
 xsi:schemaLocation="http://maven.apache.org/POM/4.0.0
http://maven.apache.org/xsd/maven-4.0.0.xsd">
 <modelVersion>4.0.0</modelVersion>
 <groupId>it.unipi.dsmt.jakartaee</groupId>
 <artifactId>lab-06-ejb-producer</artifactId>
 <version>1.0.0-SNAPSHOT</version>
 <packaging>jar</packaging>
 <name>${artifactId}</name>
 <properties>
   <project.build.sourceEncoding>UTF-8</project.build.sourceEncoding>
   <maven.compiler.source>11</maven.compiler.source>
   <maven.compiler.target>11</maven.compiler.target>
 </properties>
 <dependencies>
   <dependency>
     <groupId>it.unipi.dsmt.jakartaee</groupId>
     <artifactId>lab-06-ejb-interfaces</artifactId>
     <version>1.0.0-SNAPSHOT</version>
   </dependency>
   <dependency>
     <groupId>jakarta.platform</groupId>
     <artifactId>jakarta.jakartaee-api</artifactId>
     <version>10.0.0</version>
     <scope>provided</scope>
   </dependency>
 </dependencies>
</project>
```

pom.xml

```java
@Stateless(mappedName = "ContactUsProducerEJBV2")
public class ContactUsProducerEJBV2 implements ContactUsEJB {

   @Resource(lookup = "jms/ContactUsQueue")
   private Queue queue;
   @Inject
   private JMSContext jmsContext;
   @Override
   public void processContactUsDTO(ContactUsDTO contactUsDTO) {
       System.out.println("call ContactUsProducerEJBV2.processContactUsDTO");
       jmsContext.createProducer().send(queue, contactUsDTO);
   }
}
```

Piece of ContactUsProducerEJBV2.java

Exercise 04: EJB producer implementation and deployment



For this exercise, it is required to implement and deploy the lab-06-ejb-producer module in Glassfish.

Step 5: defining the Web Application project

In our Web Application, EJBs references are obtained by using the **@EJB annotation**. **Project: lab-06-web**

```
<groupId>it.unipi.dsmt.jakartaee</ groupId>
<artifactId>lab-06-web</ artifactId>
<packaging>war</packaging>
<version>1.0.0-SNAPSHOT</ version>
<properties>
 <maven.compiler.source >11</maven.compiler.source >
 <maven.compiler.target >11</maven.compiler.target >
</properties>
<name>${artifactId}</ name>
<dependencies>
 <dependency>
   <groupId>it.unipi.dsmt.jakartaee</ groupId>
   <artifactId>lab-06-ejb-interfaces</ artifactId>
   <version>1.0.0-SNAPSHOT</ version>
 </dependency>
 <dependency>
   <groupId>jakarta.platform</ groupId>
   <artifactId>jakarta.jakartaee-api</ artifactId>
   <version>10.0.0</version>
   <scope>provided</ scope>
 </dependency>
</dependencies>
```

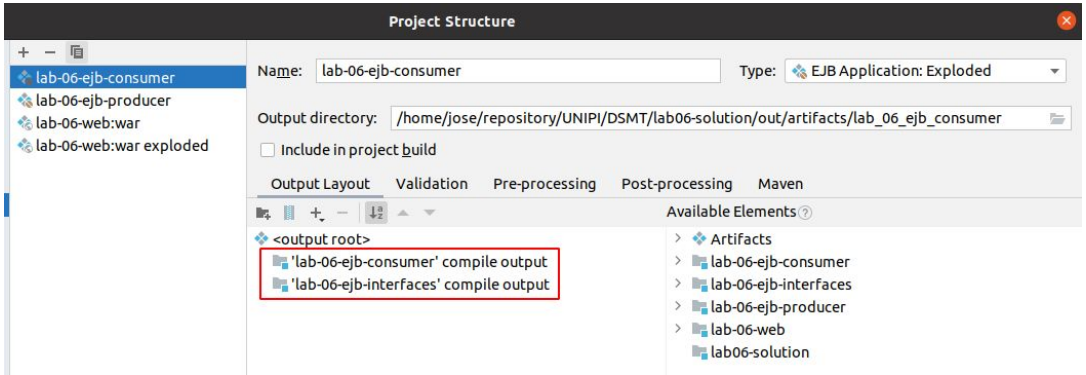
Piece of pom.xml

```
@WebServlet(name = "ContactUsServlet", value = "/ContactUsServlet")
public class ContactUsServlet extends HttpServlet {
   @EJB(mappedName = "ContactUsProducerEJBV2")
   private ContactUsEJB contactUsEJB;

   @Override
   protected void doPost(HttpServletRequest request, HttpServletResponse response)
           throws ServletException, IOException {
       String email = request.getParameter("email");
       String comments = request.getParameter("comments");
       ContactUsDTO dto = new ContactUsDTO();
       dto.setEmail(email);
       dto.setComments(comments);
       contactUsEJB.processContactUsDTO(dto);
       response.sendRedirect("contact-us-form-jms.jsp");
   }
}
```

ContactUsServlet.java

Step 6: Deployment in Glassfish (1)

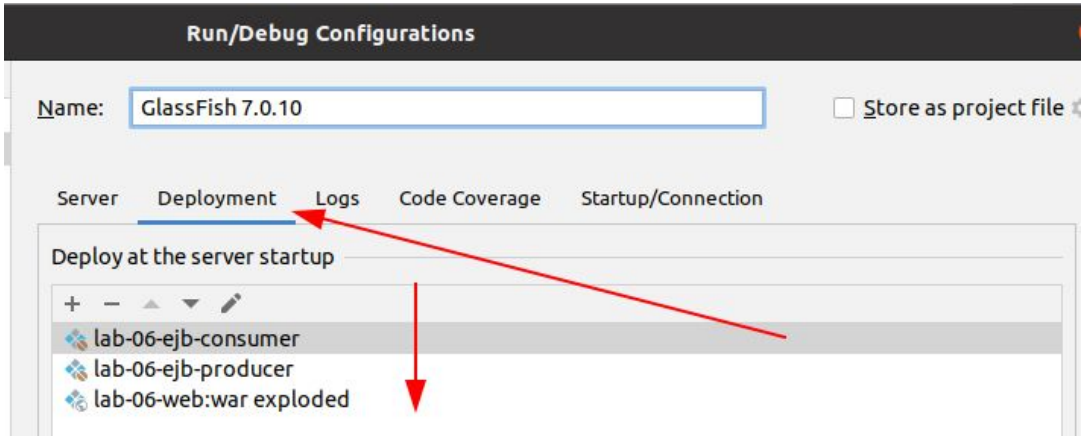
We have to configure properly our **“EJB Applications”**. To do so, go to **File -> Project Structure** and add the compile output of the **lab-06-ejb-interfaces** project to your artifact by double clicking on it. As a result, you should have set the configuration shown in the next image:



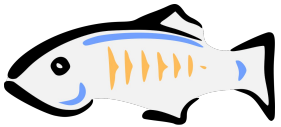
Repeat the same steps for the **lab-06-ejb-producer**.

Step 6: Deployment in Glassfish (2)

There exist a dependency in during the initialization of the projects. Remember that the **lab-06-web** application needs to inject some EJB references so the **lab-06-ejb-producer** project needs to be deployed first.



Exercise 05: Web App implementation and deployment



For this exercise, it is required to implement and deploy the lab-06-web module in Glassfish.

Exercise 06: Fetching remote EJB

For this exercise, lets deploy the lab-06-web application into an Apache Tomcat server. Make the necessary changes to fetch the ContactUsProducerEJB EJB reference.

Exercise 07: Shopping Cart Checkout

An exercise in our previous lab session was to implement the shopping cart functionality. In the **“View Cart”** page, add a checkout button. When this button is pressed, the information of the products selected in the shopping cart are sent to an **EJB** which will put them into a **queue**. Later, another **EJB** will pick them up and prints into the console the items that was left into the queue.

References

- https://jakarta.ee/specifications/messaging/3.0/jakarta-messaging-spec-3.0.html
- http://devdoc.net/javaxe/JavaEE-7u2/docs/javaee-tutorial/doc/jms-examples002.htm
- https://www.javacodegeeks.com/2013/05/java-ee-7-jms-2-0-with-glassfish-v4.html
- https://stackoverflow.com/questions/7443306/javaee-6-javax-naming-namealreadyboundexception-use-rebind-to-override
- https://medium.com/platform-engineer/web-api-design-35df8167460
- https://blogs.oracle.com/javamagazine/post/how-to-build-applications-with-the-websocket-api-for-java-ee-and-jakarta-ee
- https://jakarta.ee/specifications/websocket/2.0/websocket-spec-2.0.html