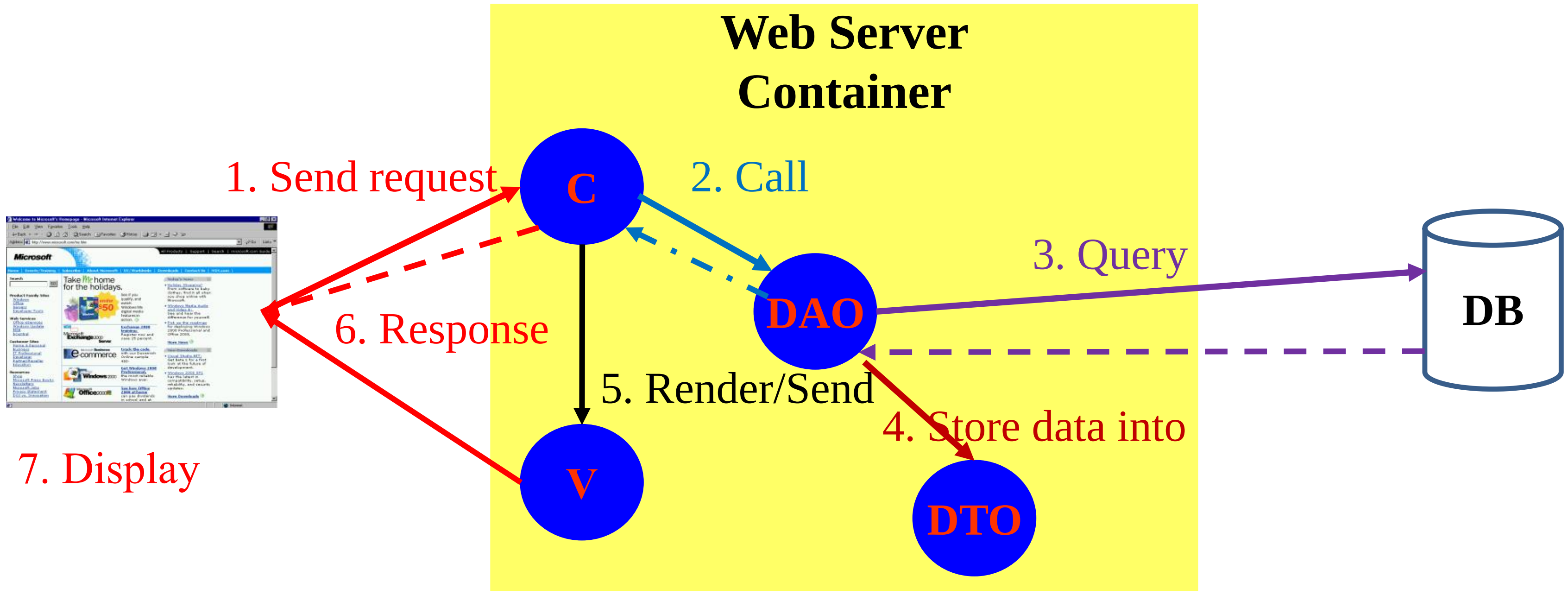
Introduction to Enterprise Java Beans

Introduction to EJBs
EJB Ecosystem
Enterprise Beans
What Constitutes an EJB?
JNDI

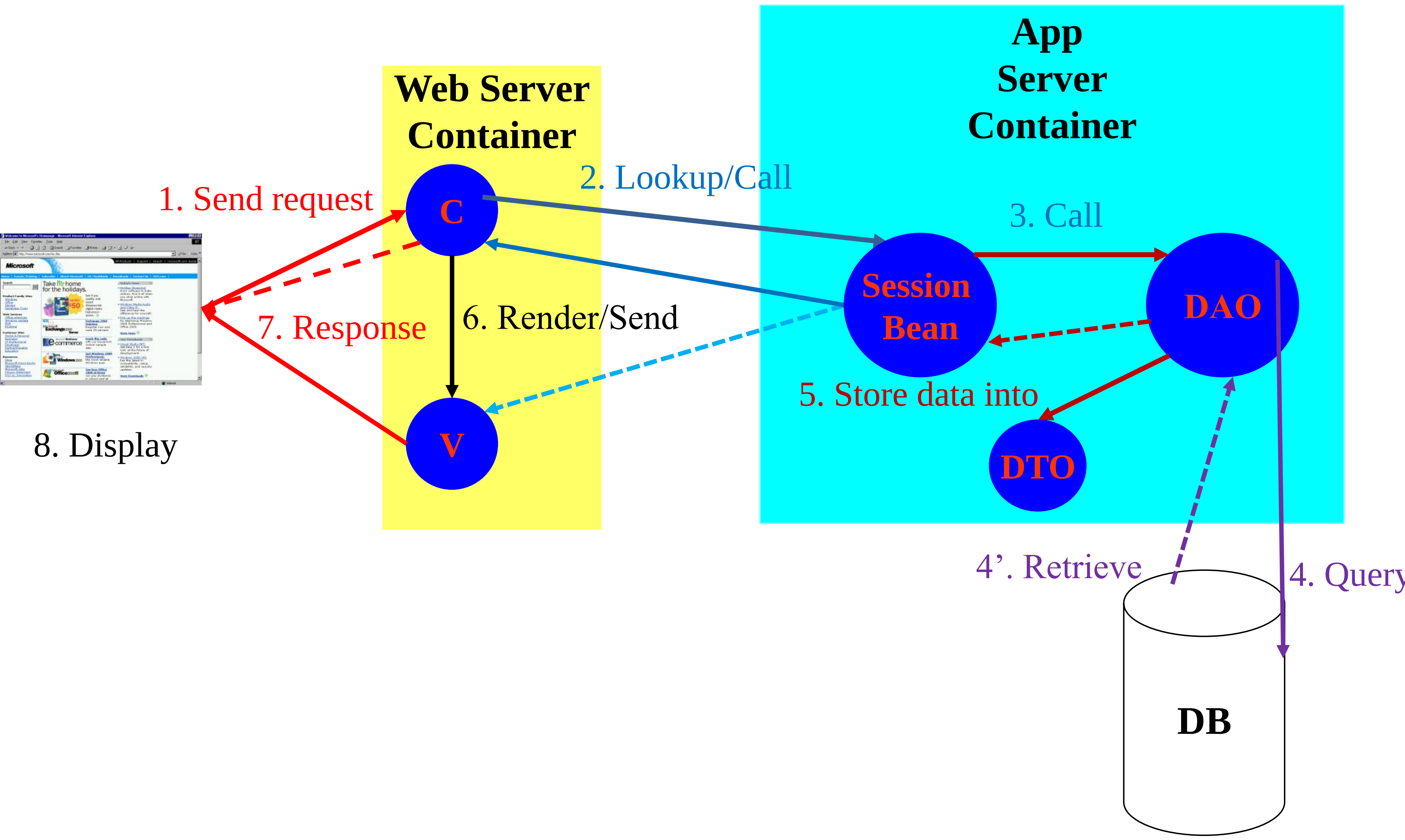
Review

- **JSTL**
  - Core, Functions, Sql
- **Custom Tag Libraries**
  - Classic Tags
  - Simple Tags
  - Tag Files
  - Tag components
    - Create tld, create tag handler class, import taglib in jsp file
  - Implementation
    - Tag without attributes, tag with attributes, empty tag, tag with body, iterative tag

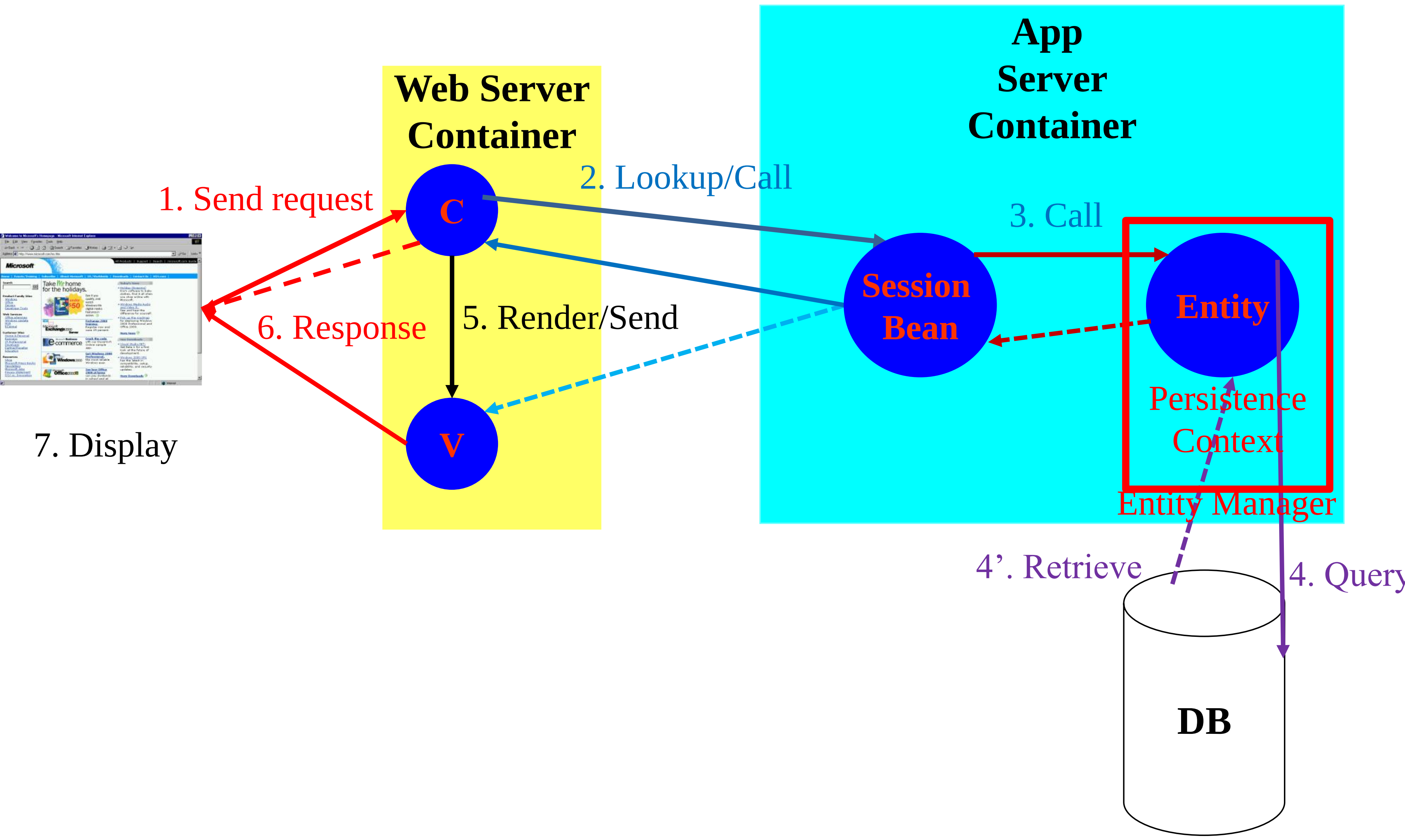
Review


Web Server Container
1. Send request
C
2. Call
3. Query
DB
DAO
6. Response
5. Render/Send
4. Store data into
7. Display
V
DTO

Overview


Web Server Container
App Server Container
C
V
Session Bean
DAO
DTO
DB
1. Send request
2. Lookup/Call
3. Call
4. Query
4'. Retrieve
5. Store data into
6. Render/Send
7. Response
8. Display

Overview

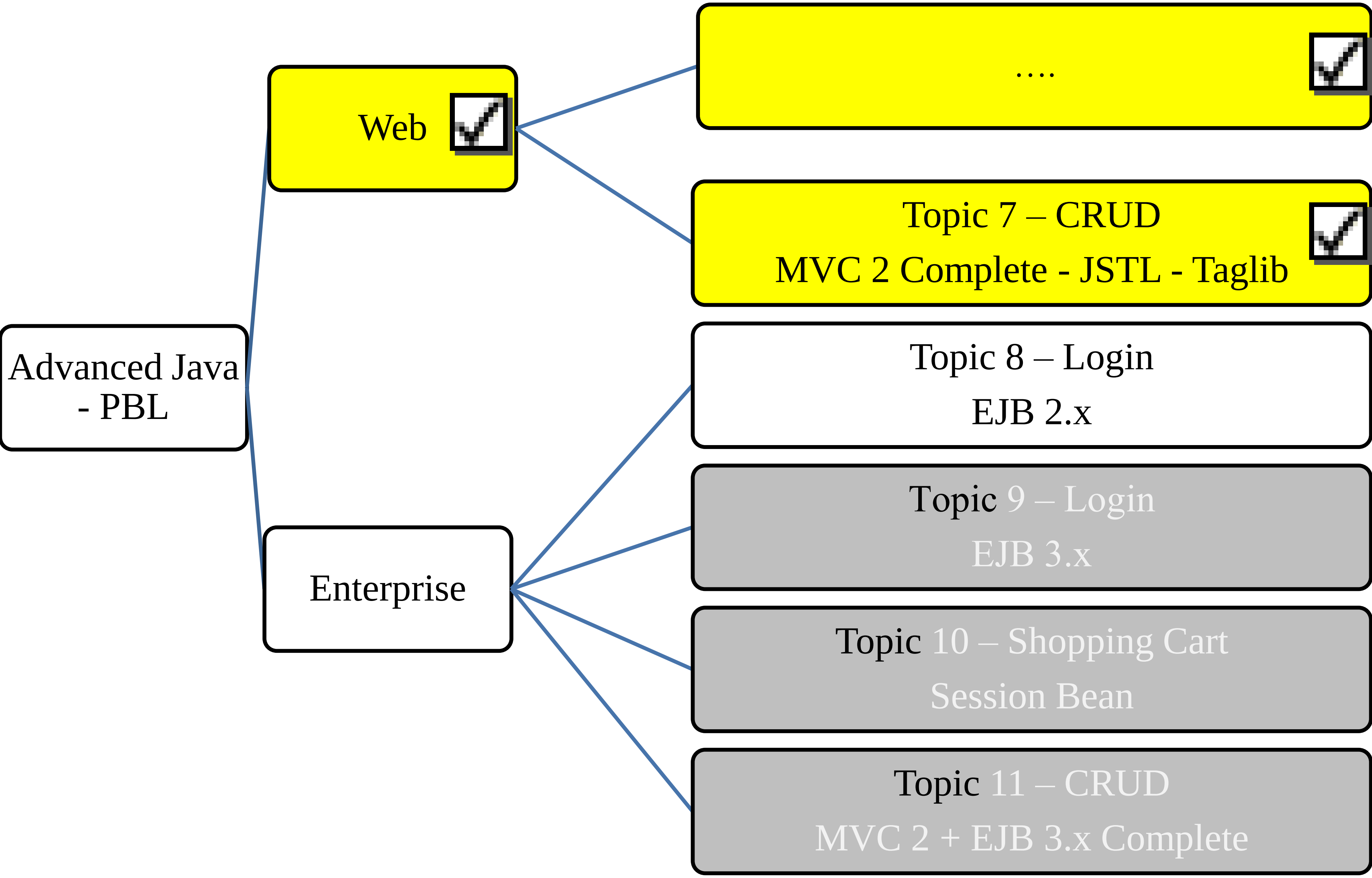


Web Server Container
App Server Container
1. Send request
C
2. Lookup/Call
3. Call
Session Bean
Entity
Persistence Context
Entity Manager
5. Render/Send
6. Response
V
7. Display
4'. Retrieve
4. Query
DB

Objectives

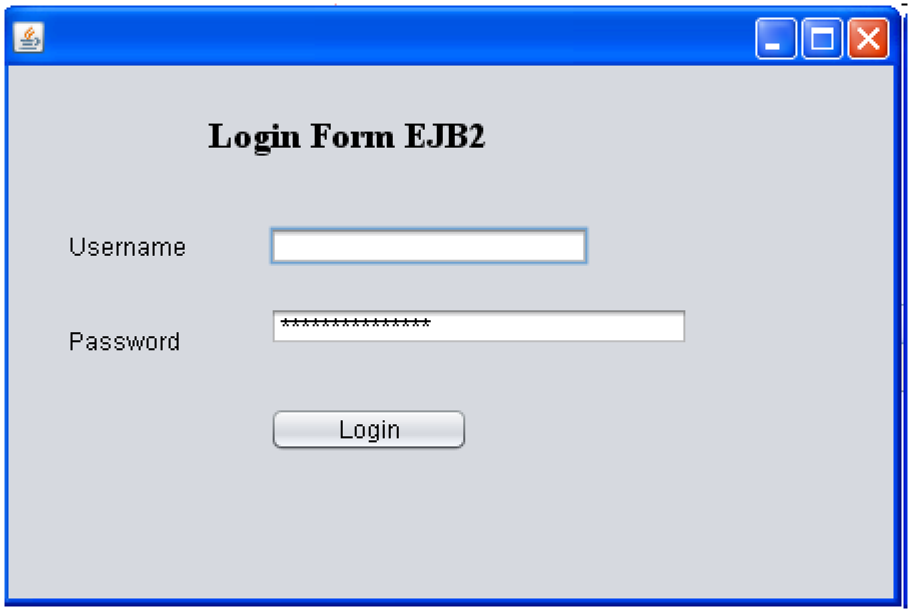
- **How to build the simple enterprise application – Login – using EJB 2.0 with GUI as Swing or web?**
  - Logical Architecture of EJB
  - Components of EJB
  - Accessing EJB from the Client/Web Side
  - File and Directory Structure of Enterprise Applications

Objectives


Advanced Java - PBL
Web ✓
Enterprise
…. ✓
Topic 7 – CRUD
MVC 2 Complete - JSTL - Taglib ✓
Topic 8 – Login
EJB 2.x
Topic 9 – Login
EJB 3.x
Topic 10 – Shopping Cart
Session Bean
Topic 11 – CRUD
MVC 2 + EJB 3.x Complete

Build the simple enterprise application

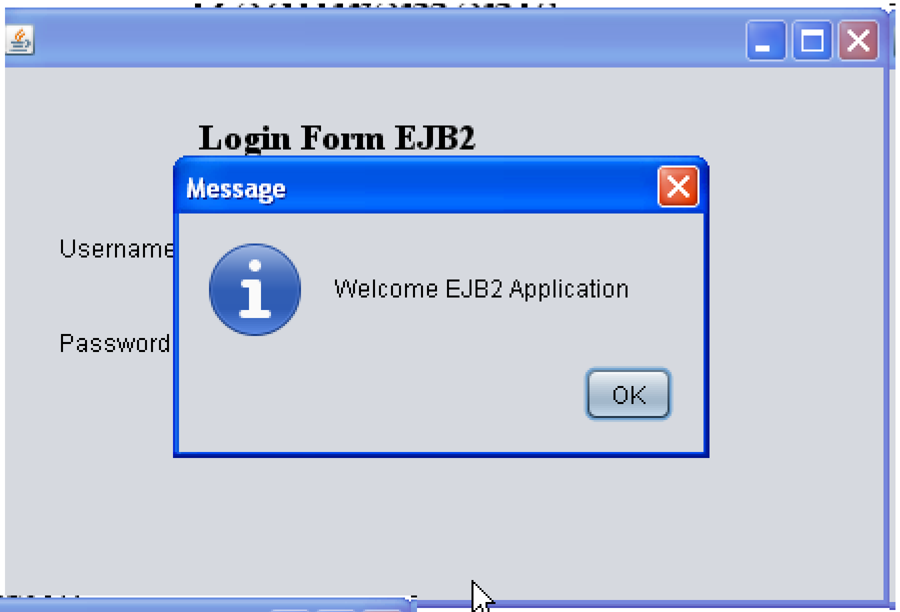
Requirements



Login Form EJB2

Username

Password ****************



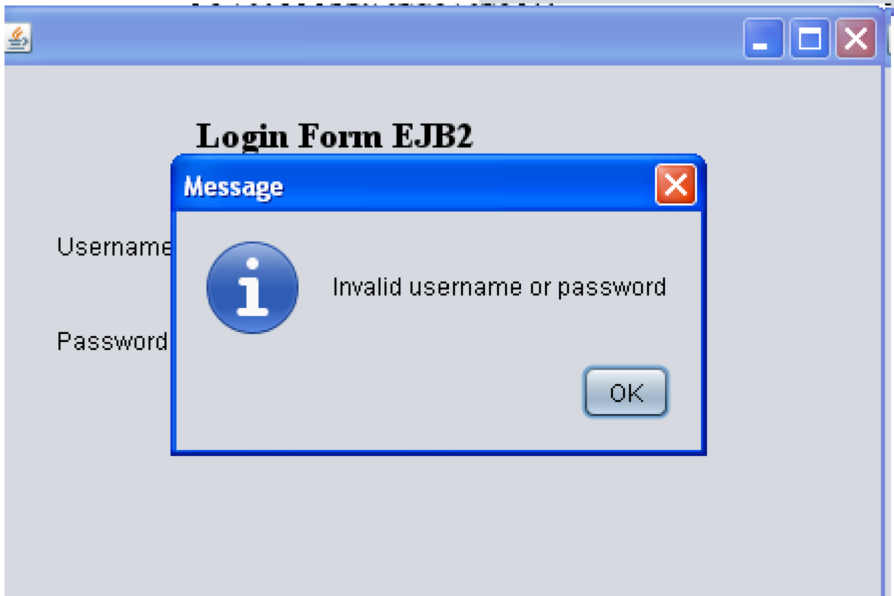
Login Form EJB2

Username

Password

Message

Welcome EJB2 Application



Login Form EJB2

Username

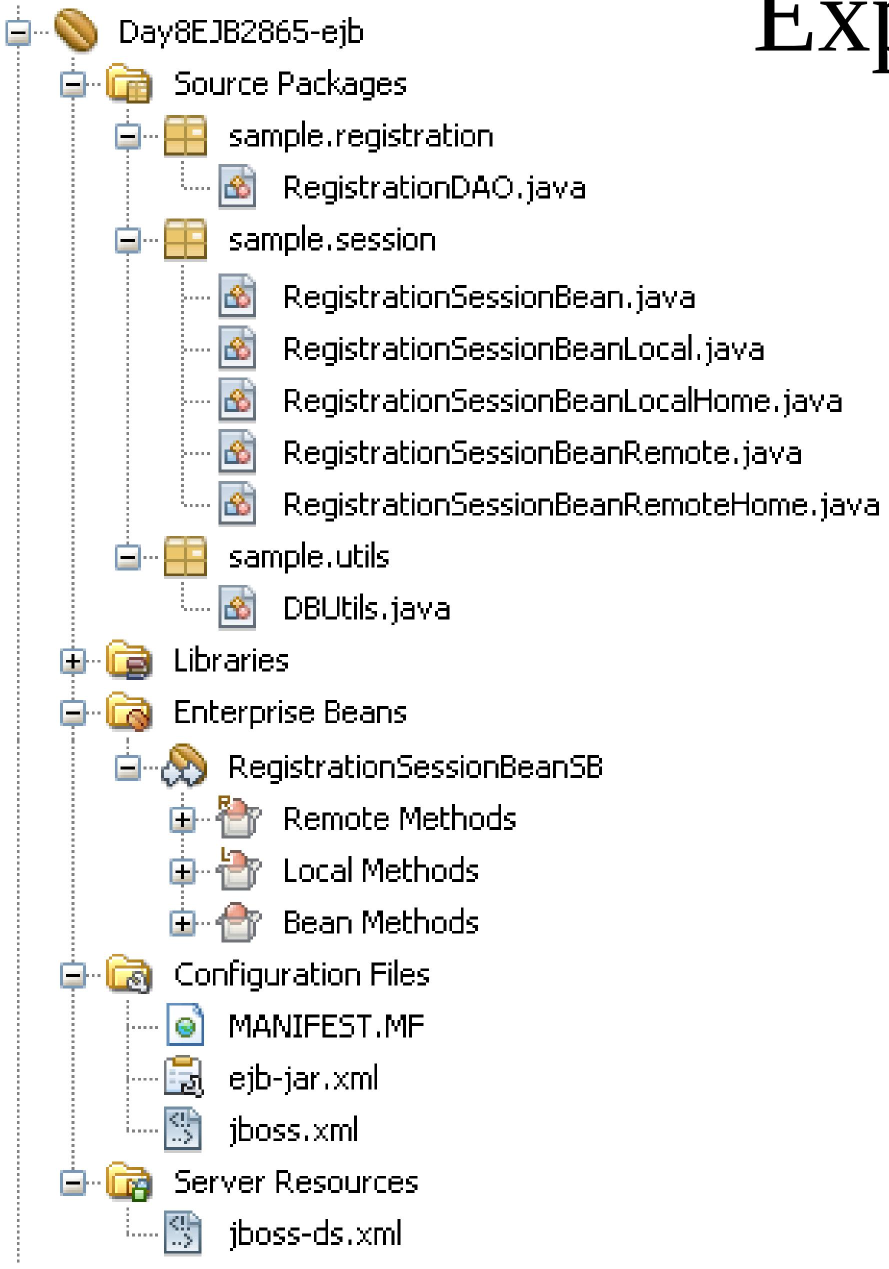
Password

Message

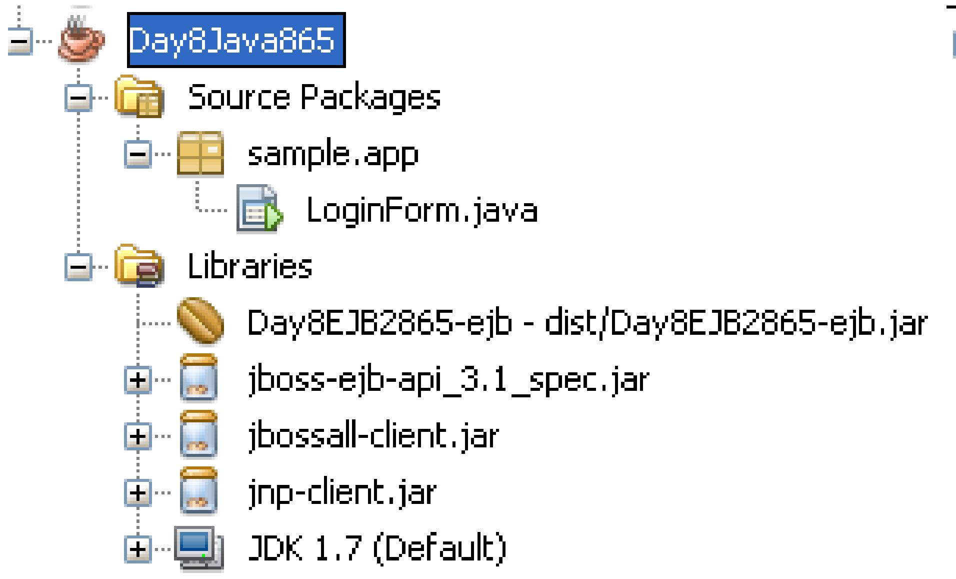
Invalid username or password

Build the simple enterprise application

Expectation



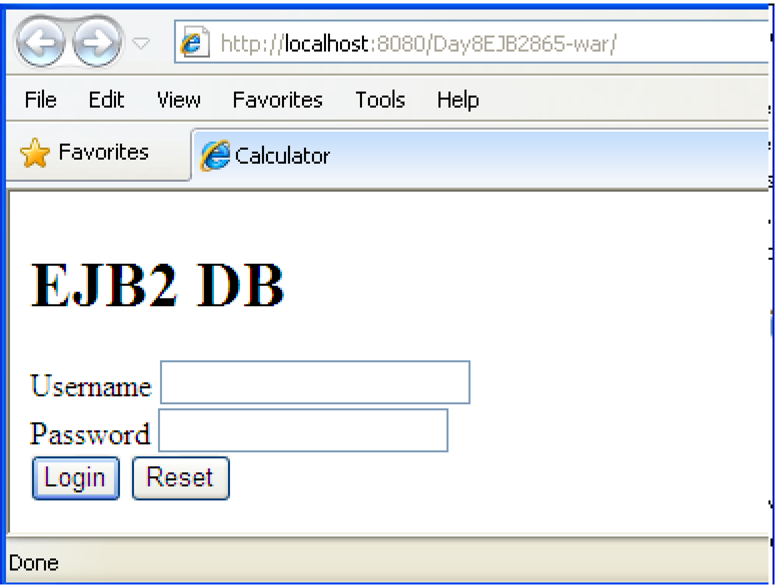
```
Day8EJB2865-ejb
  Source Packages
    sample.registration
      RegistrationDAO.java
    sample.session
      RegistrationSessionBean.java
      RegistrationSessionBeanLocal.java
      RegistrationSessionBeanLocalHome.java
      RegistrationSessionBeanRemote.java
      RegistrationSessionBeanRemoteHome.java
    sample.utils
      DBUtils.java
  Libraries
  Enterprise Beans
    RegistrationSessionBeanSB
      Remote Methods
      Local Methods
      Bean Methods
  Configuration Files
    MANIFEST.MF
    ejb-jar.xml
    jboss.xml
  Server Resources
    jboss-ds.xml
```



```
Day8Java865
  Source Packages
    sample.app
      LoginForm.java
  Libraries
    Day8EJB2865-ejb - dist/Day8EJB2865-ejb.jar
    jboss-ejb-api_3.1_spec.jar
    jbossall-client.jar
    jnp-client.jar
    JDK 1.7 (Default)
```

Build the simple enterprise application

Requirements


http://localhost:8080/Day8EJB2865-war/

File Edit View Favorites Tools Help

Favorites | Calculator

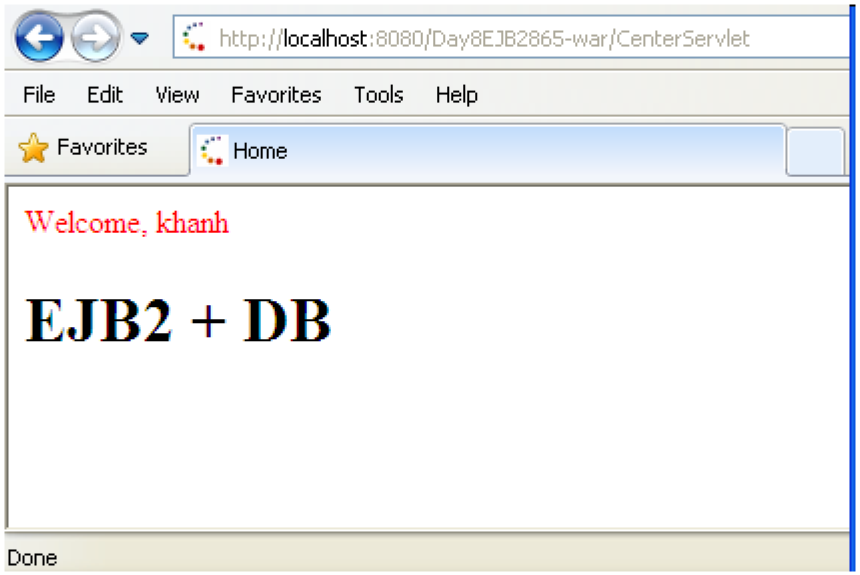
EJB2 DB

Username

Password

Login Reset

Done


http://localhost:8080/Day8EJB2865-war/CenterServlet

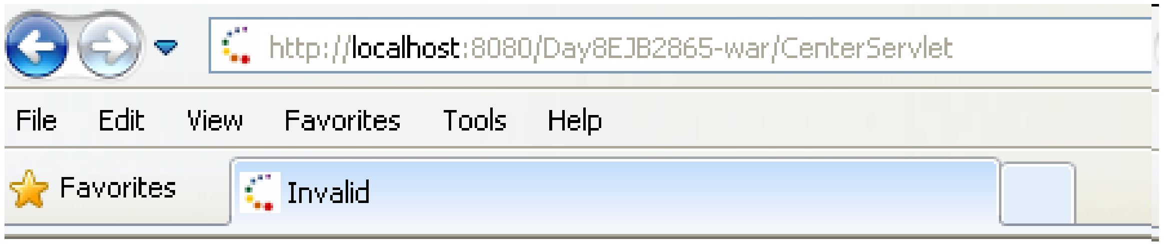
File Edit View Favorites Tools Help

Favorites | Home

Welcome, khanh

EJB2 + DB

Done


http://localhost:8080/Day8EJB2865-war/CenterServlet

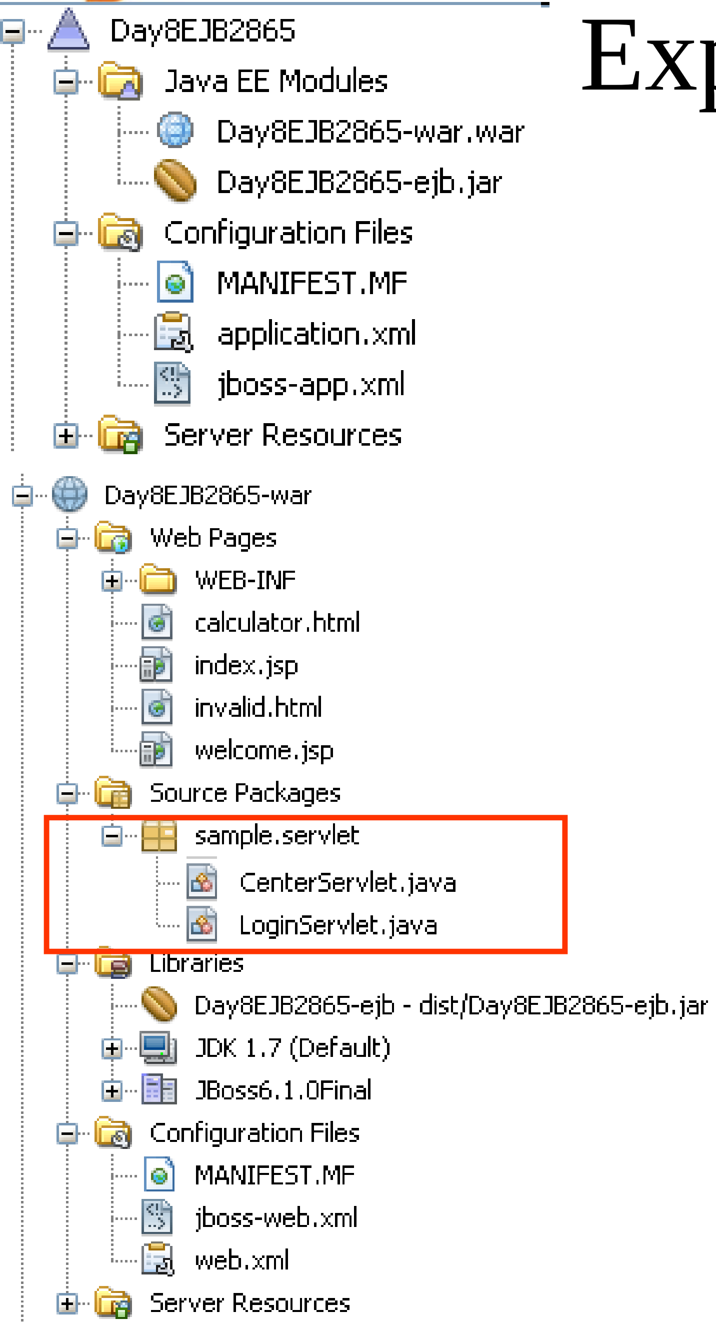
File Edit View Favorites Tools Help

Favorites | Invalid

Invalid username or password

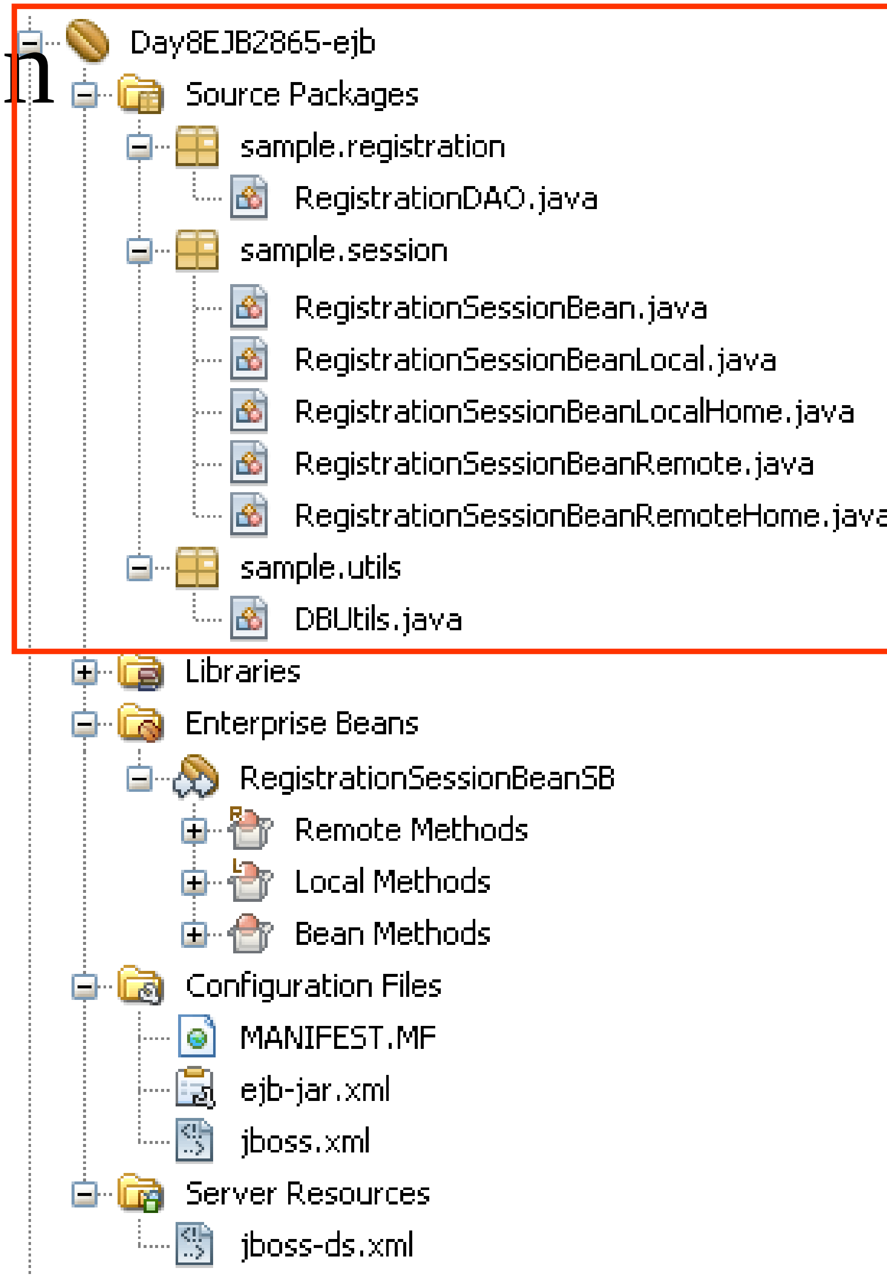
Build the simple enterprise application

Expectation



```
Day8EJB2865
  Java EE Modules
    Day8EJB2865-war.war
    Day8EJB2865-ejb.jar
  Configuration Files
    MANIFEST.MF
    application.xml
    jboss-app.xml
  Server Resources

Day8EJB2865-war
  Web Pages
    WEB-INF
    calculator.html
    index.jsp
    invalid.html
    welcome.jsp
  Source Packages
    sample.servlet
      CenterServlet.java
      LoginServlet.java
  Libraries
    Day8EJB2865-ejb - dist/Day8EJB2865-ejb.jar
    JDK 1.7 (Default)
    JBoss6.1.0Final
  Configuration Files
    MANIFEST.MF
    jboss-web.xml
    web.xml
  Server Resources
```



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    MANIFEST.MF
    ejb-jar.xml
    jboss.xml
  Server Resources
    jboss-ds.xml
```

Introduction to EJBs
Component

- Is a **piece of code** that **exhibits** the **behavior** of a **concept related** to the **real world**
- Can be **reused** in different applications
- **Main requirement** of a component is that it should **encapsulate** the **behavior** of an **application**
  - **Provides** a **set of services or functions**, such that it can easily interact with other applications or components
  - The **users are not aware** of the **internal processes** of the components in an application **but are aware** of **what they need** to **pass** in as **input and what** to **expect** as **output**
- **Component framework concept evolved** to **support development** and **deployment** of enterprise applications
- Components
  - Are **building blocks** of an application
  - Are **distributed over various tiers**

Introduction to EJBs

Component Architecture

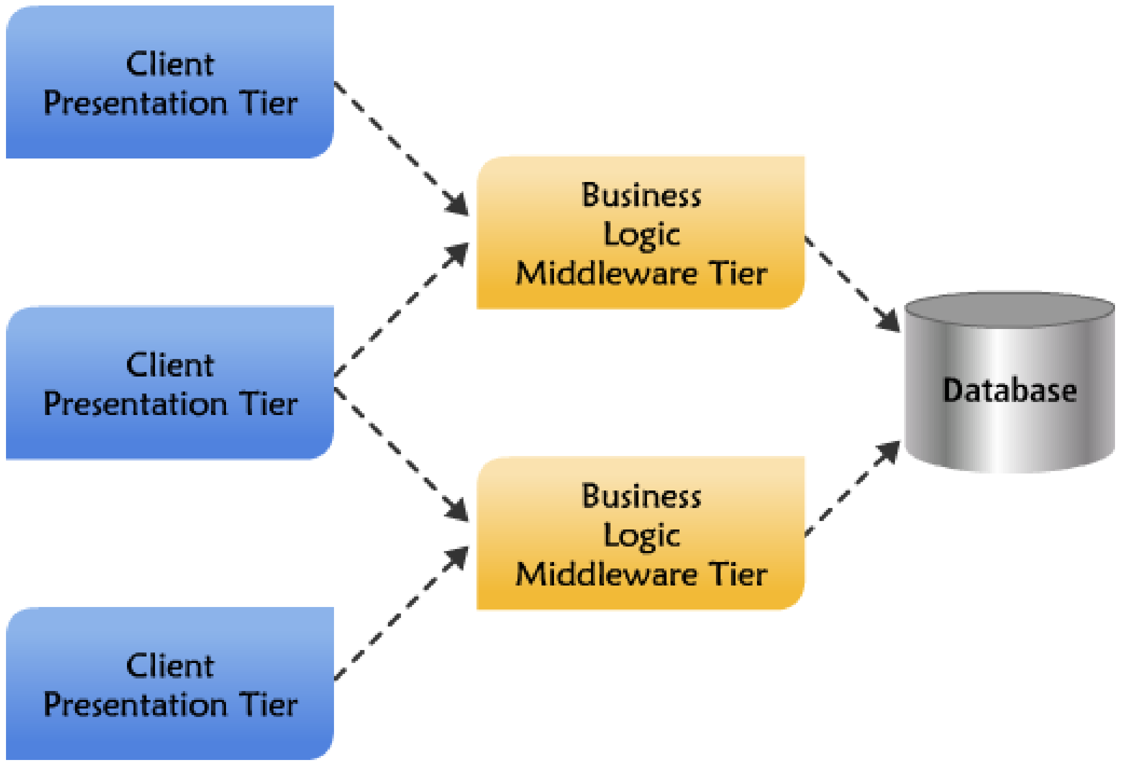
- Flexible, Portability and Reusable
- Consists mainly of **Web components** (JSP, Servlet, …), **Business components** (EJB), and **Service components** (Mail, JDBC, JMS …).
- An enterprise application is usually **composed of a three-layer architecture**
  - **Presentation** Layer (Web Component, GUI Component, Client console)
    - Is responsible for **rendering the graphical user interface** and **handling user input**
    - **Passes** down **each request for application functionality** to the business logic layer

Introduction to EJBs
Component Architecture

- An enterprise application is usually composed of a three-layer architecture
  - **Business** Layer (Business Component)
    - Is the core of the application
    - Comprises business logic and business objects
    - **Business** logic
      - **Comprises business rules or methods** using which **specific business functions** can be managed
      - **Refers** to the **workflow** or the **ordered task of passing** or **retrieving data** from one software sub-system to another
    - **Business** objects
      - Are the **set** of **objects** and the **relationships** between them
      - **Encapsulate** both the data & business behavior associated with the entity that it represents
      - Have the **required features**: reusability, access control, remote access, multi-user, highly available, state maintenance, transactional, and shared data
      - Are **stored** to **DB** or **storage** by **using an abstract layer** – **persistence layer** that lies over the DB layer and interacts with DB

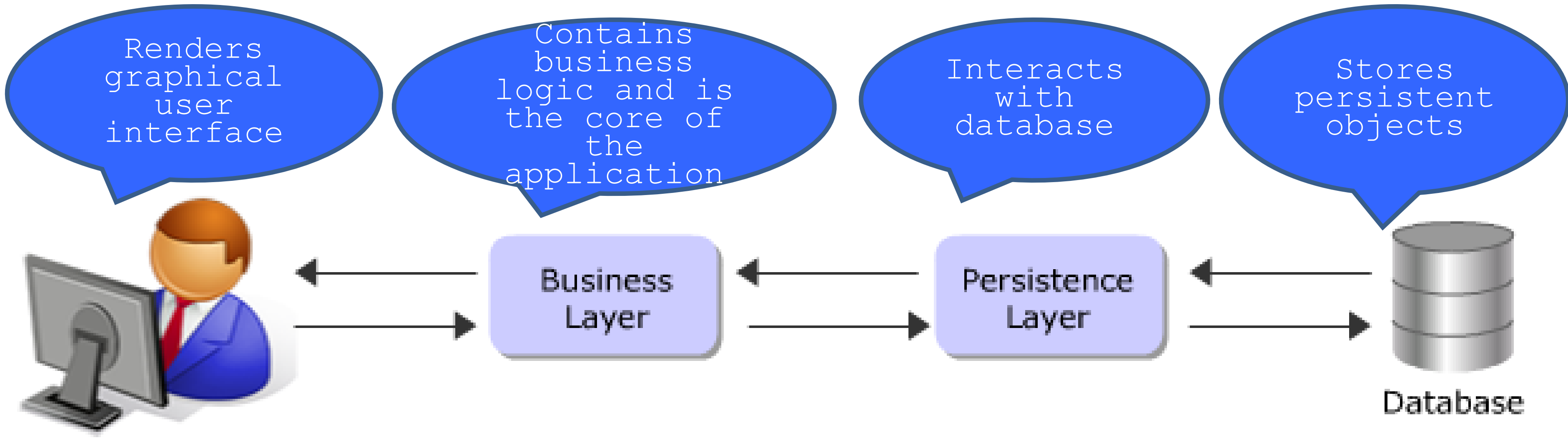
Introduction to EJBs
Component Architecture

- An enterprise application is usually composed of a three-layer architecture
  - **Data** Layer
    - Consists of relational database management systems (**RDBMS**) such as SQL Server, Oracle, DB2, … **for storing persistent objects**



Introduction to EJBs

Distributed Object Architecture

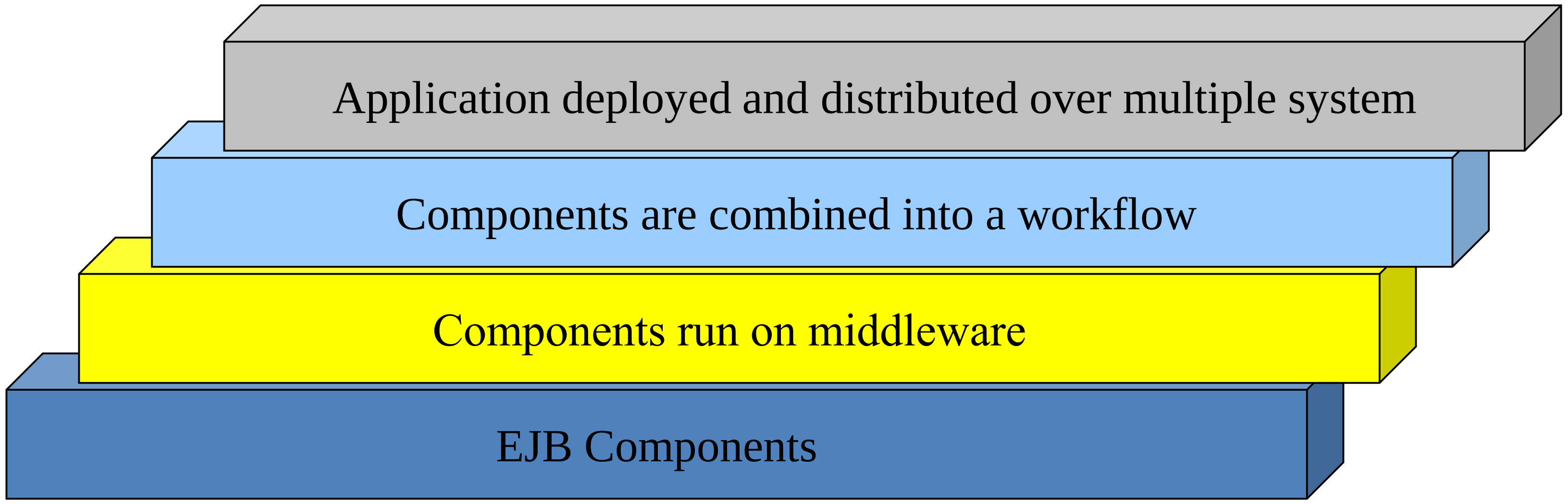

Renders graphical user interface
Contains business logic and is the core of the application
Interacts with database
Stores persistent objects
Business Layer
Persistence Layer
Database

Introduction to EJBs
EJB Technology

- Building application software is complexity
  - The software **can process multi-data**
  - The software **is available online.**
  - The developer **worries** about the security, transaction, scalability, concurrency, resource management, persistent, error handling, and **many more system level problems.**
- Software assurance and performance are affected because the developer **can not concentrate fully on the developing the business logic (from implementation logic).**
- EJB was developed so that it would:
  - Specialize in **handling the business logic** of an application
  - Be **robust**
  - **Be secure** so that it cannot be tampered.
  - EJB **provides a component to create middleware** which is deployed on Application Server (3 tiers architecture).
  - EJB Component has been designed to **encapsulate business logic**.

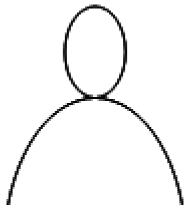
EJB EcoSystem

Stages in Developing Business Solution


Application deployed and distributed over multiple system
Components are combined into a workflow
Components run on middleware
EJB Components

EJB EcoSystem

Parties involved in EJB Development

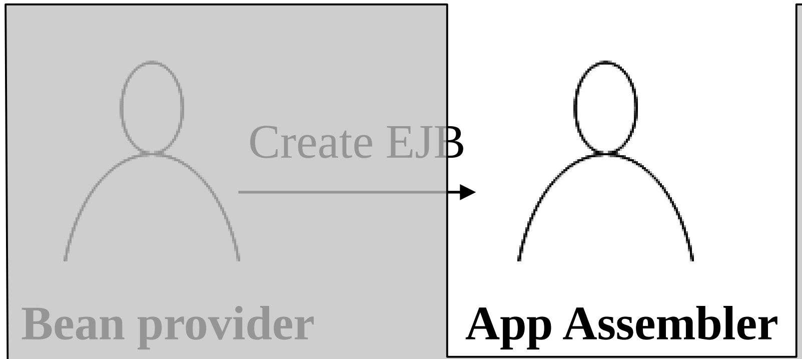


Bean provider

- Provide the components to **solve business problem** (that are packaged them to the ejb-jar file)
- **Reusable** components
- **Assemble** other components into application.
- **Distribution**

EJB EcoSystem

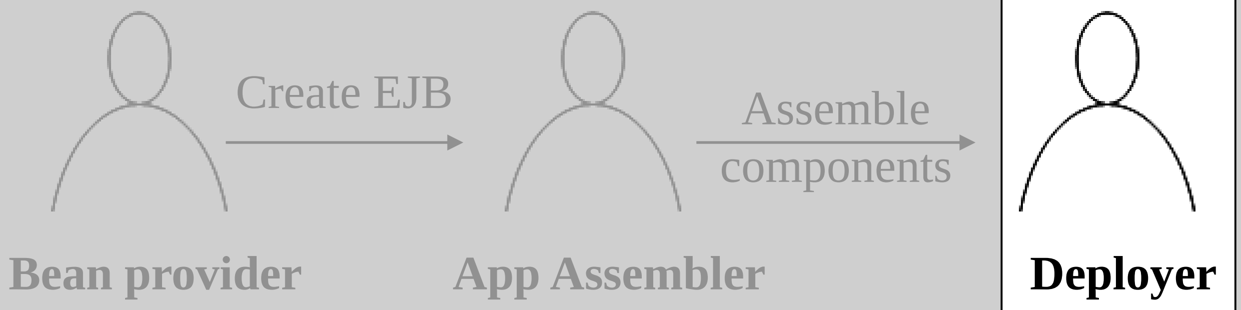
Parties involved in EJB Development



- For **assembling** different EJB Components in order to build a complete application
- **Analyzing** a business problem and **assembling** EJB components **accordingly to solve the problem**
- **Building** new EJB components
- **Writing the integration code** required to associate the EJB components build by different bean providers

EJB EcoSystem

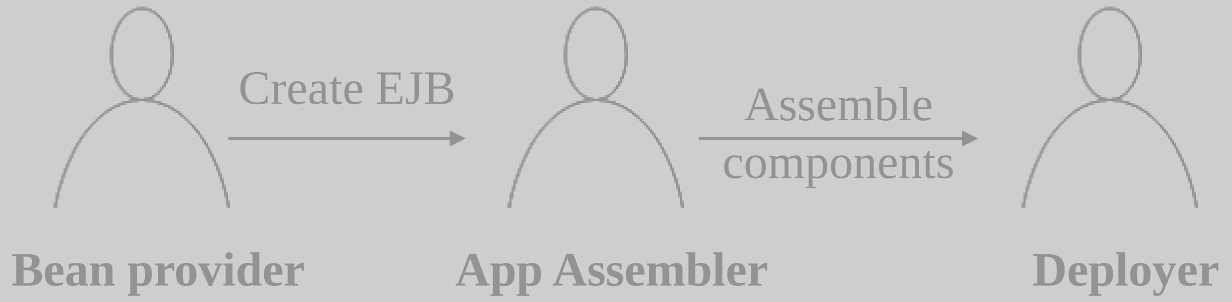
Parties involved in EJB Development



- **Customizing** enterprise bean
- **Accumulate information** about operational requirements such as security, hardware, and transaction before deploying the bean
- For **deploying** an assembled application in an application server

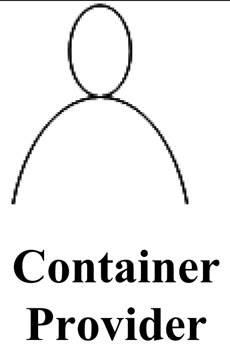
EJB EcoSystem

Parties involved in EJB Development



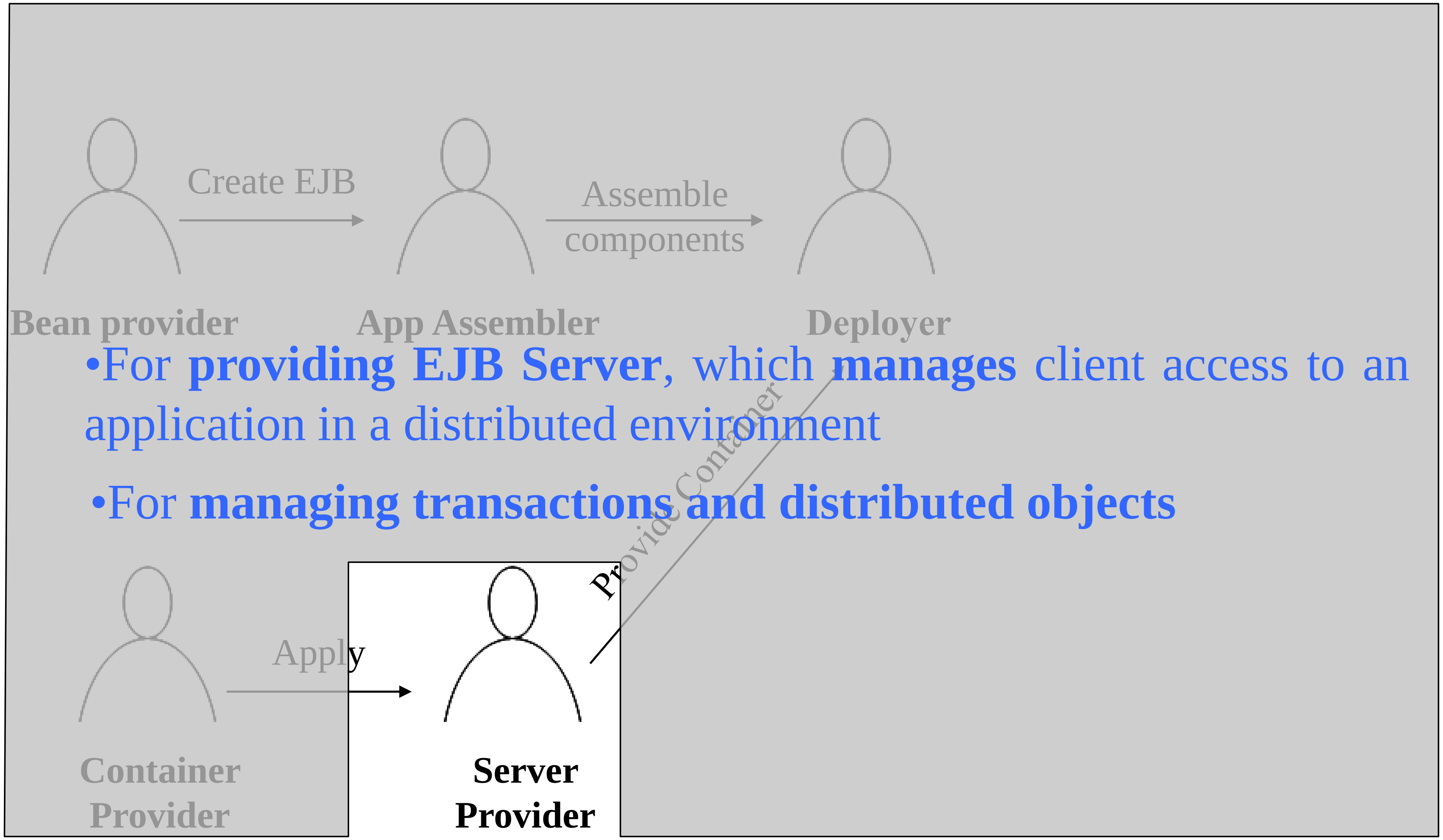
•**Providing the deployment tools** that are required by the deployer for deploying EJB components

•**Providing run-time support for beans** that are deployed on EJB Server



EJB EcoSystem

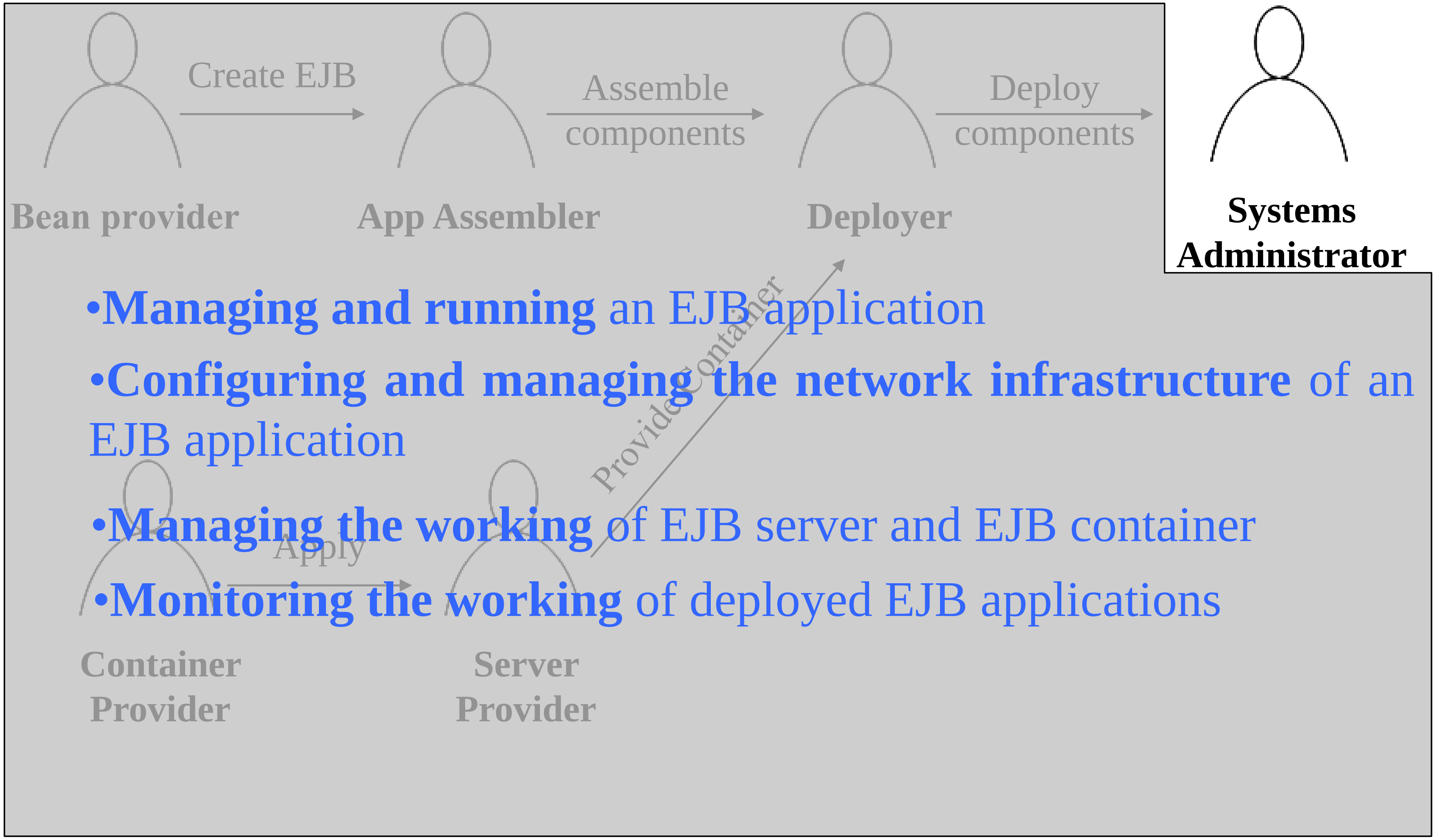
Parties involved in EJB Development



- For **providing EJB Server**, which **manages** client access to an application in a distributed environment
- For **managing transactions and distributed objects**

EJB EcoSystem

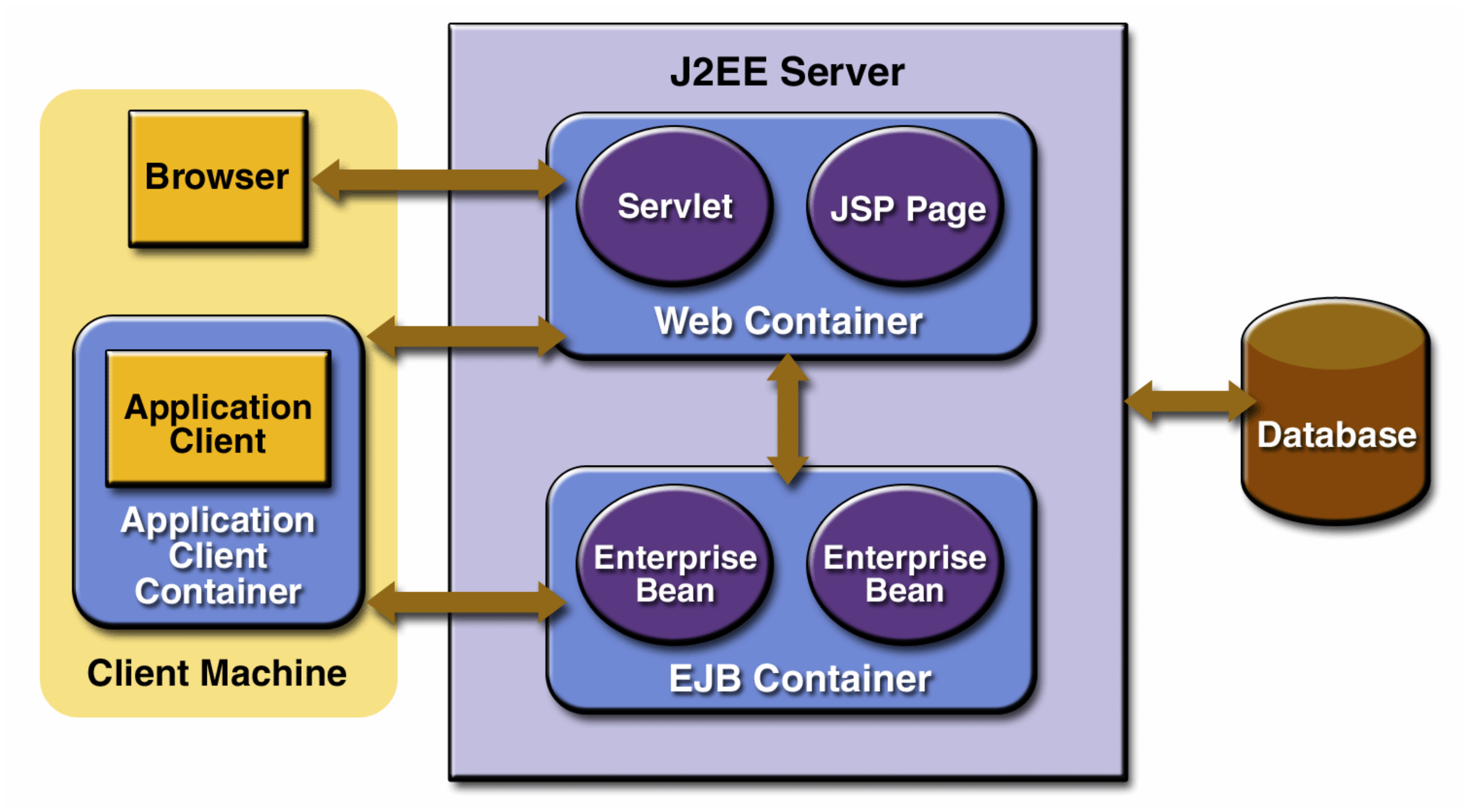
Parties involved in EJB Development



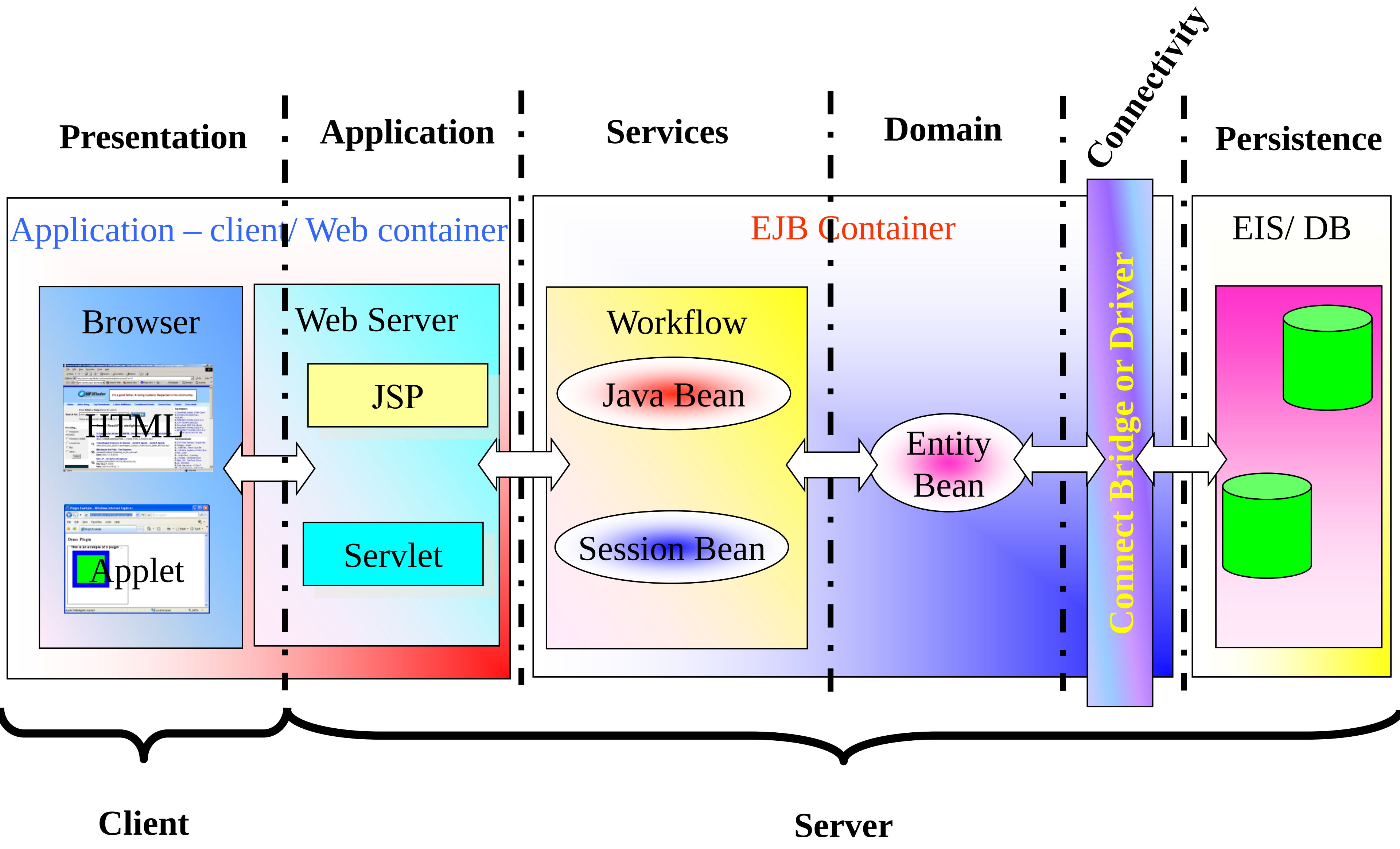
- **Managing and running** an EJB application
- **Configuring and managing the network infrastructure** of an EJB application
- **Managing the working** of EJB server and EJB container
- **Monitoring the working** of deployed EJB applications

Enterprise Java Beans

EJB in J2EE Architecture

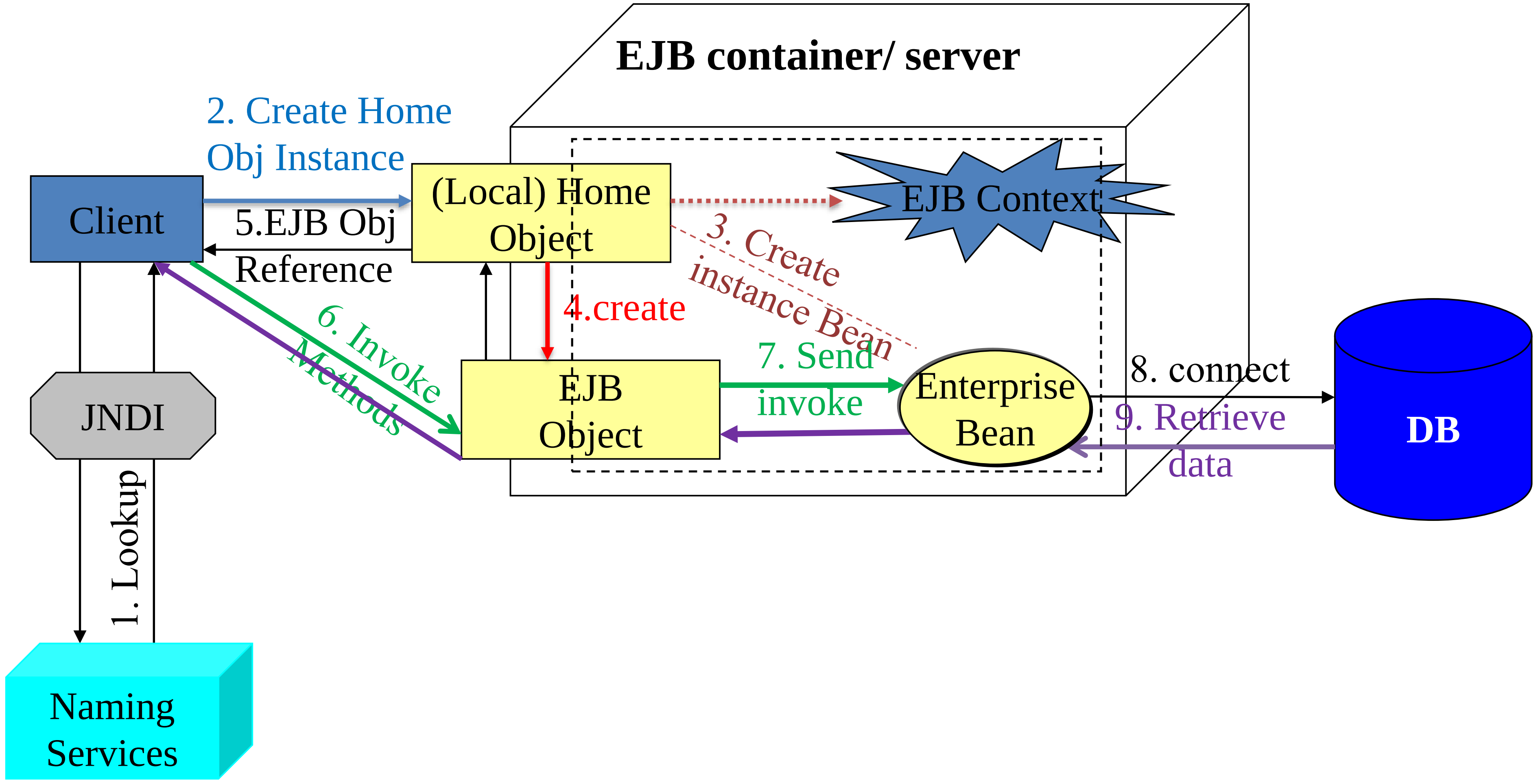


J2EE Architecture



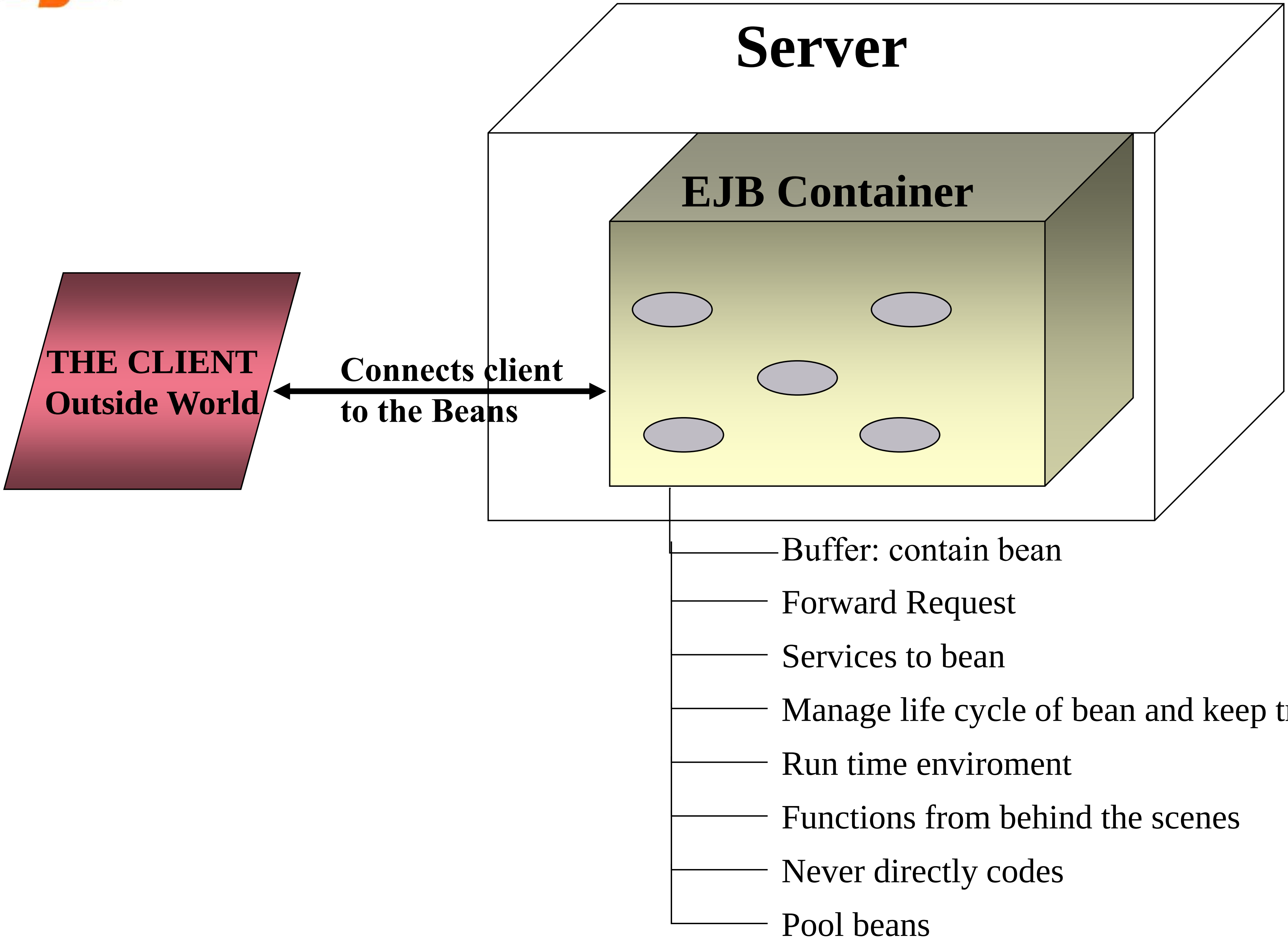
Enterprise Java Beans

Logical Architecture of EJB



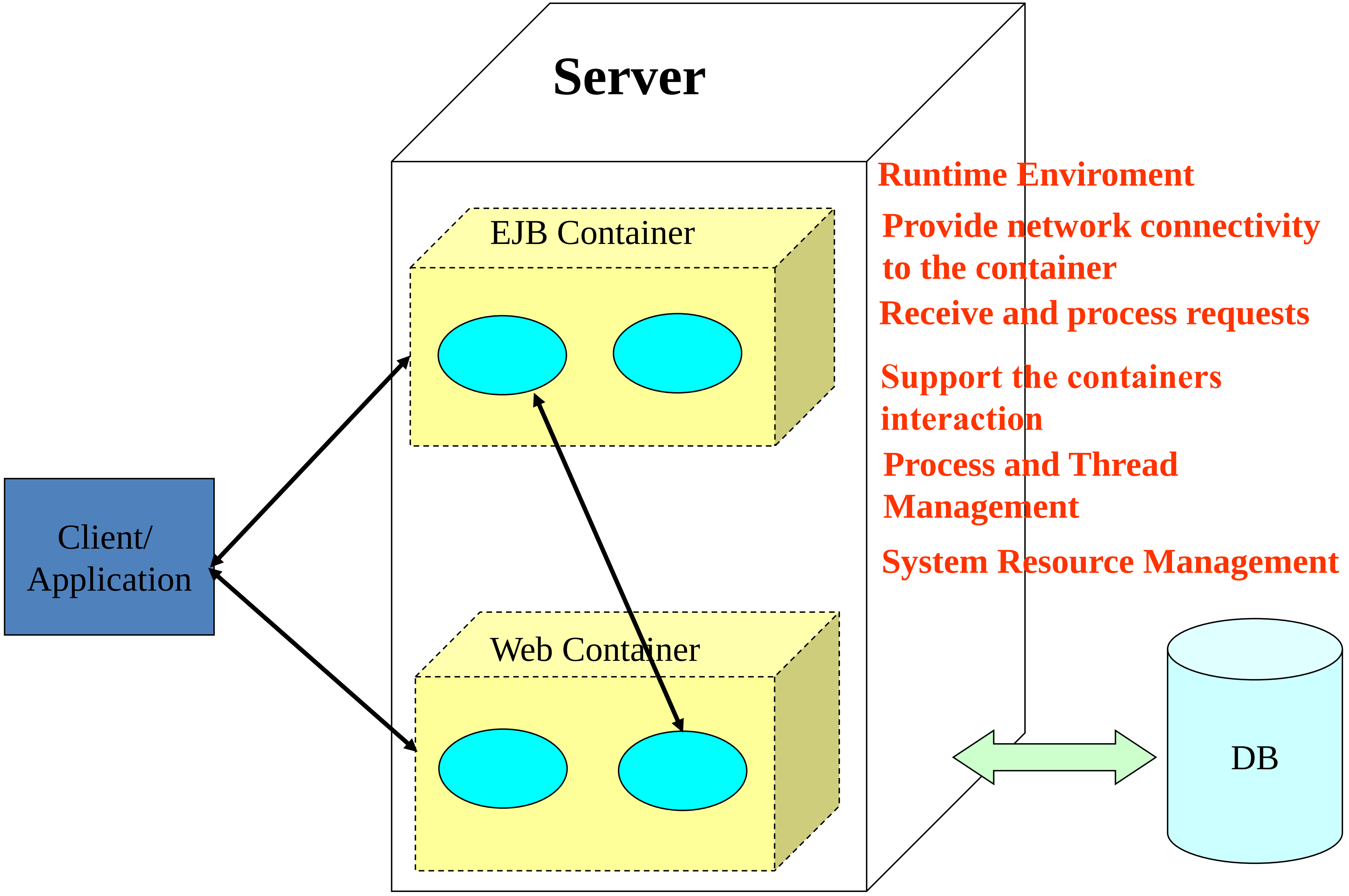
03 tiers Architecture

EJB Container



- Buffer: contain bean
- Forward Request
- Services to bean
- Manage life cycle of bean and keep track
- Run time enviroment
- Functions from behind the scenes
- Never directly codes
- Pool beans

EJB Server



Runtime Enviroment

Provide network connectivity to the container

Receive and process requests

Support the containers interaction

Process and Thread Management

System Resource Management

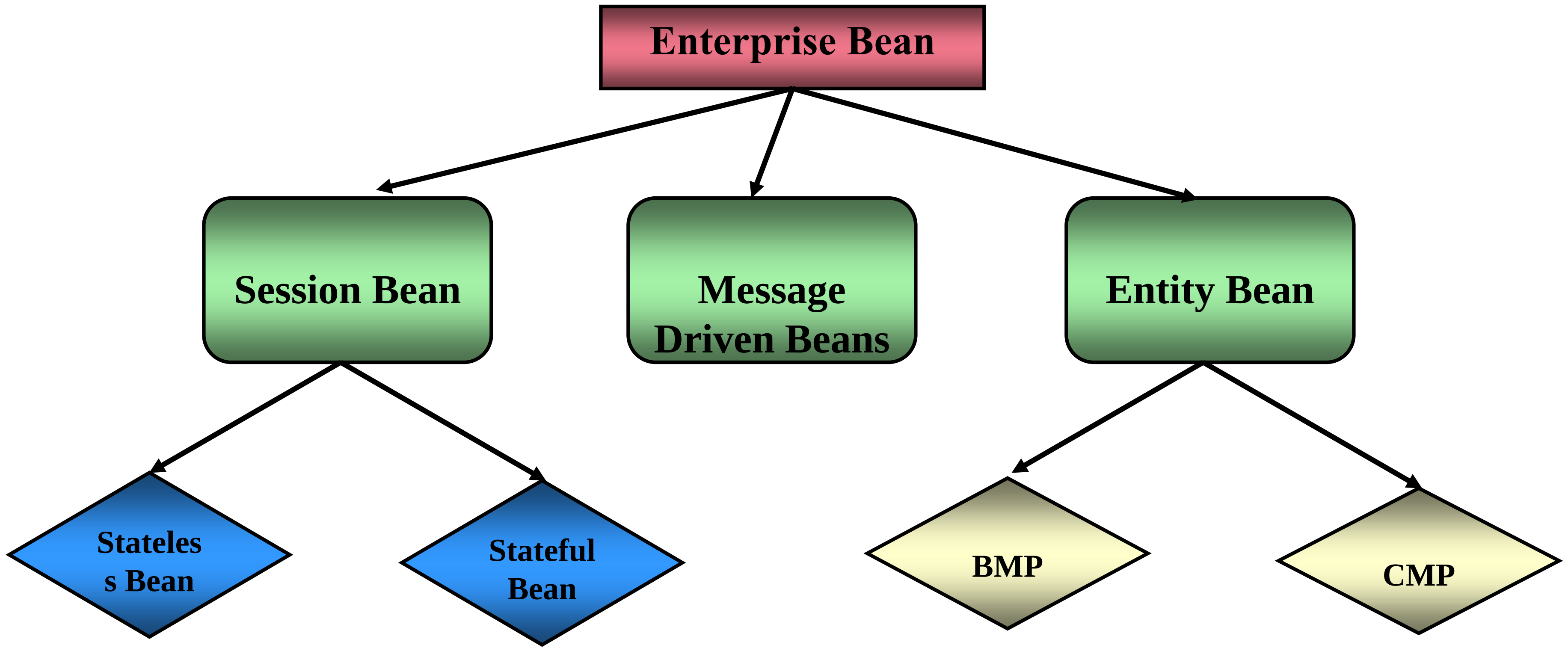
Enterprise Java Beans

Services provided by the Container and Server

- Transaction
- Security
- Persistence
- Support for Management of multiple instances
- Remote Accessibility
- Location transparency

Enterprise Java Beans

Components of EJB



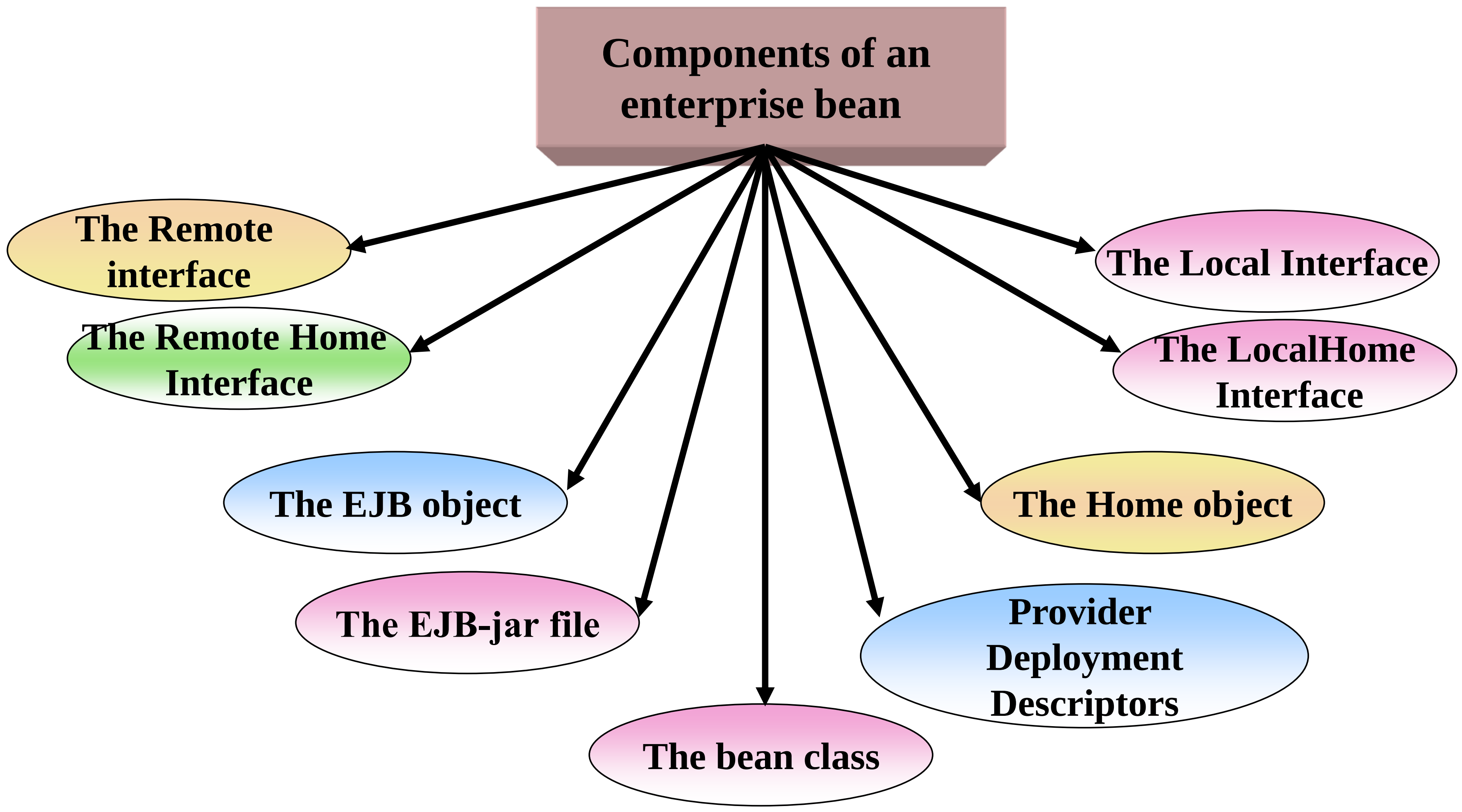
Enterprise Java Beans

Components Summary

Feature	Session	Message-Driven	Entity
Process	Business	Communication	DB models
Life Cycle	Short	Short	Longer
Reuseable	Lower	N/A	Higher

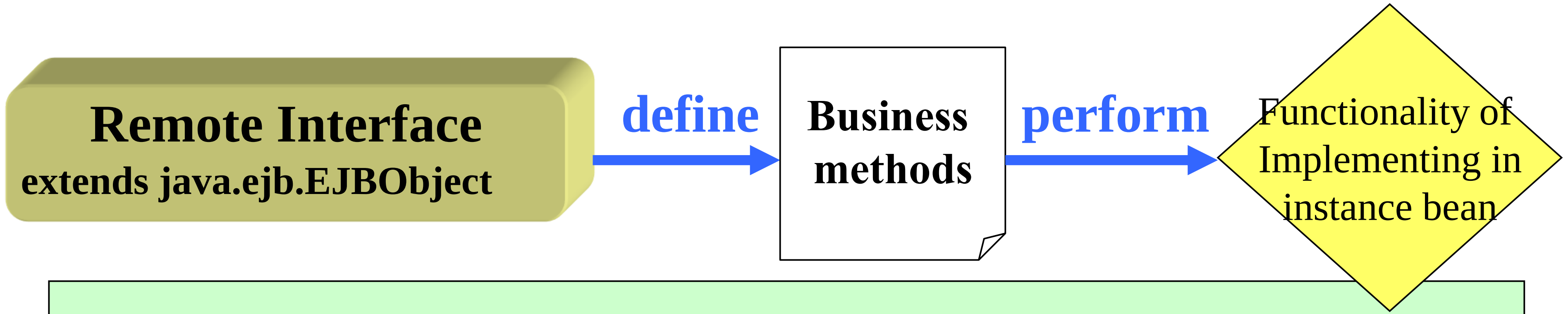
What Constitutes an EJB?

Components of EJB



What Constitutes an EJB?

Remote Interface


Remote Interface
extends java.ejb.EJBObject
define
Business methods
perform
Functionality of Implementing in instance bean

```
public interface WelcomeRemote extends javax.ejb.EJBObject {

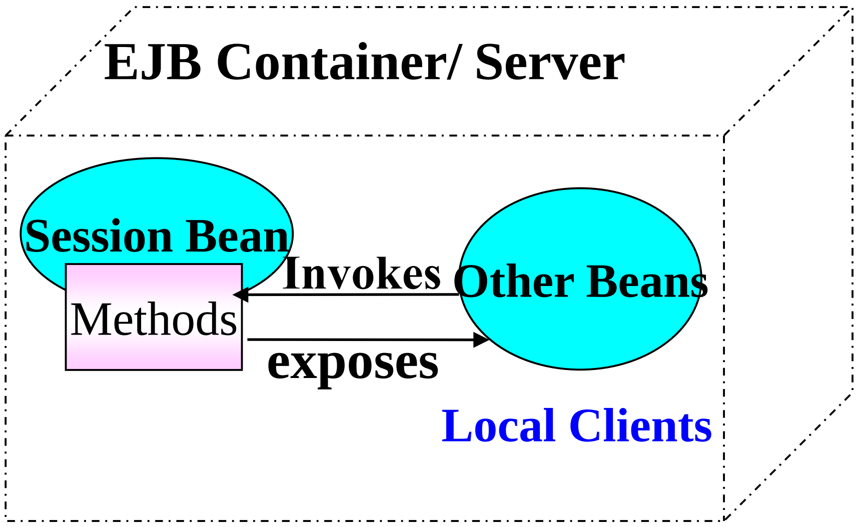
      public String welcome()  throws java.rmi.RemoteException;

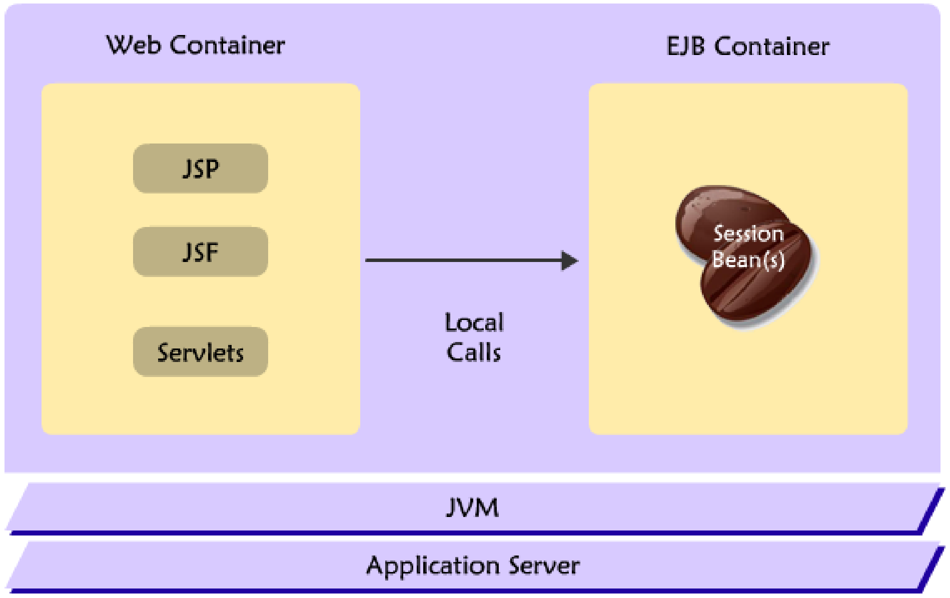
      ...
}
```

•**Note**: System level operations such as persistence, security and concurrency are not included in remote interface.

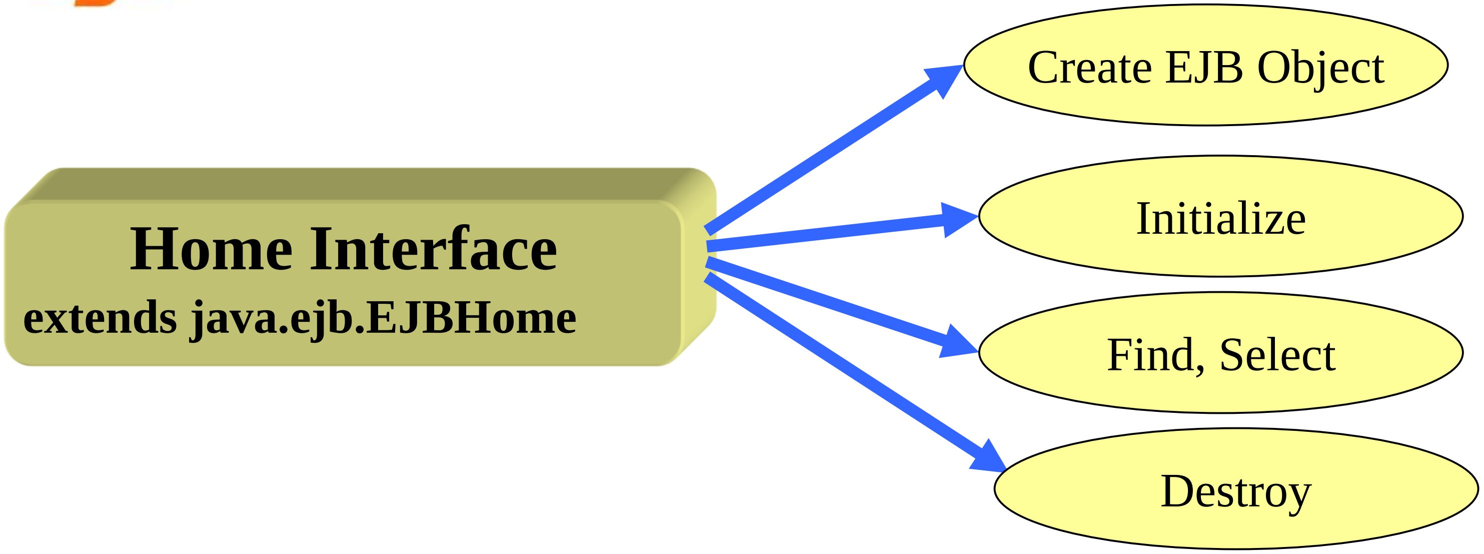
What Constitutes an EJB?
Local Interface

```
public interface WelcomeLocal extends javax.ejb.EJBLocalObject {
   public String welcome();
   ...
}
```





Home Interfaces



```
public interface WelcomeRemoteHome  extends java.ejb.EJBHome {

 public WelcomeRemote   create() throws java.rmi.RemoteException;
 public WelcomeRemote findByPrimaryKey() ...;

 ...
}
```

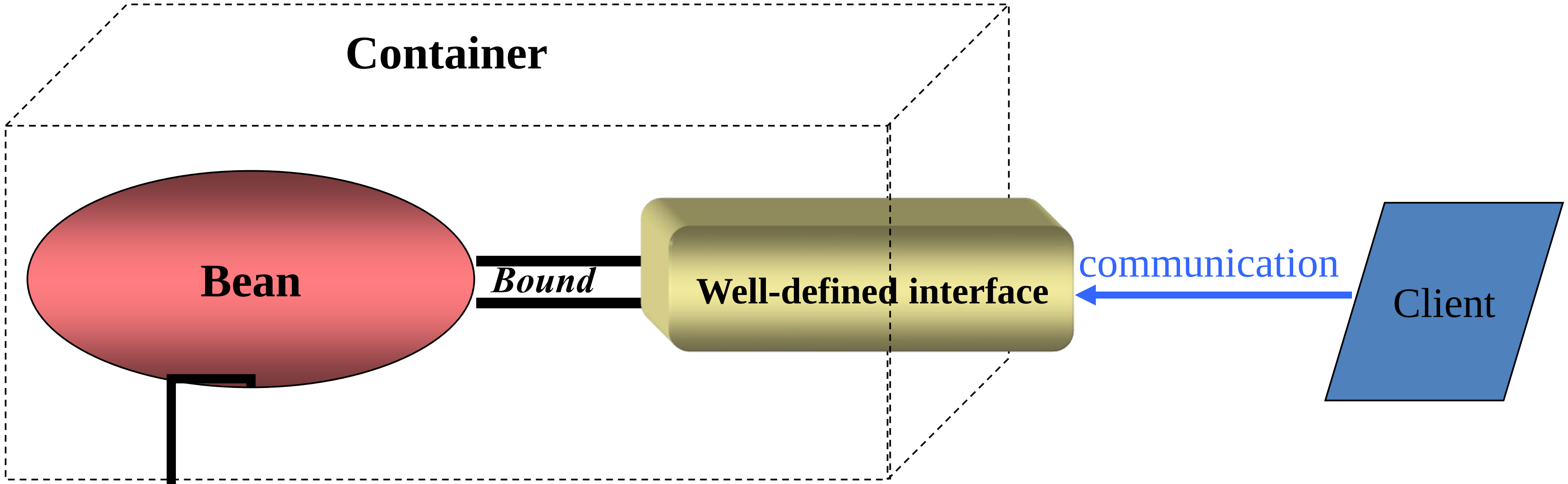
What Constitutes an EJB?

Local Home Objects

- Standard Java interface which allows the beans to expose its methods to other bean **reside within the same container** (local clients)
- **Eleminate the overhead** of the remote method call (java.rmi.RemoteException)
- Use pass by reference semantics (speed up in processing and efficiency)
- extends javax.ejb.EJBLocalHome
- **Notes**: LocalObject is used as Return Values

```
public interface WelcomeLocalHome extends javax.ejb.EJBLocalHome {
   public WelcomeLocal create();
   public WelcomeLocal findByPrimaryKey();
   ...
}
```

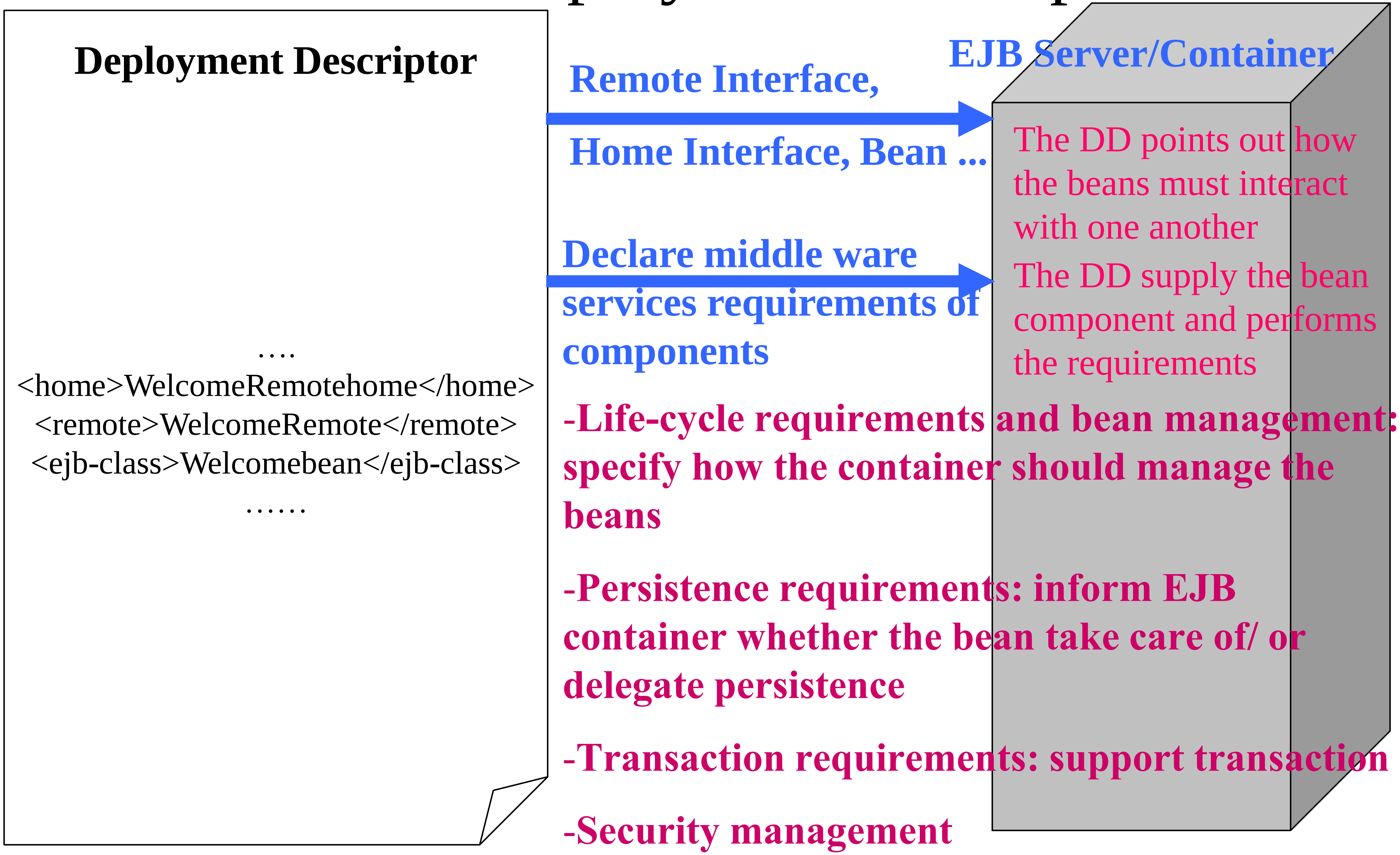
Bean Class



- **Implements defined method from Component Interface (Remote and Local)**
- Override default Bean class
- **These methods are then called by container manage bean and keep the bean informed of important events**
- EJB can share the propertiess of the serialiable objects because the javax.ejb.EnterpriseBean extends Serializable
- **Once the interface javax.ejb.EnterpriseBean is implemented, the bean class is confirmed**

What Constitutes an EJB?

Deployment Descriptors



Deployment Descriptor

….
<home>WelcomeRemotehome</home>
<remote>WelcomeRemote</remote>
<ejb-class>Welcomebean</ejb-class>
……

EJB Server/Container

Remote Interface,

Home Interface, Bean ...

Declare middle ware services requirements of components

The DD points out how the beans must interact with one another

The DD supply the bean component and performs the requirements

-Life-cycle requirements and bean management: specify how the container should manage the beans

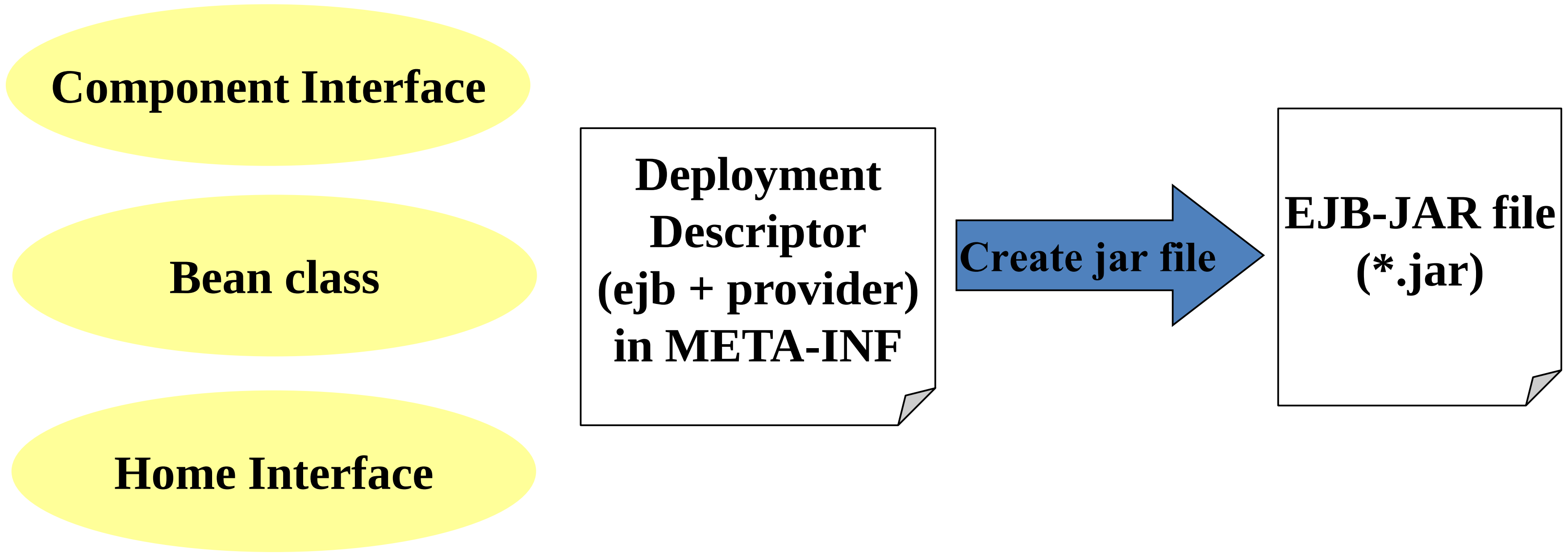
-Persistence requirements: inform EJB container whether the bean take care of/ or delegate persistence

-Transaction requirements: support transaction

-Security management

What Constitutes an EJB?

EJB-JAR file



- EJB container **decompress**, **read and extract** information contained in the EJB-JAR file.
- **Generation** of the EJB object and the home objects, and the bean. (**deployer**)

JNDI
API and Libraries

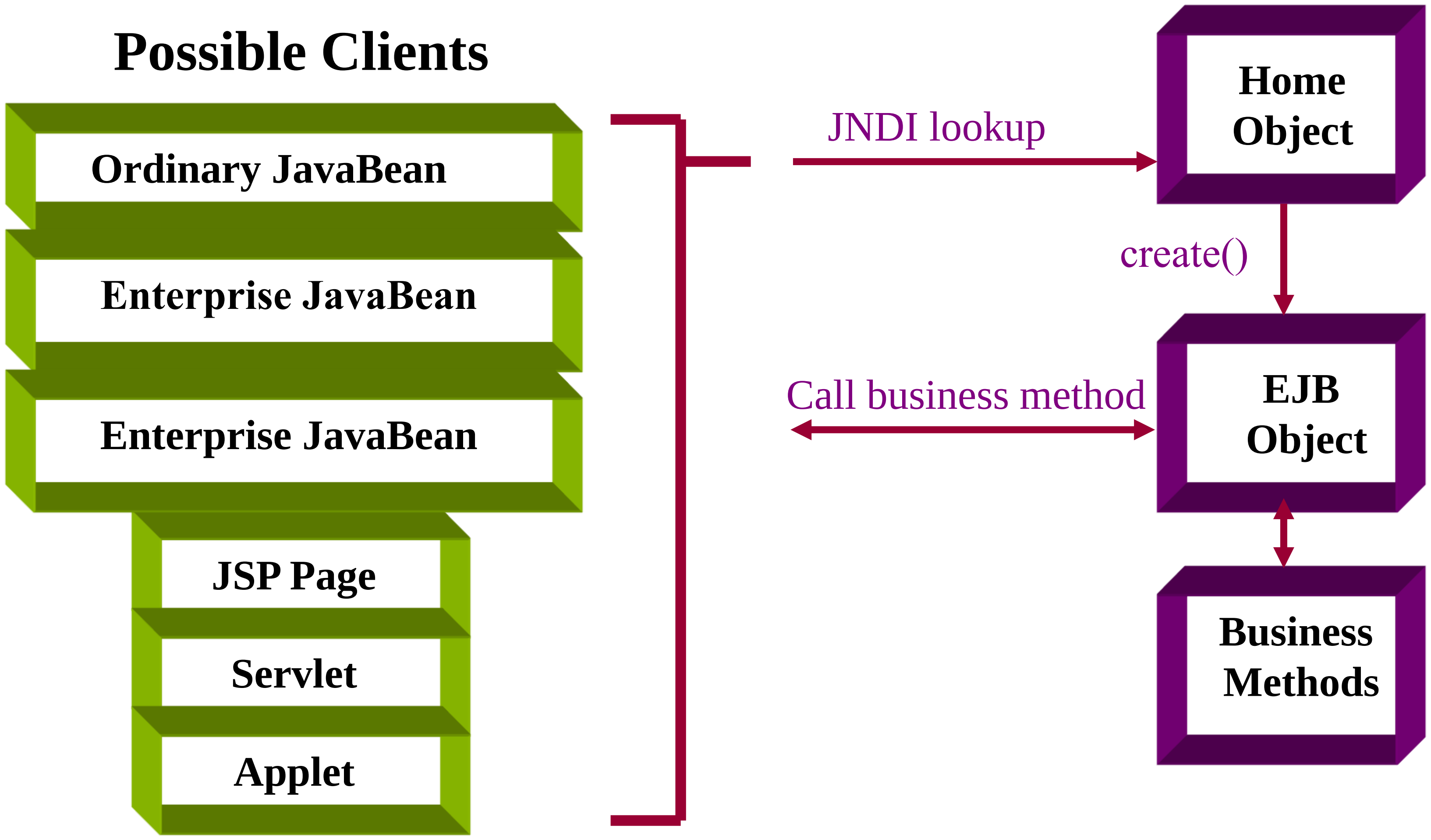
- The **Context** is represented by the **javax.naming.Context interface** that has the necessary methods to put objects into the naming service, and also to locate them.
- The starting point is called an **InitialContext**, represented by **javax.naming.InitialContext interface**
- The references in JNDI are represented by **javax.naming.Reference interface**
  - **The lookup() method** retrieves the object bound to the name and throws a **javax.naming.NamingException**, if a naming exception is encountered

<context_variable>.lookup("object_name")

- The remote calls in EJB make use of **RMI-IIOP** (Remote Method Invocation-Internet Inter-Orb Protocol) which **does not support explicit casting of the EJB object** obtained **from the remote object to a local object**. Instead, Java a RMI-IIOP provides **a mechanism to narrow** the Object you have received from your lookup to the appropriate type by using the **javax.rmi.PortableRemoteObject** class & its **narrow**() method
  - The method narrow() of which parameters narrowFrom is the object that has to be narrowed and narrowTo is the desired type. It returns the object which is cast to the desired type and throws **ClassCastException**, if narrowFrom cannot be cast to narrowTo
- The supported files are **jndi.jar, fscontext.jar, providerutil.jar**

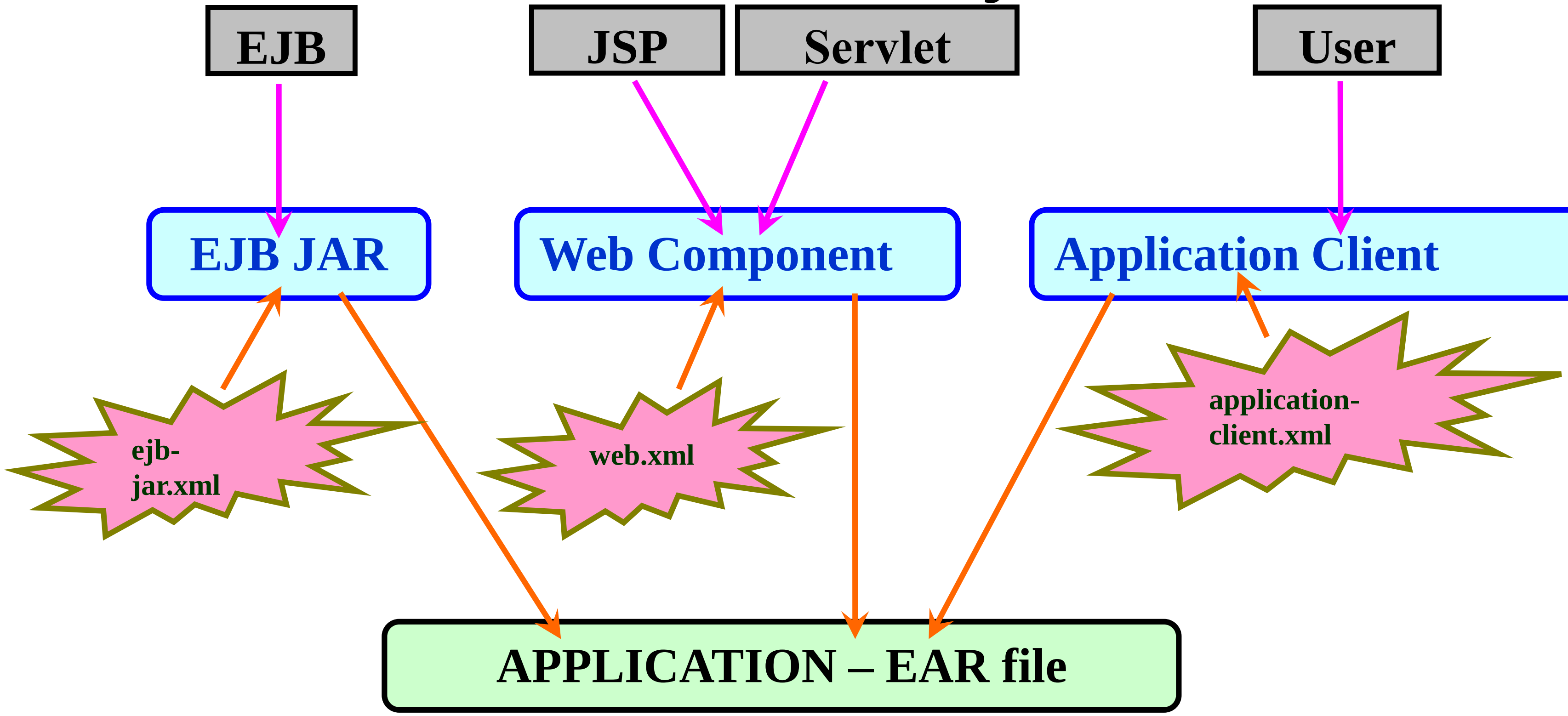
EJB Implementation

Accessing EJB from Client Side



EJB Implementation

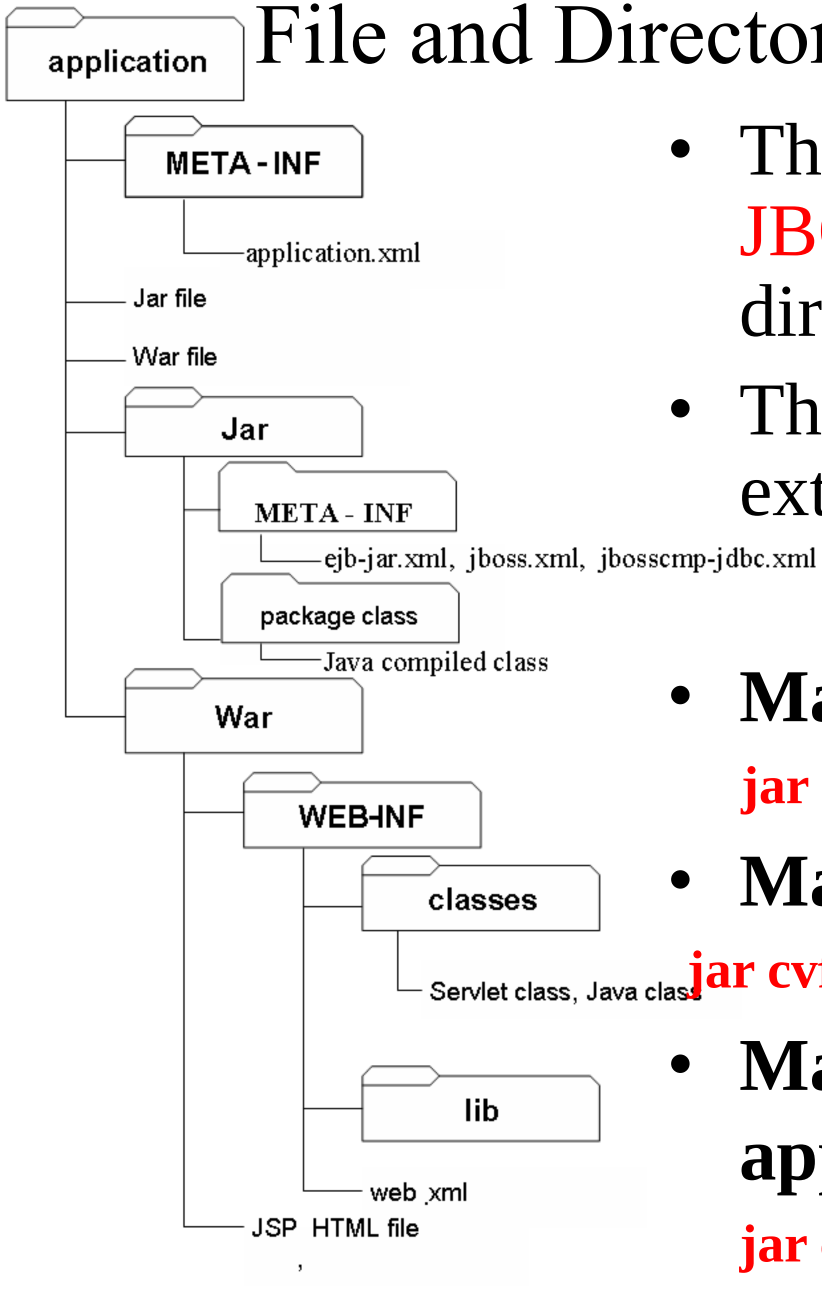
File and Directory Structure



- **Modules** of J2EE Platform (**must** contain **at least one** J2EE module)
  - **EJB modules** cover the data layer and part of the logic layer
  - **Web application** modules cover part of the **logic layer** and the **presentation layer (web application)**
  - **Application client** modules cover part of **logic layer**, and the **presentation layer** (**desktop application**)

EJB Implementation

File and Directory Structure of Enterprise Apps



- This structure is **deployed at** JBOSS_HOME\server\default\deploy directory
- This structure is name with the extension **.ear (include jar and war)**
- **Make deploy ejb file (*.jar)**

  jar cvf user.jar [package/]*.class META-INF/*
- **Make deploy web file (*.war)**

  jar cvf user.war [dir/]*.jsp [dir/]*.html WEB-INF/*
- **Make deploy enterprise application file (*.ear)**

  jar cvf user.ear user.jar user.war META-INF/*

EJB Implementation

Additional – Configure Jboss 6.1.0 Final

- **Go to JBOSS_HOME/bin**
- Open run.bat
- **Edit following content**
  - **Search the line "set JAVA_OPTS=-Dprogram.name=%PROGNAME% -Dlogging.configuration=file:%DIRNAME%logging.properties %JAVA_OPTS%" (line 43)**
  - **Change** the **%DIRNAME% to** the **absolute path** to the "bin" directory of the installed JBoss
  - **Ex:** set JAVA_OPTS=-Dprogram.name=%PROGNAME% -Dlogging.configuration=file: "C:\Programming\jboss6.1.0\bin\logging.properties" %JAVA_OPTS%

EJB Implementation

EJB Development Process

- **Requirement: JBoss 6.1.0 Final Application Server & Netbeans 7.2.1**
- **Step 1:** Creating a new EJB Module project
- **Step 2:** Creating the new corresponding bean depending on your purpose.
- **Step 3:** Building/ Modifying the business/callback methods on Beans
- **Step 4:** Mapping the JNDI to beans
- **Step 5:** Building the project to jar file
- **Step 6:** Deploying the project on Application server
- **Step 7:** Creating the client application to consume
- **Step 8:** Running the client to test the EJB

Summary

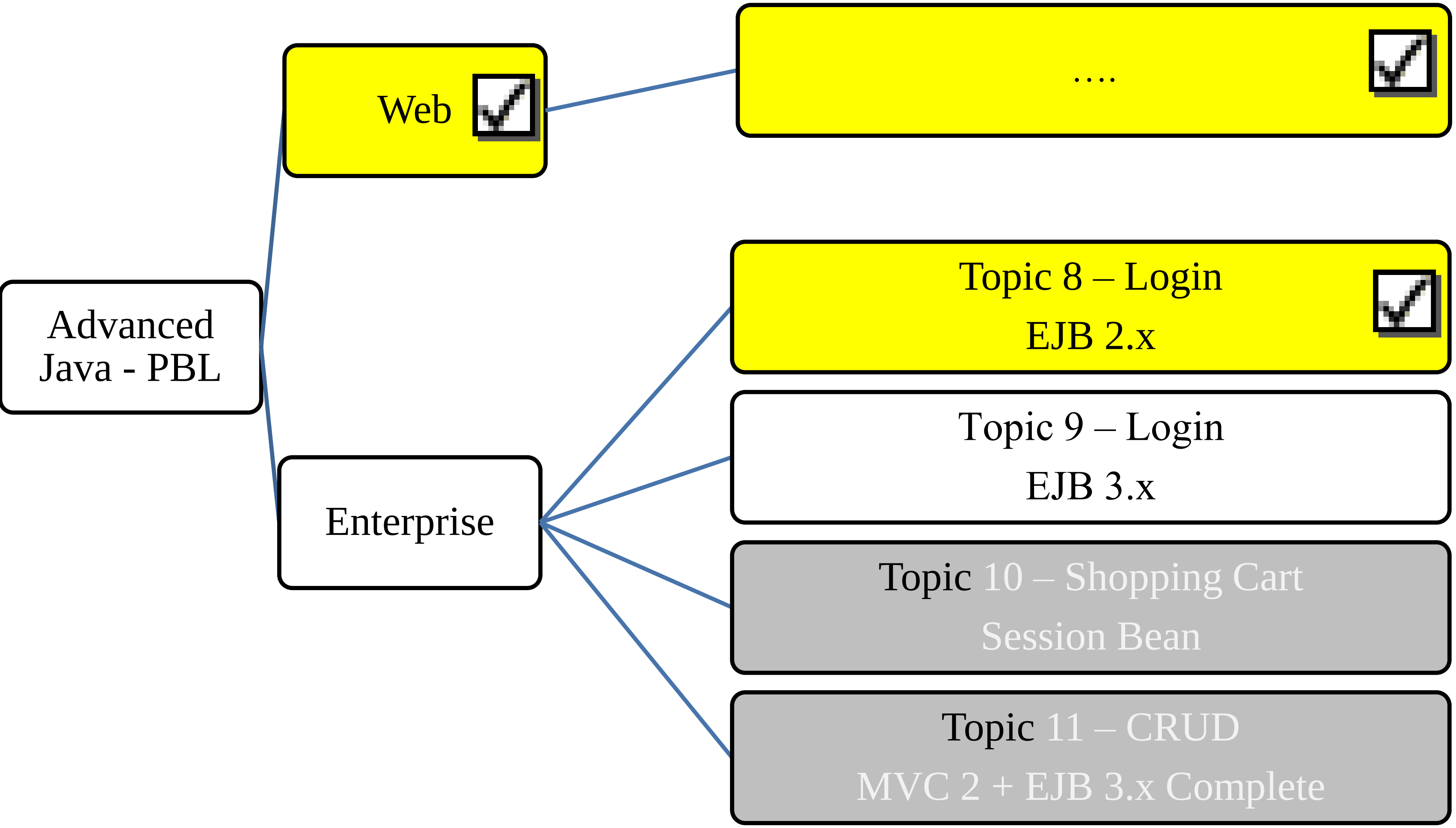
- **How to build the simple enterprise application using EJB 2.0 with GUI as Swing or web?**
  - Logical Architecture of EJB
  - Components of EJB
  - Accessing EJB from the Client/Web Side
  - File and Directory Structure of Enterprise Applications

Q&A

Next Lecture

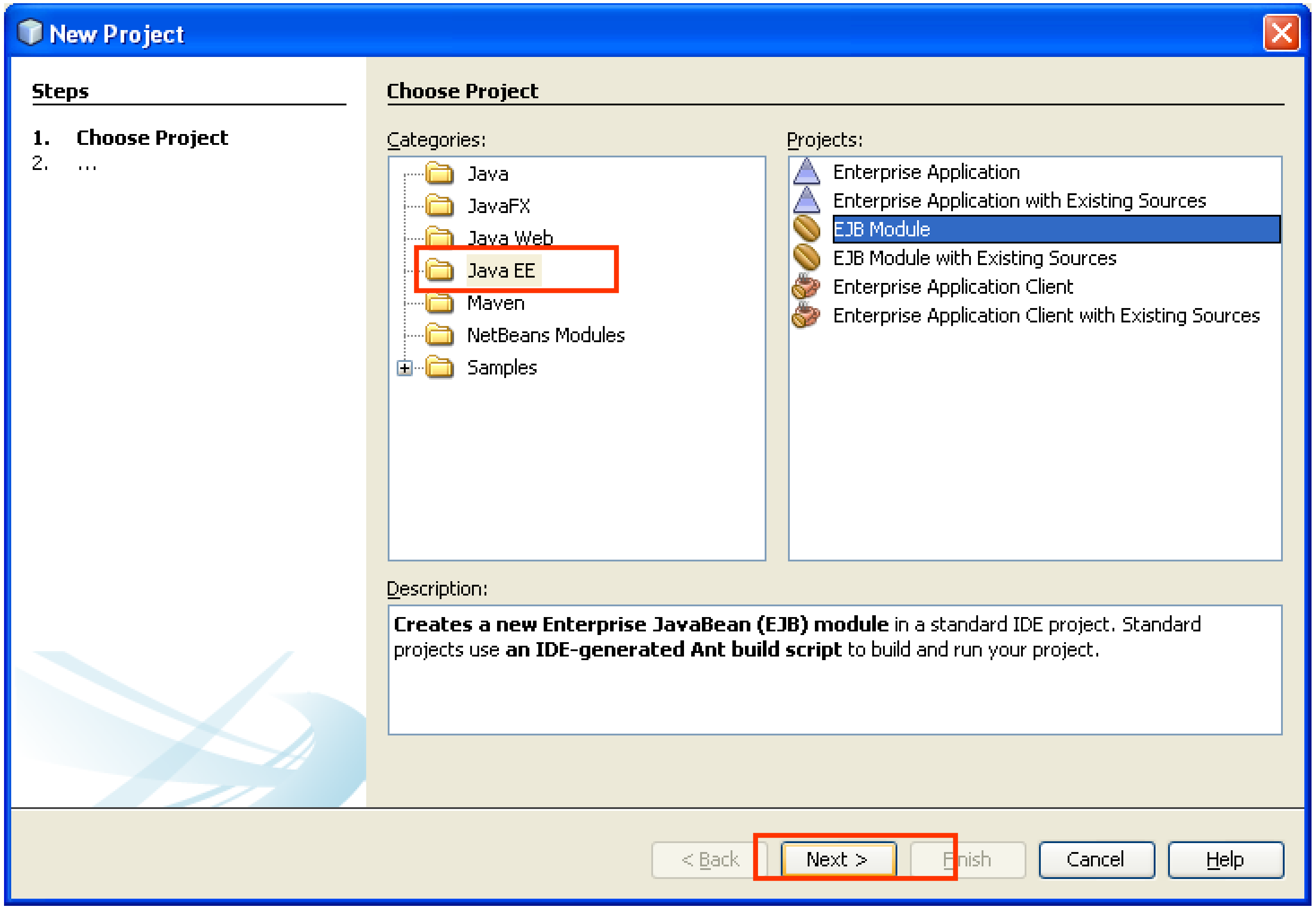
- **How to build the application using EJB 3**
  - Need of EJB 3
  - New Features

Next Lecture


Advanced Java - PBL
Web ✓
…. ✓
Enterprise
Topic 8 – Login EJB 2.x ✓
Topic 9 – Login EJB 3.x
Topic 10 – Shopping Cart Session Bean
Topic 11 – CRUD MVC 2 + EJB 3.x Complete

Appendix – EJB Implementation

Step 1: Creating a new EJB Module project

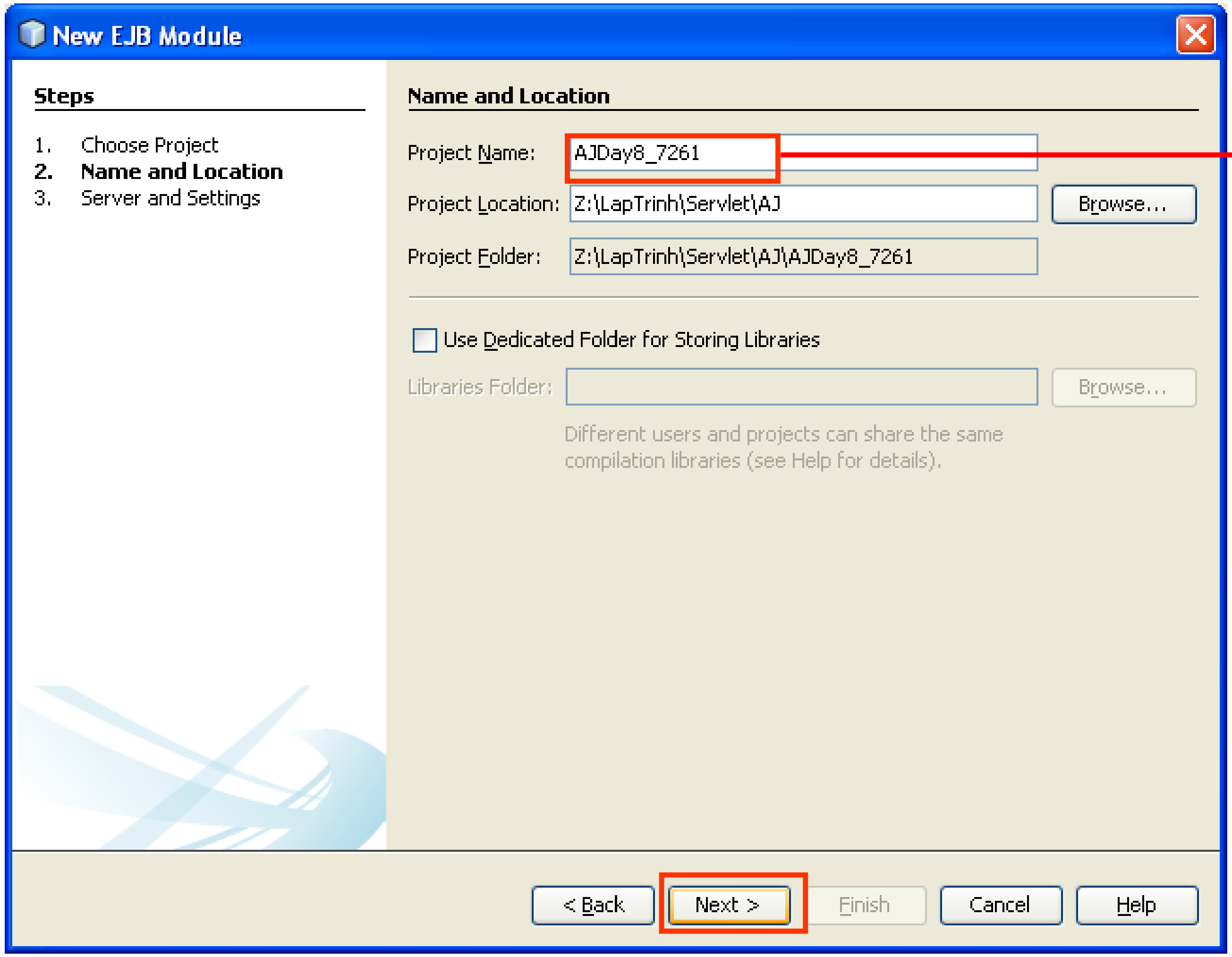


Creates a new Enterprise JavaBean (EJB) module in a standard IDE project. Standard projects use **an IDE-generated Ant build script** to build and run your project.

- Choose "**Enterprise Java Beans**" on "**Categories**"
- Then, choose "**EJB Module**" on "**Projects**". Click **Next** button

EJB Implementation

Step 1: Creating a new EJB Module project



New EJB Module

Steps

1. Choose Project
2. **Name and Location**
3. Server and Settings

Name and Location

Project Name: AJDay8_7261

Project Location: Z:\LapTrinh\Servlet\AJ

Project Folder: Z:\LapTrinh\Servlet\AJ\AJDay8_7261

☐ Use Dedicated Folder for Storing Libraries

Libraries Folder:

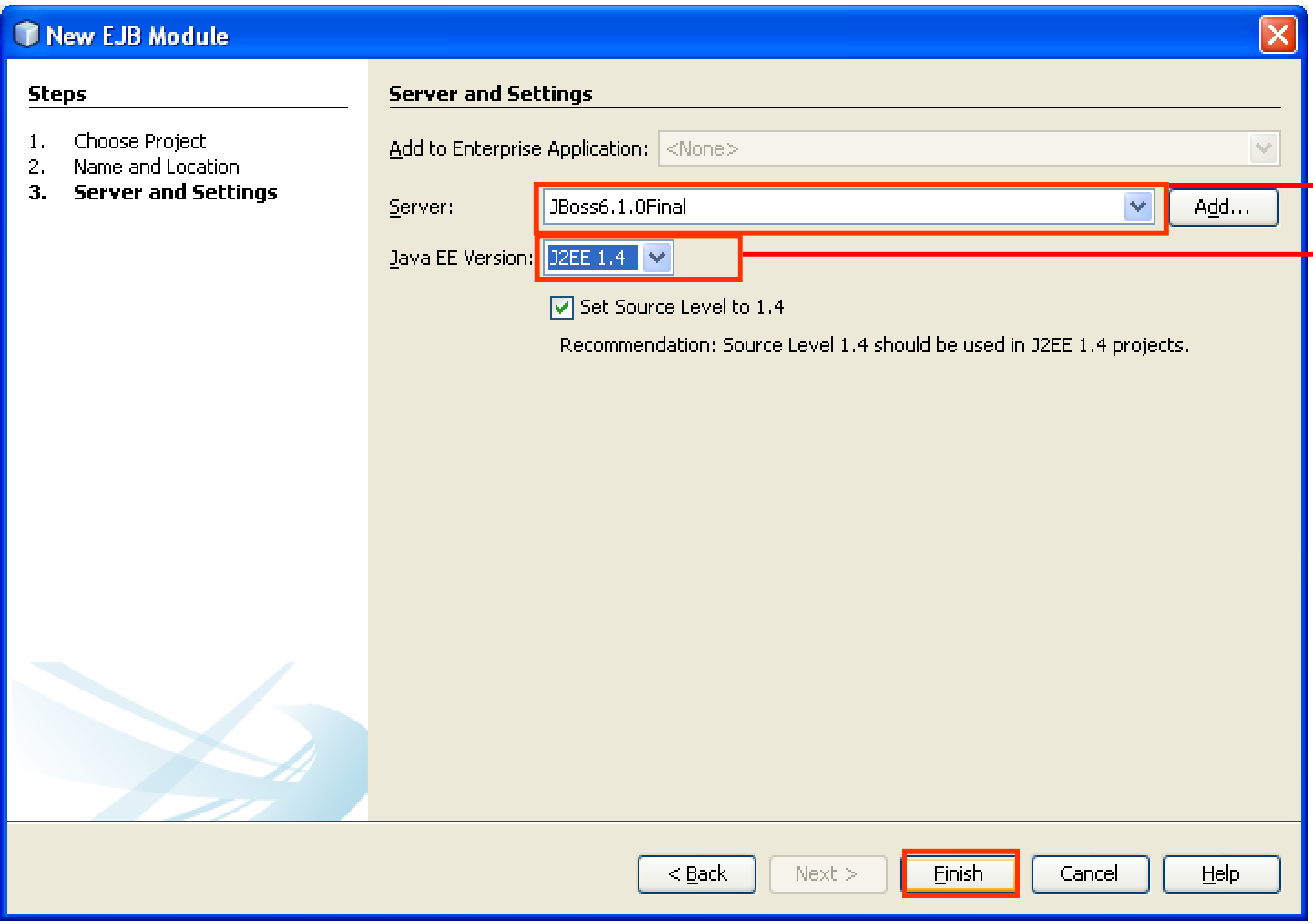
Different users and projects can share the same compilation libraries (see Help for details).

Fill your project name

- Click **Next** button

EJB Implementation

Step 1: Creating a new EJB Module project


New EJB Module

Steps

1. Choose Project
2. Name and Location
3. **Server and Settings**

Server and Settings

Add to Enterprise Application: <None>

Server: JBoss6.1.0Final

Java EE Version: J2EE 1.4

☑ Set Source Level to 1.4

Recommendation: Source Level 1.4 should be used in J2EE 1.4 projects.

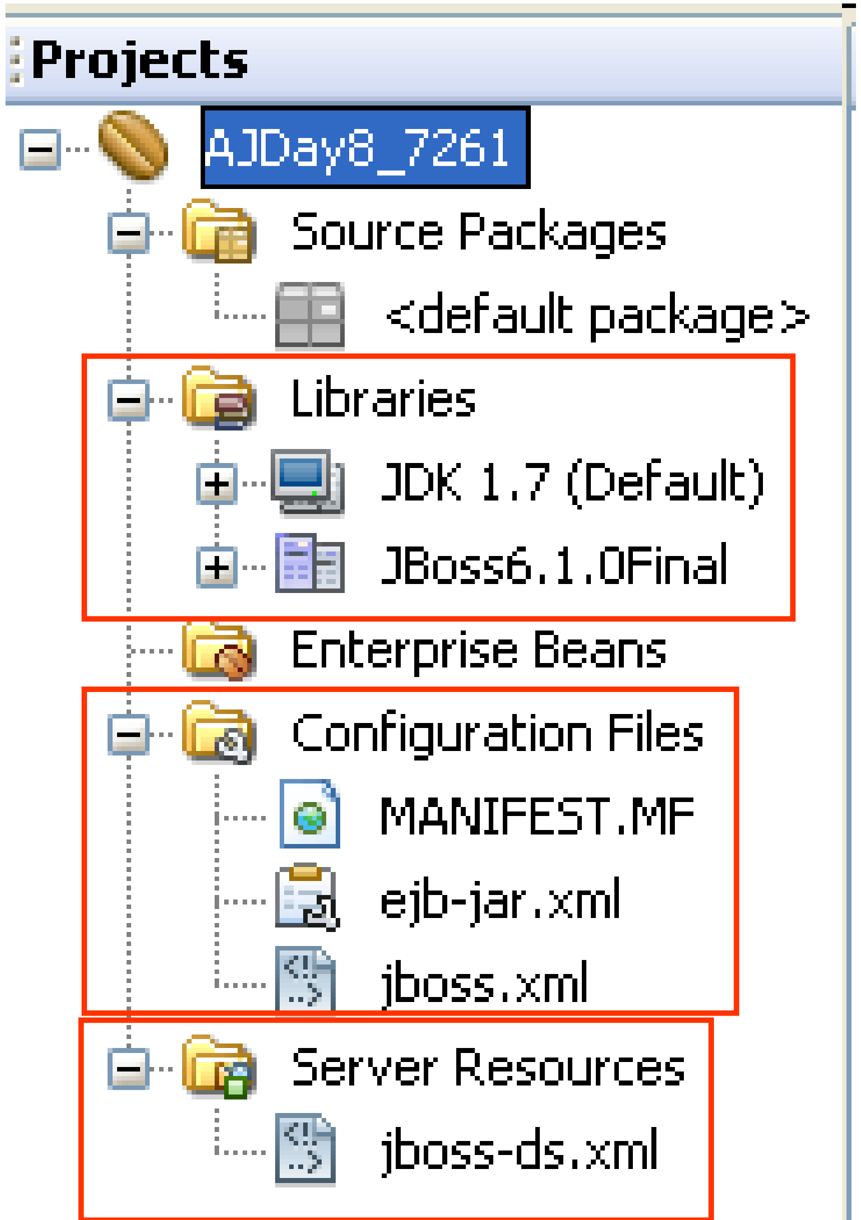
Choose the Jboss Server that is added

Choose the J2EE1.4

- Click **Finish** button

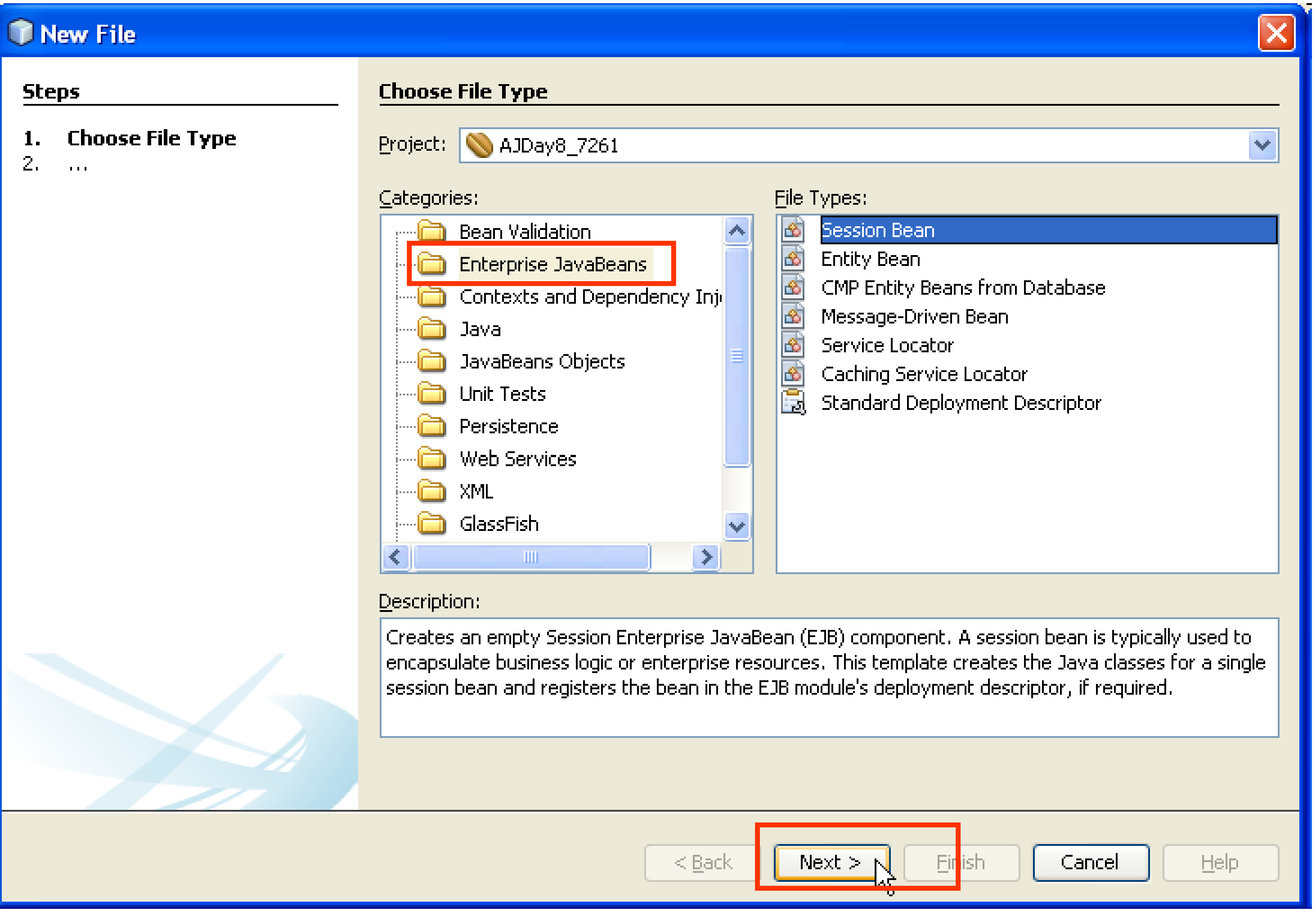
EJB Implementation

Step 1: Creating a new EJB Module project


Projects
AJDay8_7261
Source Packages
<default package>
Libraries
JDK 1.7 (Default)
JBoss6.1.0Final
Enterprise Beans
Configuration Files
MANIFEST.MF
ejb-jar.xml
jboss.xml
Server Resources
jboss-ds.xml

EJB Implementation

Step 2: Creating the new corresponding bean



New File

Steps
1. Choose File Type
2. ...

Choose File Type

Project: AJDay8_7261

Categories:
- Bean Validation
- Enterprise JavaBeans
- Contexts and Dependency Inj
- Java
- JavaBeans Objects
- Unit Tests
- Persistence
- Web Services
- XML
- GlassFish

File Types:
- Session Bean
- Entity Bean
- CMP Entity Beans from Database
- Message-Driven Bean
- Service Locator
- Caching Service Locator
- Standard Deployment Descriptor

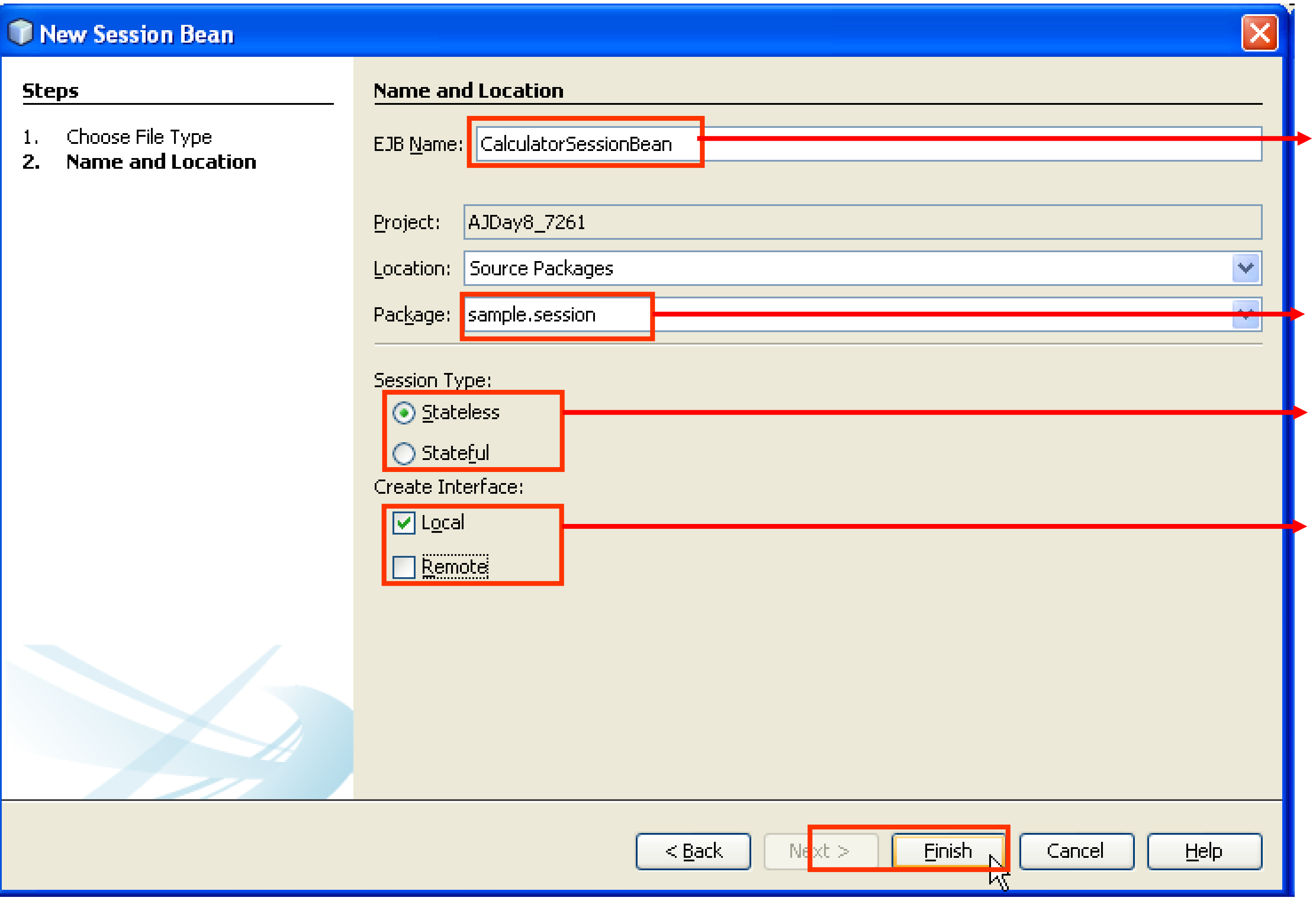
Description:

Creates an empty Session Enterprise JavaBean (EJB) component. A session bean is typically used to encapsulate business logic or enterprise resources. This template creates the Java classes for a single session bean and registers the bean in the EJB module's deployment descriptor, if required.

- Choose "**Enterprise JavaBeans**" on "**Categories**"
- Then, choose "**Session** Bean" on "**File Types**". Click **Next** button

EJB Implementation

Step 2: Creating the new corresponding bean



EJB Name: CalculatorSessionBean

Project: AJDay8_7261

Location: Source Packages

Package: sample.session

Session Type: [✓ Stateless] Stateful

Create Interface: [✓ Local] Remote

Fill your bean name

Fill or choose the package name

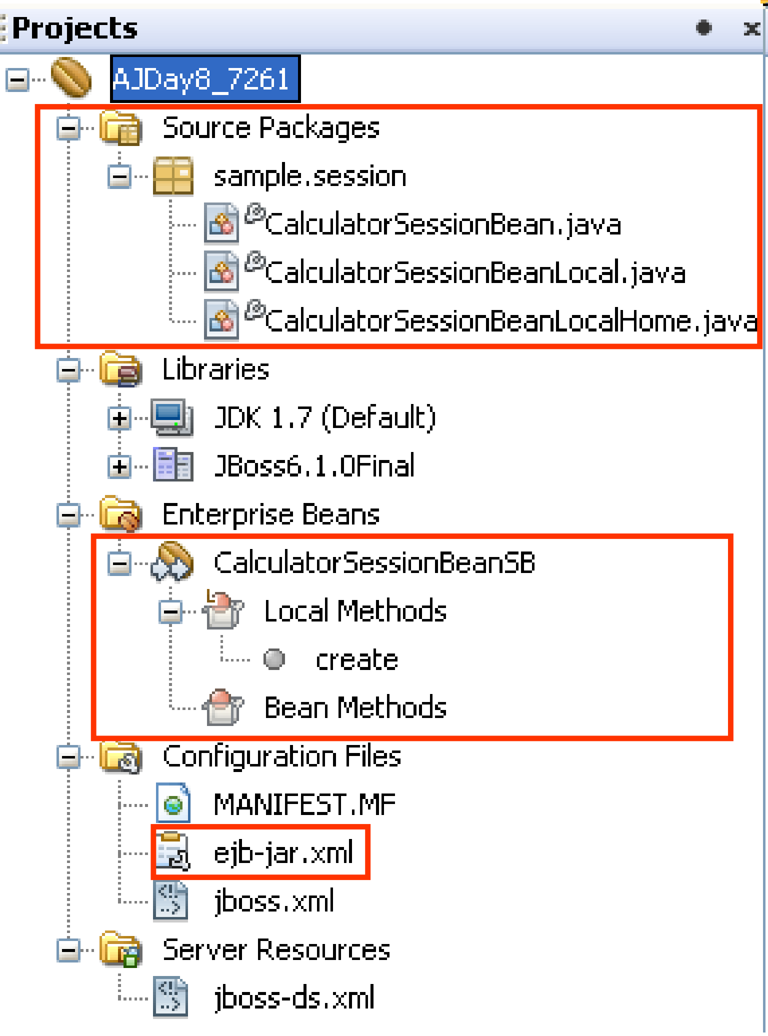
Choose stateless or stateful

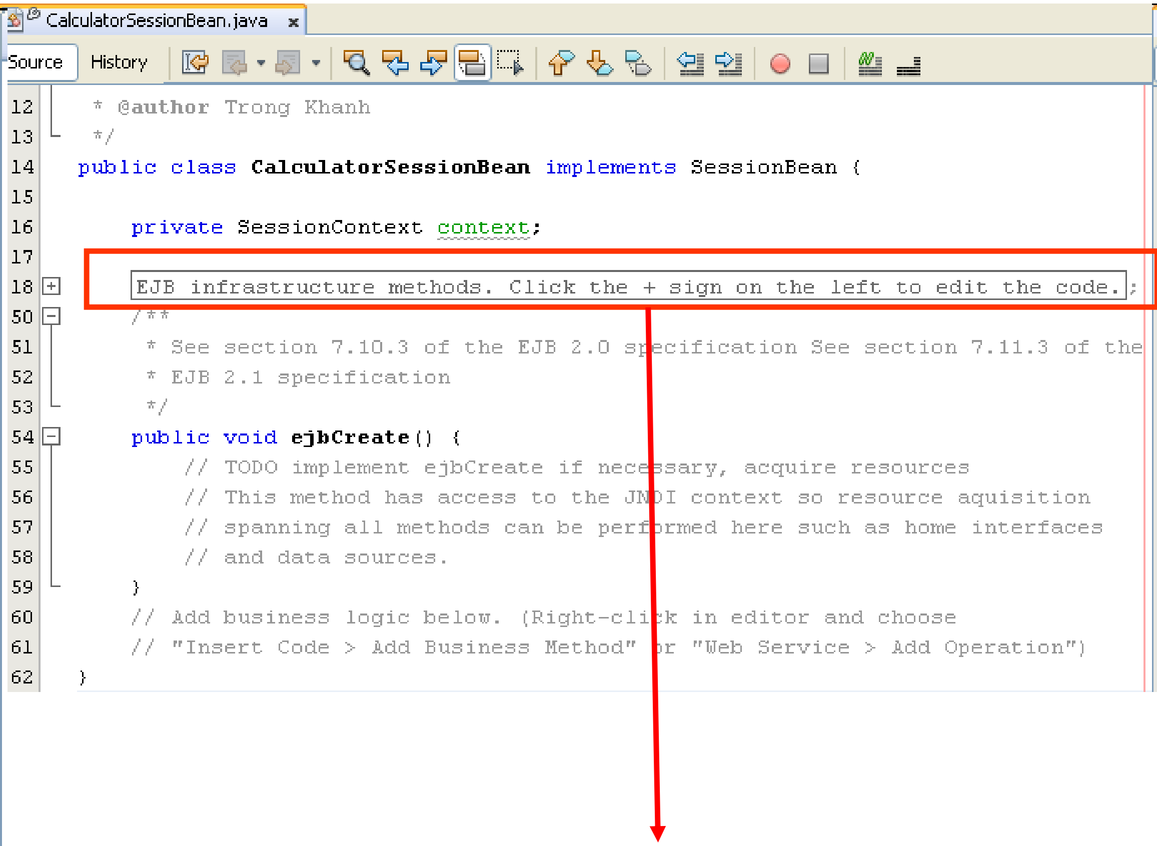
Choose remote or local or both

- Click **Finish** button

EJB Implementation

Step 2: Creating the new corresponding bean





```
 * @author Trong Khanh
 */
public class CalculatorSessionBean implements SessionBean {

    private SessionContext context;

    EJB infrastructure methods. Click the + sign on the left to edit the code.;
    /**
     * See section 7.10.3 of the EJB 2.0 specification See section 7.11.3 of the
     * EJB 2.1 specification
     */
    public void ejbCreate() {
        // TODO implement ejbCreate if necessary, acquire resources
        // This method has access to the JNDI context so resource aquisition
        // spanning all methods can be performed here such as home interfaces
        // and data sources.
    }
    // Add business logic below. (Right-click in editor and choose
    // "Insert Code > Add Business Method" or "Web Service > Add Operation")
}
```

Generate automatically four callback methods:

•setSessionContext

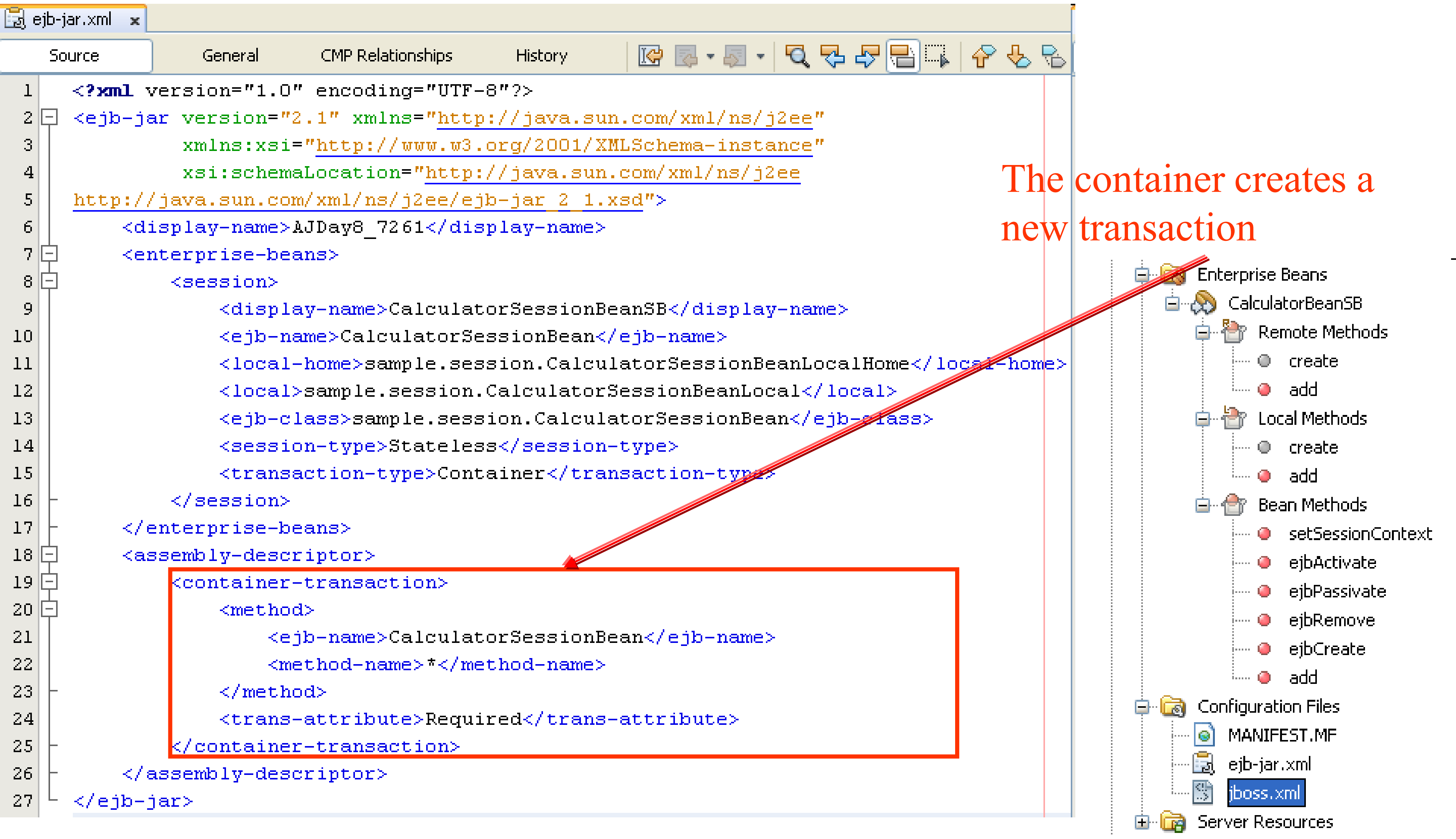
•ejbActivate

•ejbPassivate

•ejbRemove

EJB Implementation

Step 2: Creating the new corresponding bean

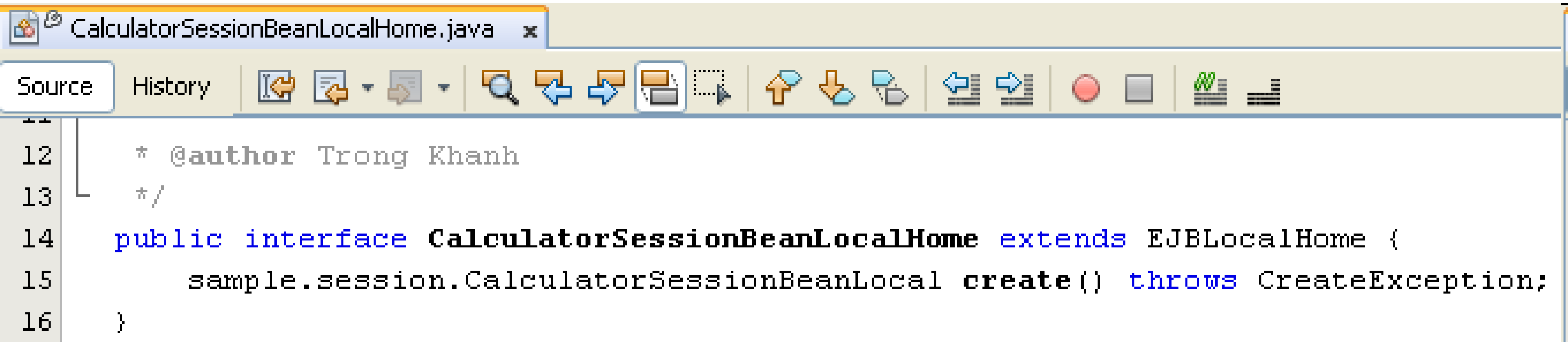


```
<?xml version="1.0" encoding="UTF-8"?>
<ejb-jar version="2.1" xmlns="http://java.sun.com/xml/ns/j2ee"
         xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
         xsi:schemaLocation="http://java.sun.com/xml/ns/j2ee
http://java.sun.com/xml/ns/j2ee/ejb-jar_2_1.xsd">
    <display-name>AJDay8_7261</display-name>
    <enterprise-beans>
        <session>
            <display-name>CalculatorSessionBeanSB</display-name>
            <ejb-name>CalculatorSessionBean</ejb-name>
            <local-home>sample.session.CalculatorSessionBeanLocalHome</local-home>
            <local>sample.session.CalculatorSessionBeanLocal</local>
            <ejb-class>sample.session.CalculatorSessionBean</ejb-class>
            <session-type>Stateless</session-type>
            <transaction-type>Container</transaction-type>
        </session>
    </enterprise-beans>
    <assembly-descriptor>
        <container-transaction>
            <method>
                <ejb-name>CalculatorSessionBean</ejb-name>
                <method-name>*</method-name>
            </method>
            <trans-attribute>Required</trans-attribute>
        </container-transaction>
    </assembly-descriptor>
</ejb-jar>
```

The container creates a new transaction

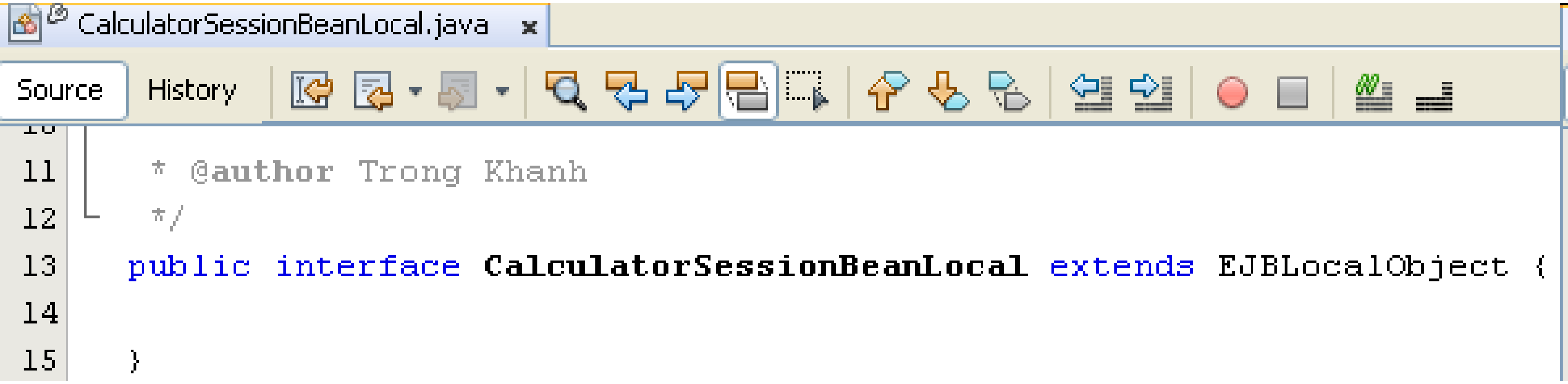
EJB Implementation

Step 2: Creating the new corresponding bean



CalculatorSessionBeanLocalHome.java

```
 * @author Trong Khanh
 */
public interface CalculatorSessionBeanLocalHome extends EJBLocalHome {
    sample.session.CalculatorSessionBeanLocal create() throws CreateException;
}
```



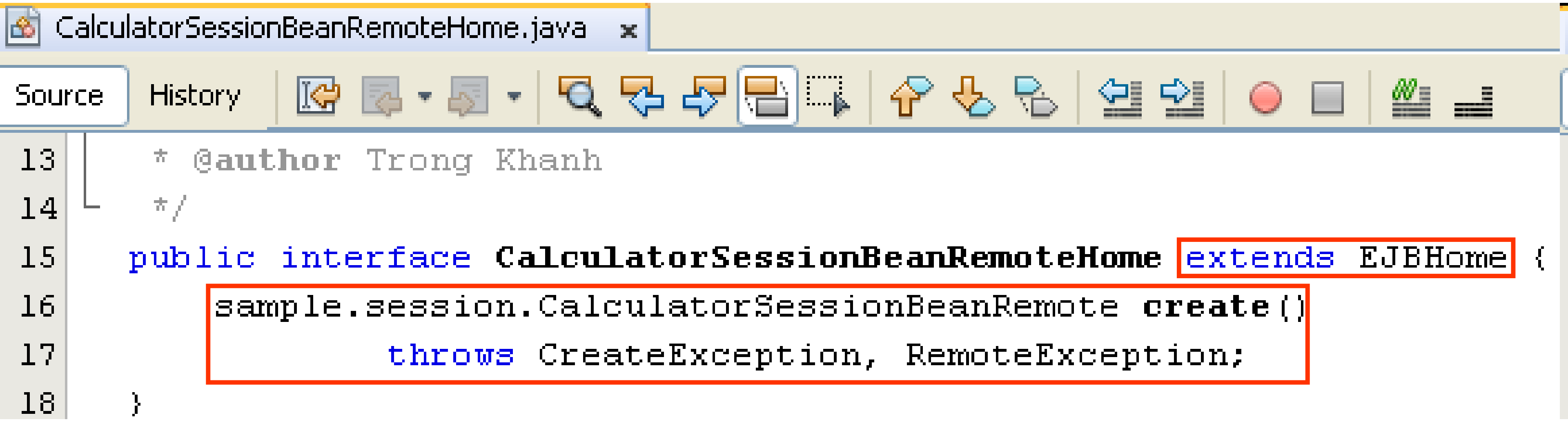
CalculatorSessionBeanLocal.java

```
 * @author Trong Khanh
 */
public interface CalculatorSessionBeanLocal extends EJBLocalObject {

}
```

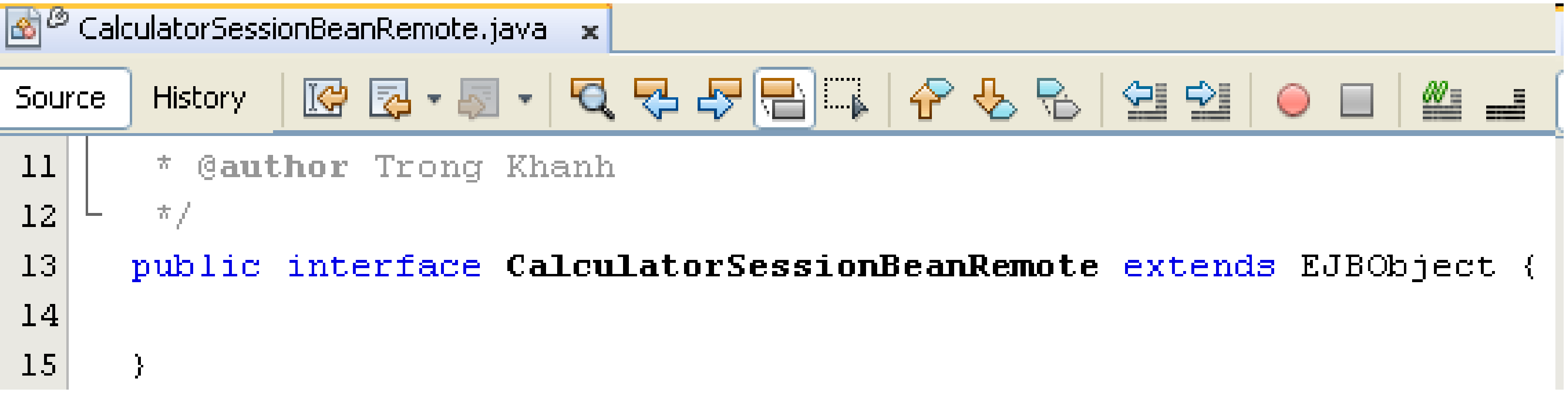
EJB Implementation
Step 2: Creating the new corresponding bean

- **Create** the **remote interface** and the **remote home interface**
  - **Create** two **java interface**, then **extends** the **EJBHome** and **EJBObject**
  - **Then**, update the **ejb-jar.xml** file



CalculatorSessionBeanRemoteHome.java

```java
 * @author Trong Khanh
 */
public interface CalculatorSessionBeanRemoteHome extends EJBHome {
    sample.session.CalculatorSessionBeanRemote create()
            throws CreateException, RemoteException;
}
```

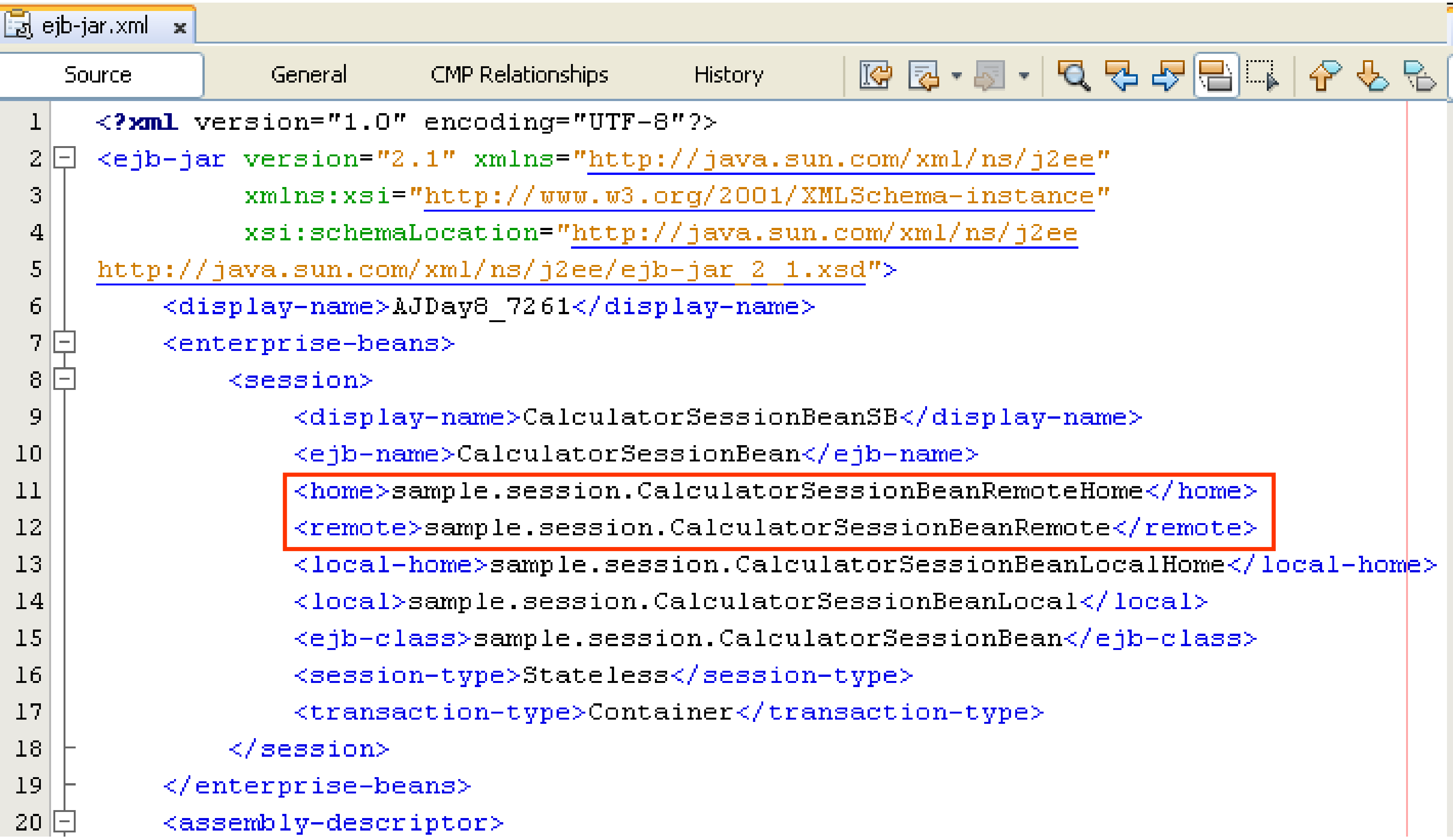


CalculatorSessionBeanRemote.java

```java
 * @author Trong Khanh
 */
public interface CalculatorSessionBeanRemote extends EJBObject {

}
```

EJB Implementation

Step 2: Creating the new corresponding bean

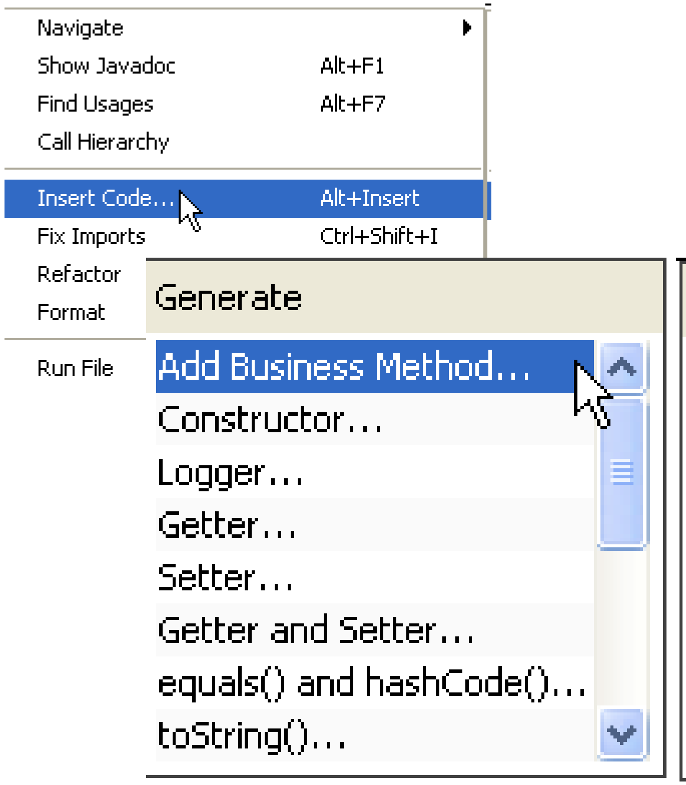


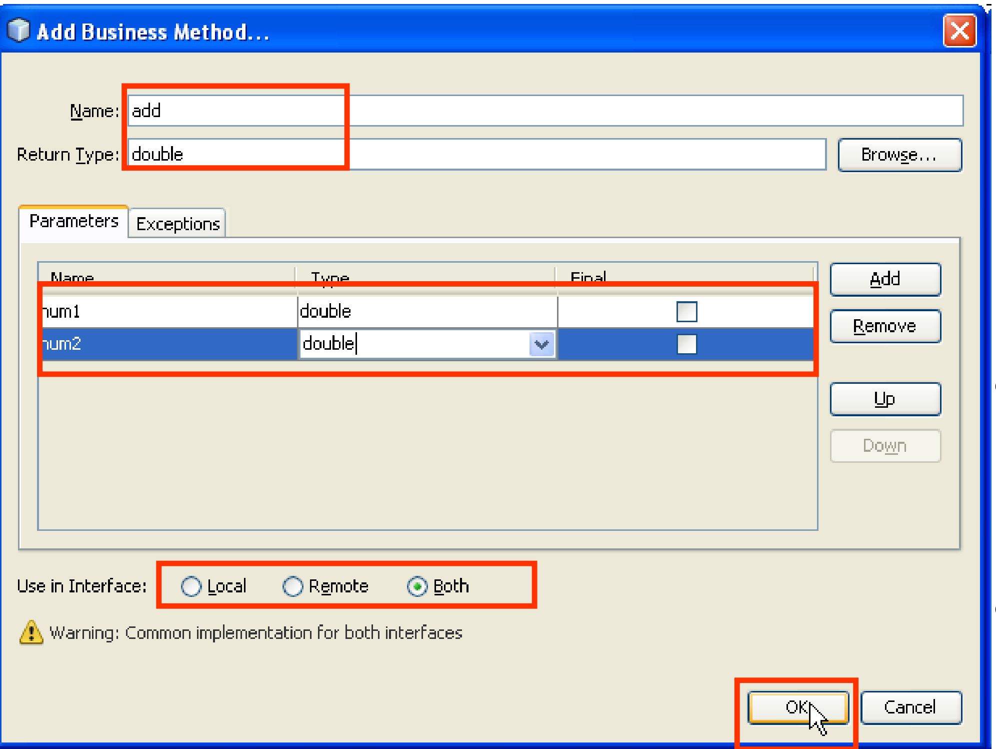
```xml
<?xml version="1.0" encoding="UTF-8"?>
<ejb-jar version="2.1" xmlns="http://java.sun.com/xml/ns/j2ee"
         xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
         xsi:schemaLocation="http://java.sun.com/xml/ns/j2ee
http://java.sun.com/xml/ns/j2ee/ejb-jar_2_1.xsd">
    <display-name>AJDay8_7261</display-name>
    <enterprise-beans>
        <session>
            <display-name>CalculatorSessionBeanSB</display-name>
            <ejb-name>CalculatorSessionBean</ejb-name>
            <home>sample.session.CalculatorSessionBeanRemoteHome</home>
            <remote>sample.session.CalculatorSessionBeanRemote</remote>
            <local-home>sample.session.CalculatorSessionBeanLocalHome</local-home>
            <local>sample.session.CalculatorSessionBeanLocal</local>
            <ejb-class>sample.session.CalculatorSessionBean</ejb-class>
            <session-type>Stateless</session-type>
            <transaction-type>Container</transaction-type>
        </session>
    </enterprise-beans>
    <assembly-descriptor>
```

EJB Implementation

Building/ Modifying the business/callback methods

- **Modifying** the **callback method** if necessary
- **Adding** a new **business method**
  - Right click on source code of the Bean file (Ex: CalculateBean)
  - Then, choose Insert Code, click Add Business Method…




Add Business Method…

Name: add

Return Type: double

Name	Type	Final
num1	double	☐
num2	double	☐

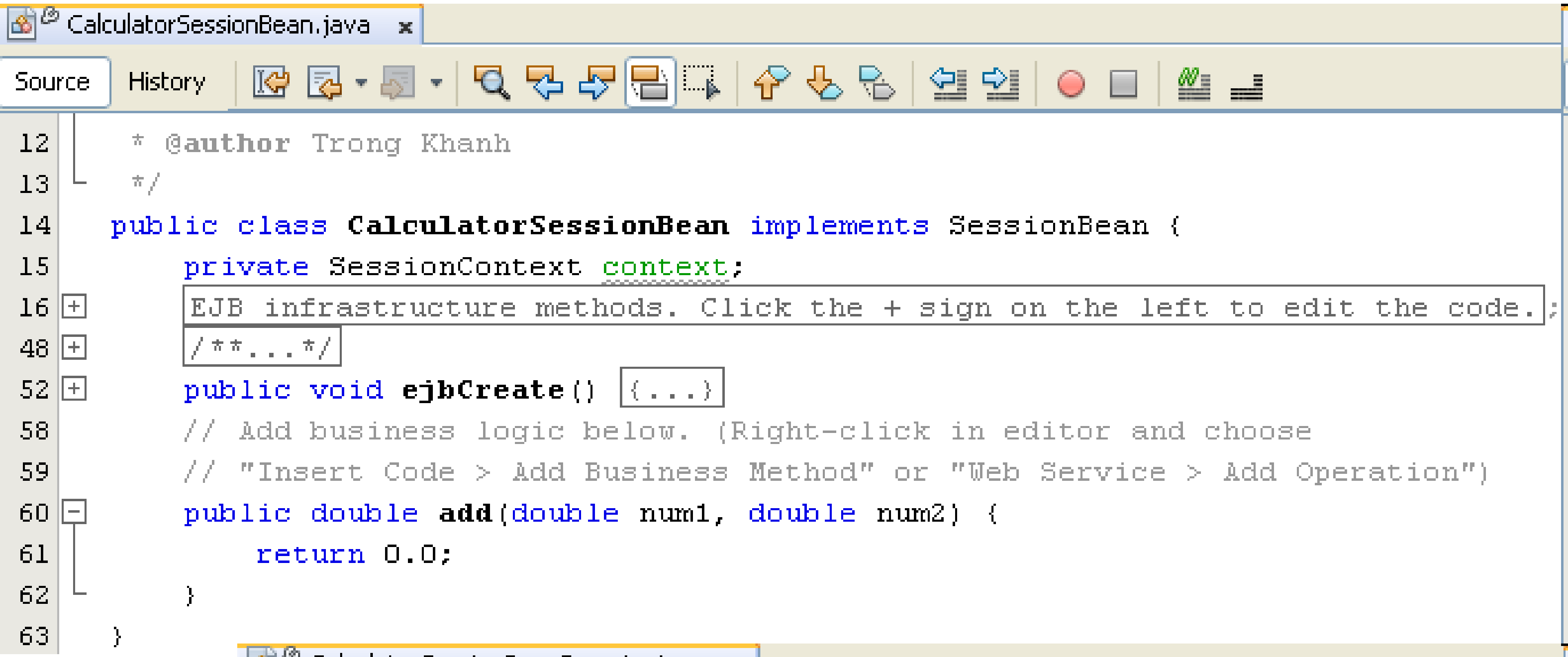
Use in Interface: ◯ Local ◯ Remote [✓ Both]

Warning: Common implementation for both interfaces

- Fill or type the method name with return type and add all parameters
- Then, click OK Button

EJB Implementation

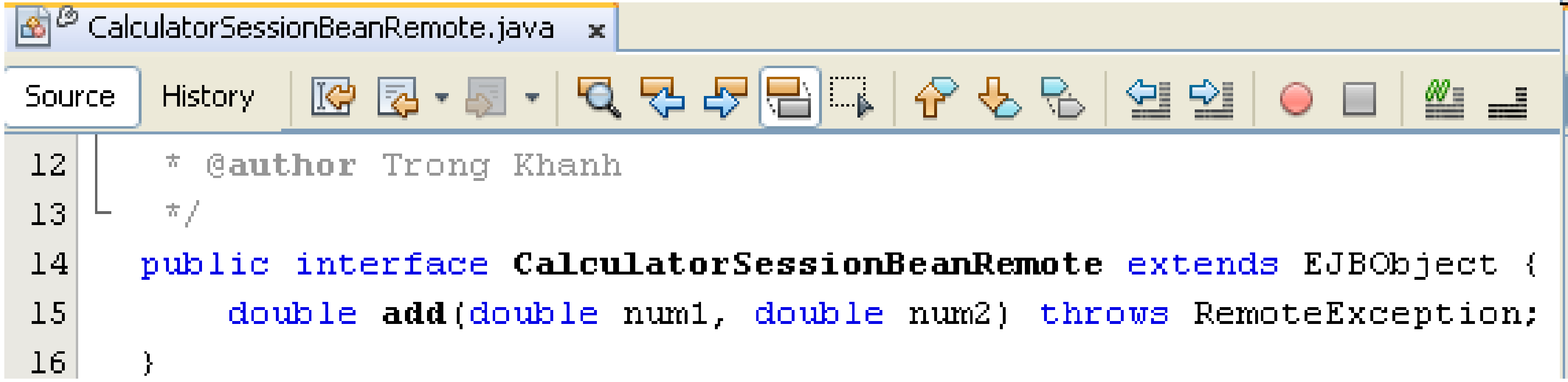
Building/ Modifying the business/callback methods



CalculatorSessionBean.java

Source History

```
 * @author Trong Khanh
 */
public class CalculatorSessionBean implements SessionBean {
    private SessionContext context;
    EJB infrastructure methods. Click the + sign on the left to edit the code.;
    /**...*/
    public void ejbCreate() {...}
    // Add business logic below. (Right-click in editor and choose
    // "Insert Code > Add Business Method" or "Web Service > Add Operation")
    public double add(double num1, double num2) {
        return 0.0;
    }
}
```



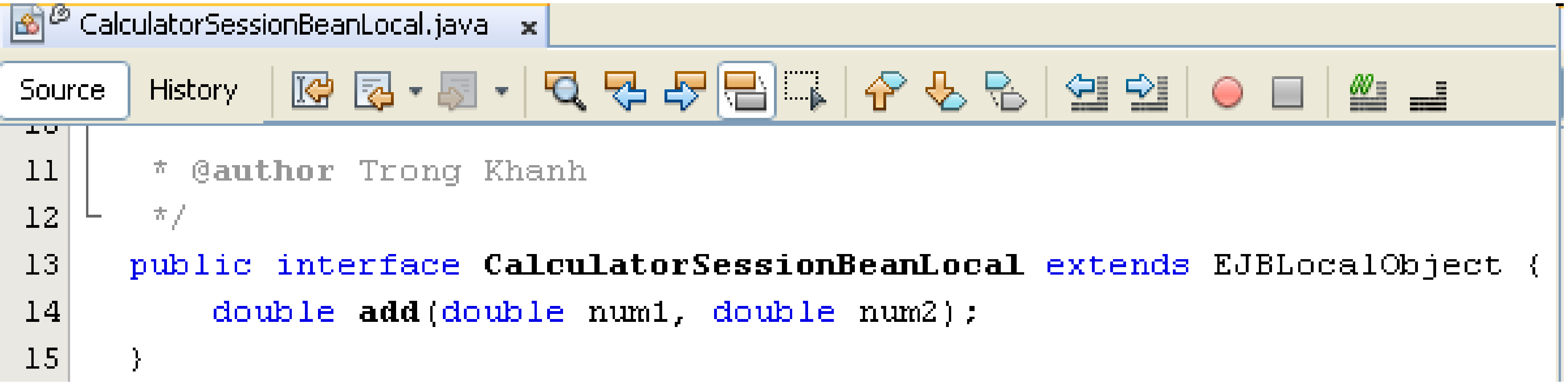
CalculatorSessionBeanRemote.java

Source History

```
 * @author Trong Khanh
 */
public interface CalculatorSessionBeanRemote extends EJBObject {
    double add(double num1, double num2) throws RemoteException;
}
```

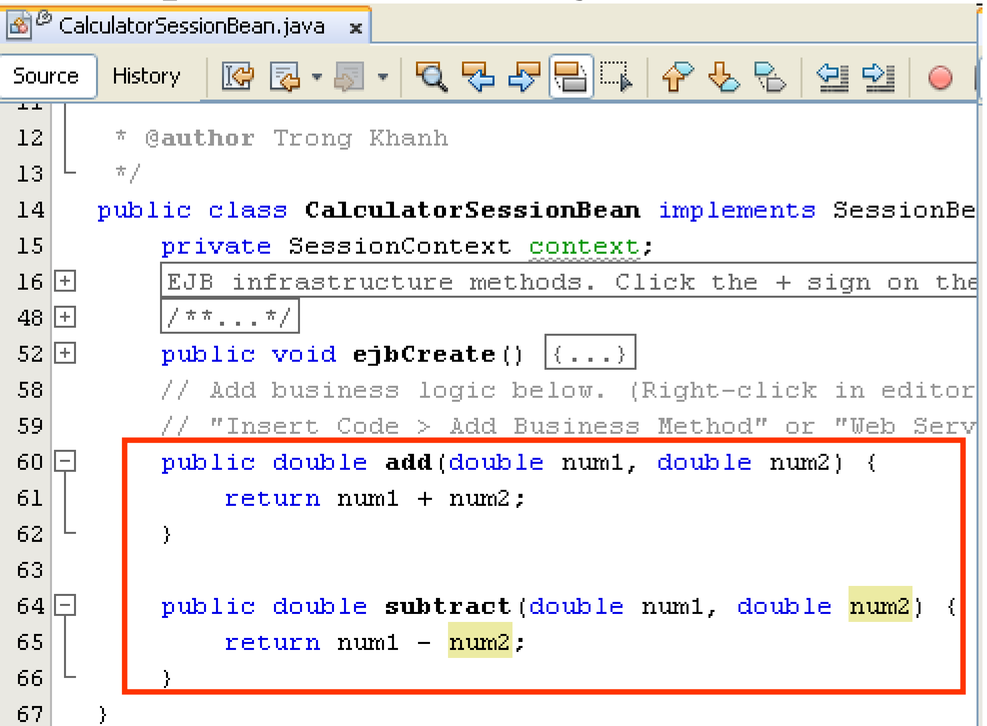
EJB Implementation

Building/ Modifying the business/callback methods

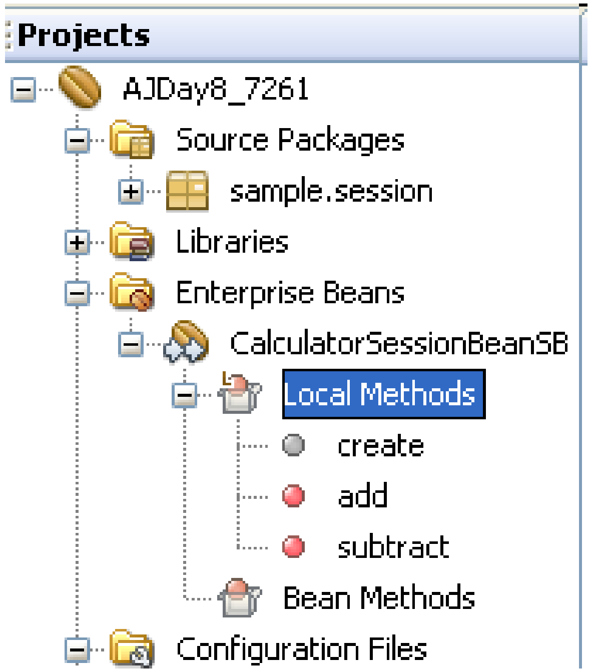


```
 * @author Trong Khanh
 */
public interface CalculatorSessionBeanLocal extends EJBLocalObject {
    double add(double num1, double num2);
}
```

- Implement the body of method corresponding with your purpose

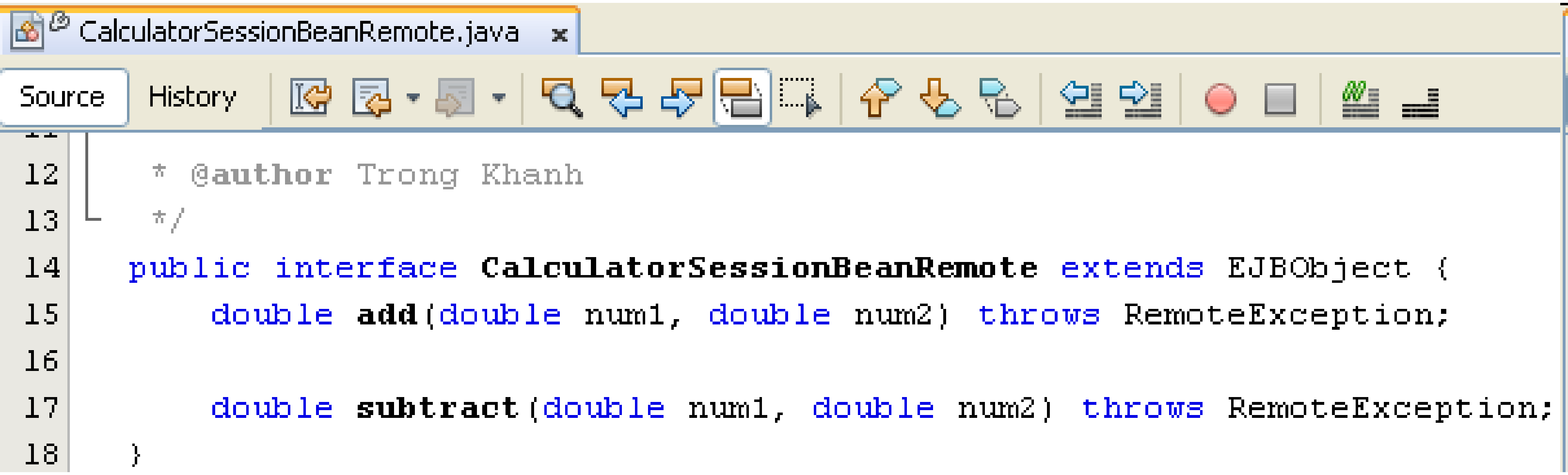


```
 * @author Trong Khanh
 */
public class CalculatorSessionBean implements SessionBe
    private SessionContext context;
    EJB infrastructure methods. Click the + sign on the
    /**...*/
    public void ejbCreate() {...}
    // Add business logic below. (Right-click in editor
    // "Insert Code > Add Business Method" or "Web Serv
    public double add(double num1, double num2) {
        return num1 + num2;
    }

    public double subtract(double num1, double num2) {
        return num1 - num2;
    }
}
```

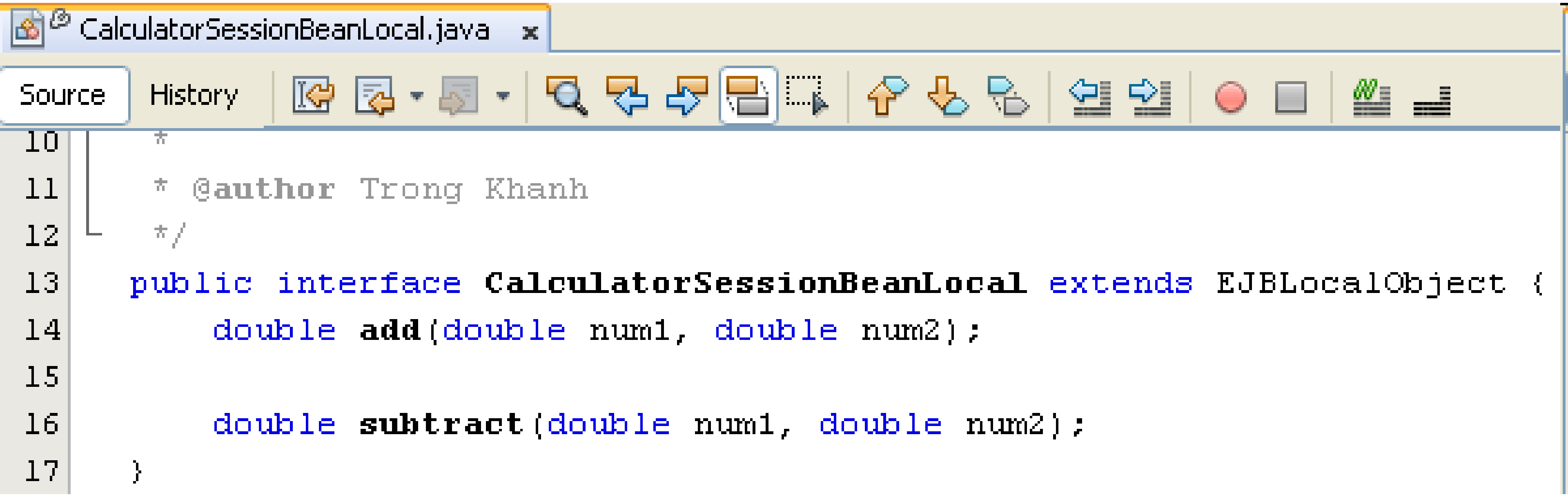


EJB Implementation

Building/ Modifying the business/callback methods



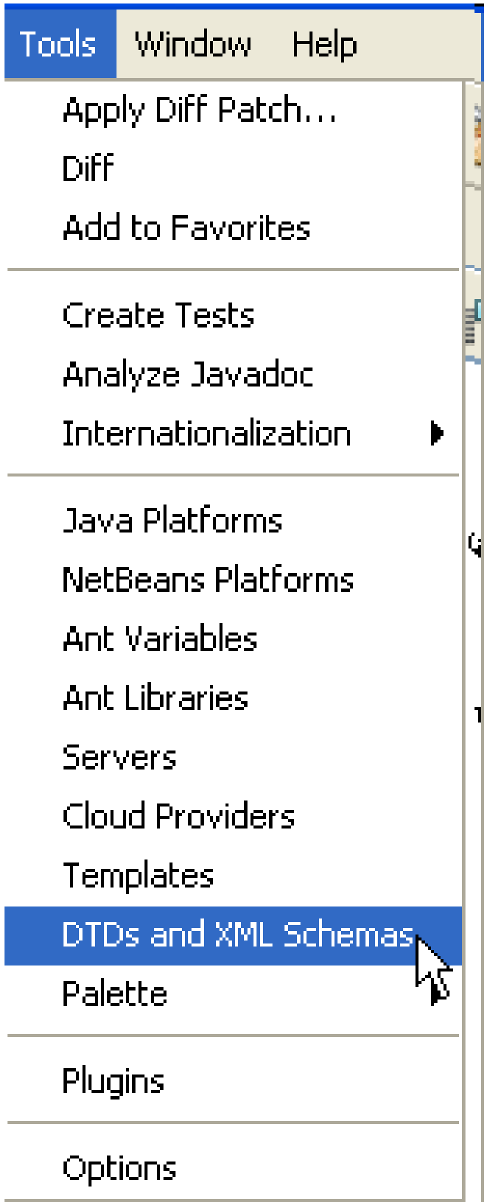
```
 * @author Trong Khanh
 */
public interface CalculatorSessionBeanRemote extends EJBObject {
    double add(double num1, double num2) throws RemoteException;

    double subtract(double num1, double num2) throws RemoteException;
}
```

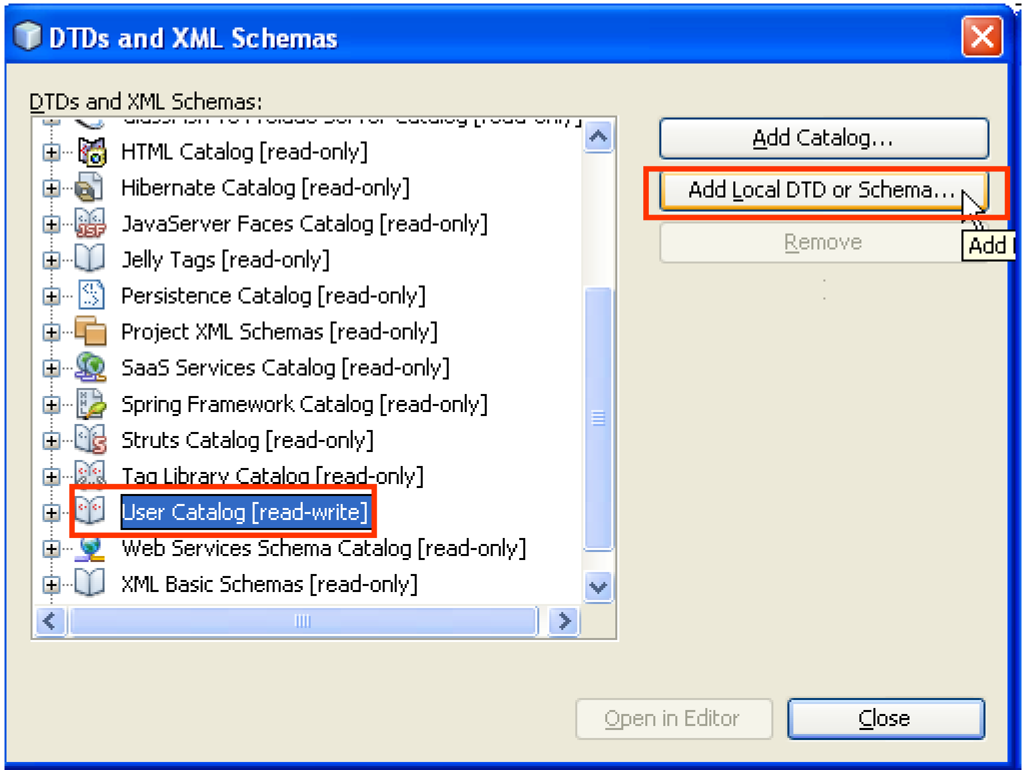


```
 *
 * @author Trong Khanh
 */
public interface CalculatorSessionBeanLocal extends EJBLocalObject {
    double add(double num1, double num2);

    double subtract(double num1, double num2);
}
```

EJB Implementation
Additional - Mapping JNDI

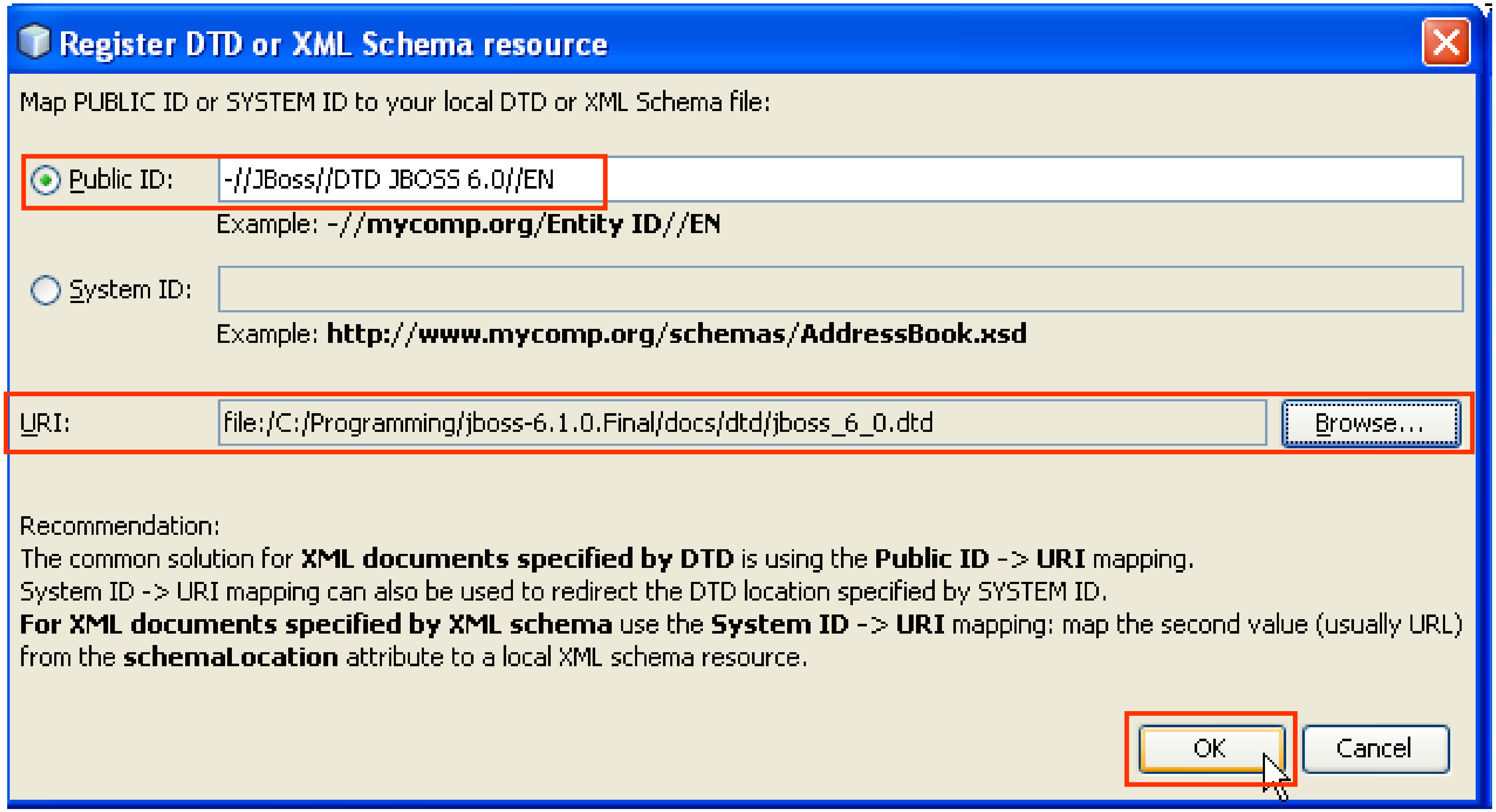
- **Set up** visual typing to **jboss.xml file**
  - Copy **the jboss_6_0.dtd** file to your local disk
  - Mapping this file to Netbeans as following steps
    - Click menu Tools, click "**DTDs and XML Schemas**" items





DTDs and XML Schemas
DTDs and XML Schemas:
HTML Catalog [read-only]
Hibernate Catalog [read-only]
JavaServer Faces Catalog [read-only]
Jelly Tags [read-only]
Persistence Catalog [read-only]
Project XML Schemas [read-only]
SaaS Services Catalog [read-only]
Spring Framework Catalog [read-only]
Struts Catalog [read-only]
Tag Library Catalog [read-only]
User Catalog [read-write]
Web Services Schema Catalog [read-only]
XML Basic Schemas [read-only]
Add Catalog...
Add Local DTD or Schema...
Remove
Add
Open in Editor
Close

EJB Implementation
Additional - Mapping JNDI



Register DTD or XML Schema resource

Map PUBLIC ID or SYSTEM ID to your local DTD or XML Schema file:

(●) Public ID: -//JBoss//DTD JBOSS 6.0//EN

Example: **-//mycomp.org/Entity ID//EN**

( ) System ID:

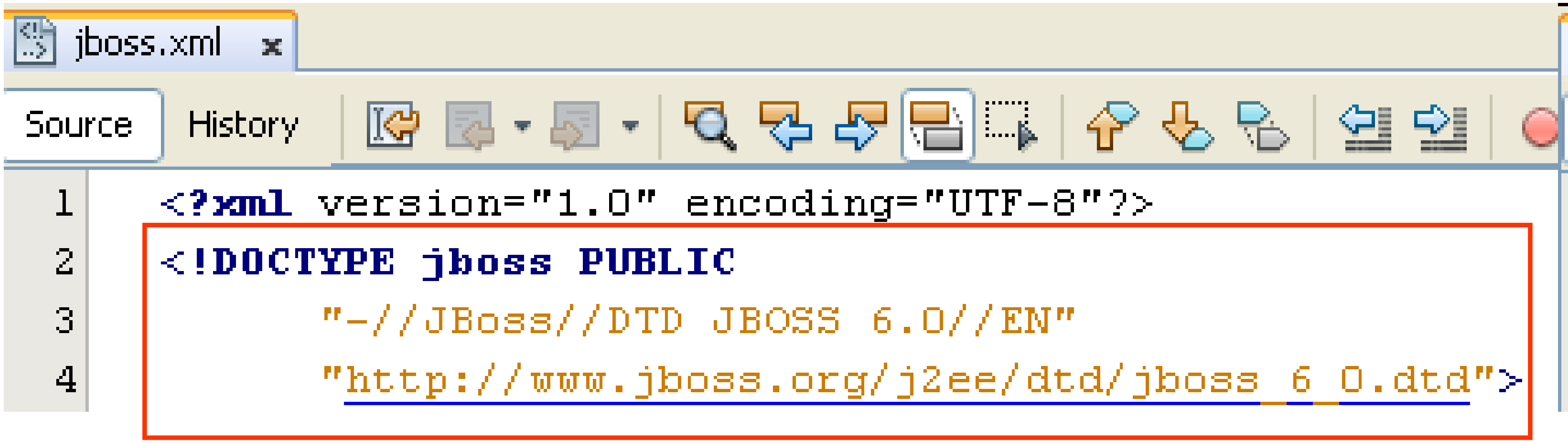
Example: **http://www.mycomp.org/schemas/AddressBook.xsd**

URI: file:/C:/Programming/jboss-6.1.0.Final/docs/dtd/jboss_6_0.dtd

Recommendation:
The common solution for **XML documents specified by DTD** is using the **Public ID -> URI** mapping.
System ID -> URI mapping can also be used to redirect the DTD location specified by SYSTEM ID.
For XML documents specified by XML schema use the **System ID -> URI** mapping: map the second value (usually URL) from the **schemaLocation** attribute to a local XML schema resource.

EJB Implementation

Additional - Mapping JNDI

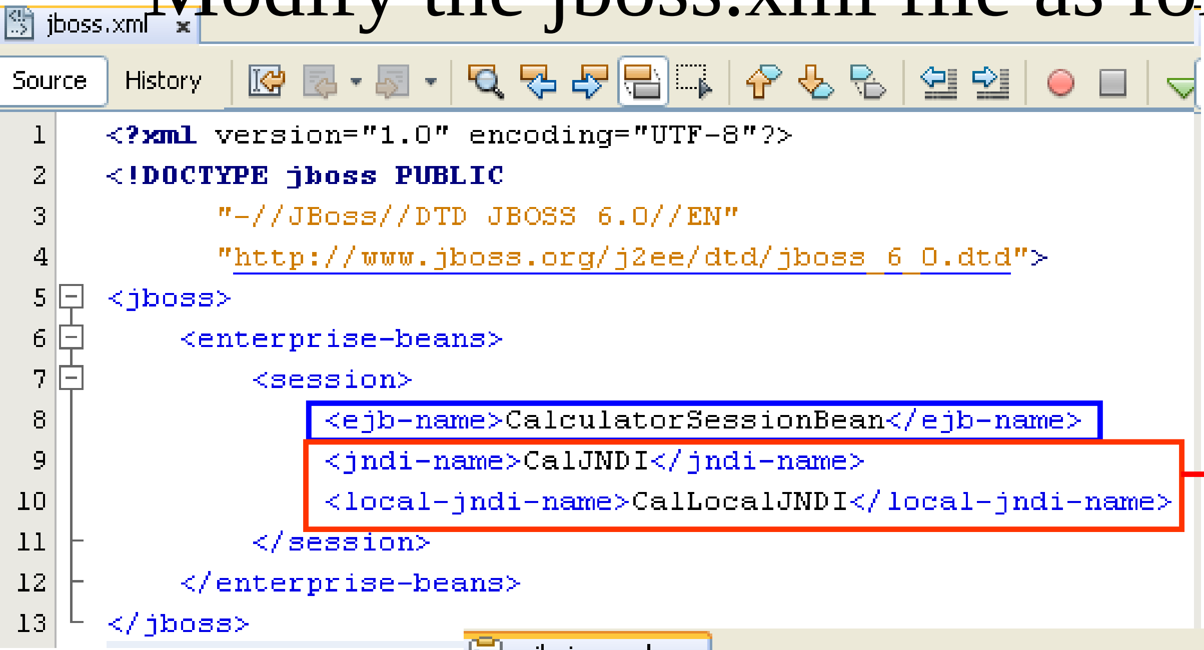


```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE jboss PUBLIC
      "-//JBoss//DTD JBOSS 6.0//EN"
      "http://www.jboss.org/j2ee/dtd/jboss_6_0.dtd">
```

EJB Implementation

Step 4: Mapping the JNDI to beans

- Modify the jboss.xml file as following

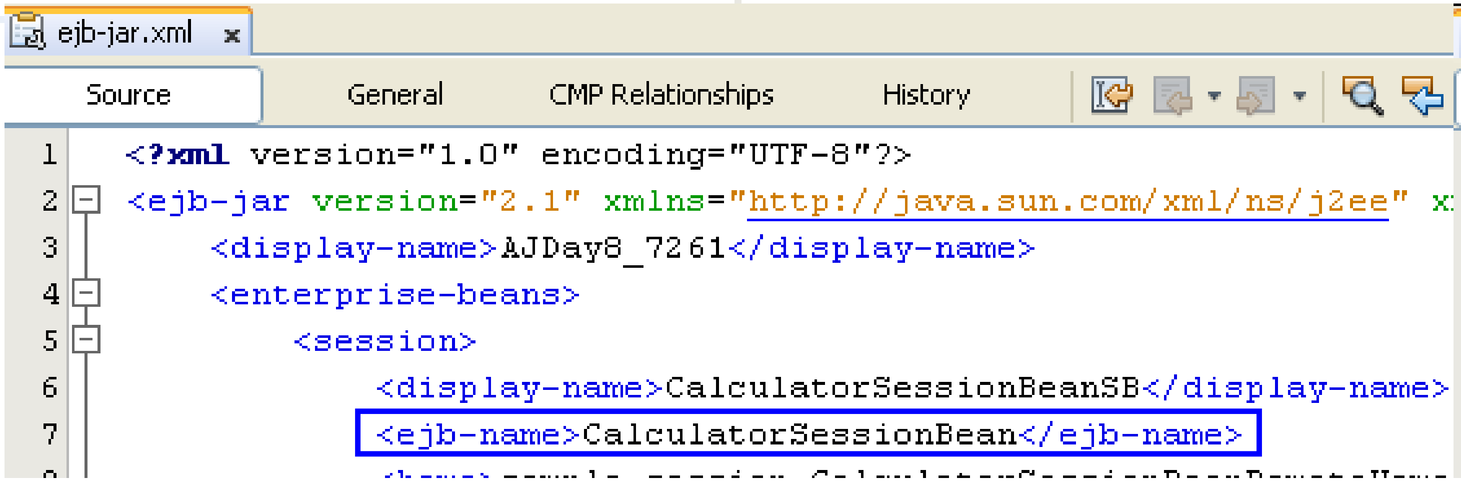


jboss.xml

Source History

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE jboss PUBLIC
      "-//JBoss//DTD JBOSS 6.0//EN"
      "http://www.jboss.org/j2ee/dtd/jboss_6_0.dtd">
<jboss>
    <enterprise-beans>
        <session>
            <ejb-name>CalculatorSessionBean</ejb-name>
            <jndi-name>CalJNDI</jndi-name>
            <local-jndi-name>CalLocalJNDI</local-jndi-name>
        </session>
    </enterprise-beans>
</jboss>
```

Fill your wanted JNDI that you want to reference



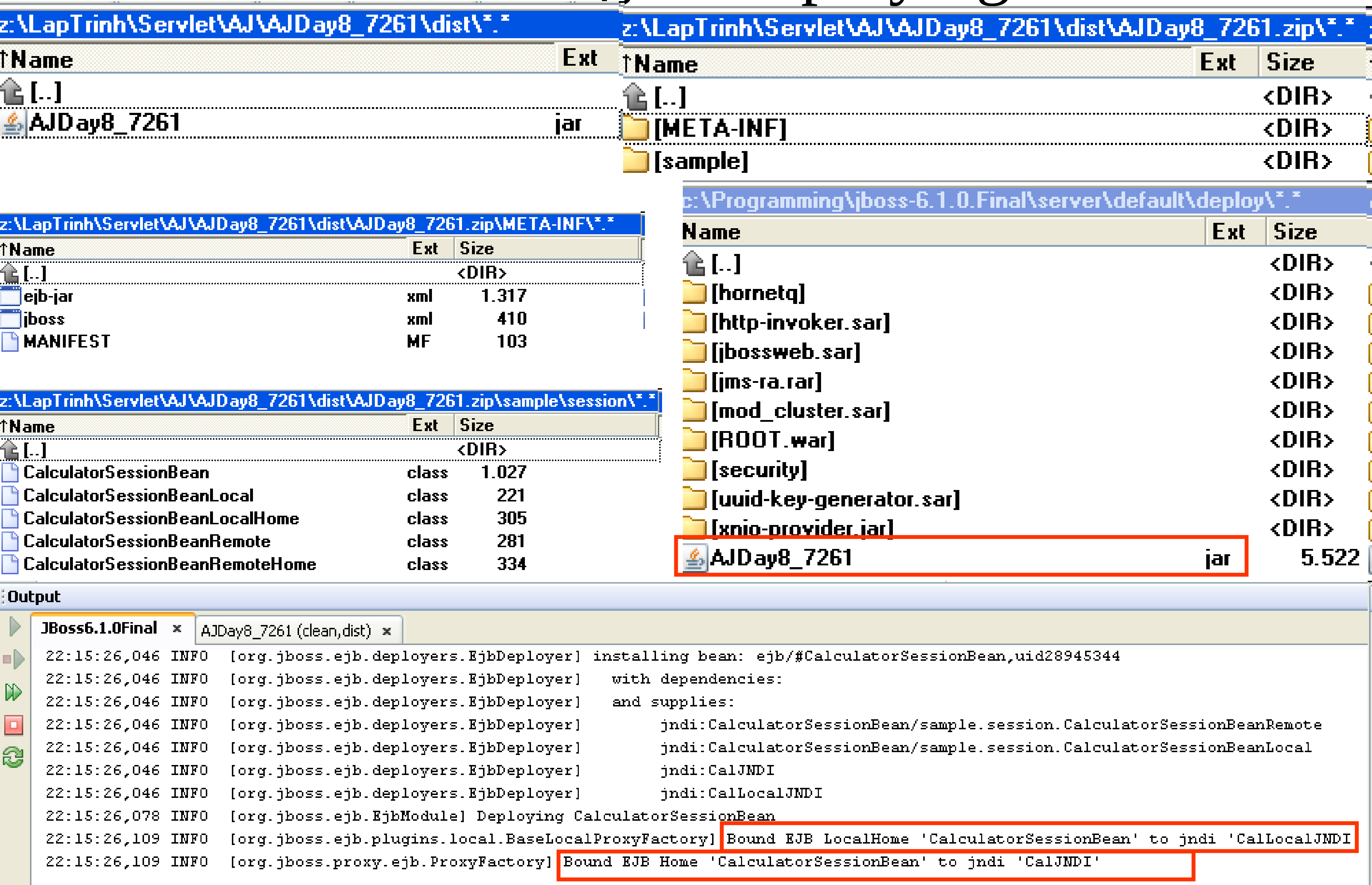
ejb-jar.xml

Source General CMP Relationships History

```
<?xml version="1.0" encoding="UTF-8"?>
<ejb-jar version="2.1" xmlns="http://java.sun.com/xml/ns/j2ee" x
    <display-name>AJDay8_7261</display-name>
    <enterprise-beans>
        <session>
            <display-name>CalculatorSessionBeanSB</display-name>
            <ejb-name>CalculatorSessionBean</ejb-name>
```

EJB Implementation

Building & Deploying



z:\LapTrinh\Servlet\AJ\AJDay8_7261\dist\*.*

↑Name	Ext
[..]	
AJDay8_7261	jar

z:\LapTrinh\Servlet\AJ\AJDay8_7261\dist\AJDay8_7261.zip\*.*

↑Name	Ext	Size
[..]		<DIR>
[META-INF]		<DIR>
[sample]		<DIR>

z:\LapTrinh\Servlet\AJ\AJDay8_7261\dist\AJDay8_7261.zip\META-INF\*.*

↑Name	Ext	Size
[..]		<DIR>
ejb-jar	xml	1.317
jboss	xml	410
MANIFEST	MF	103

z:\LapTrinh\Servlet\AJ\AJDay8_7261\dist\AJDay8_7261.zip\sample\session\*.*

↑Name	Ext	Size
[..]		<DIR>
CalculatorSessionBean	class	1.027
CalculatorSessionBeanLocal	class	221
CalculatorSessionBeanLocalHome	class	305
CalculatorSessionBeanRemote	class	281
CalculatorSessionBeanRemoteHome	class	334

c:\Programming\jboss-6.1.0.Final\server\default\deploy\*.*

Name	Ext	Size
[..]		<DIR>
[hornetq]		<DIR>
[http-invoker.sar]		<DIR>
[jbossweb.sar]		<DIR>
[jms-ra.rar]		<DIR>
[mod_cluster.sar]		<DIR>
[ROOT.war]		<DIR>
[security]		<DIR>
[uuid-key-generator.sar]		<DIR>
[xnio-provider.jar]		<DIR>
AJDay8_7261	jar	5.522

Output

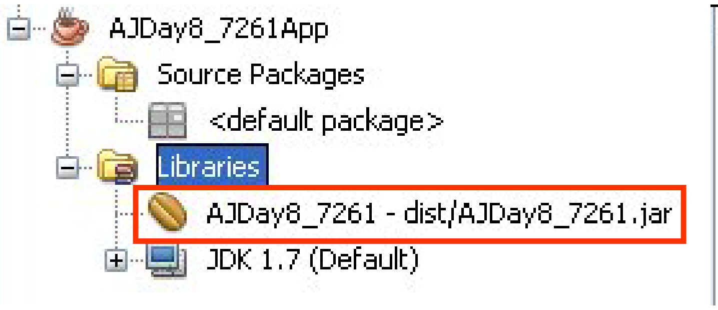
JBoss6.1.0Final × | AJDay8_7261 (clean,dist) ×

```
22:15:26,046 INFO  [org.jboss.ejb.deployers.EjbDeployer] installing bean: ejb/#CalculatorSessionBean,uid28945344
22:15:26,046 INFO  [org.jboss.ejb.deployers.EjbDeployer]   with dependencies:
22:15:26,046 INFO  [org.jboss.ejb.deployers.EjbDeployer]   and supplies:
22:15:26,046 INFO  [org.jboss.ejb.deployers.EjbDeployer]        jndi:CalculatorSessionBean/sample.session.CalculatorSessionBeanRemote
22:15:26,046 INFO  [org.jboss.ejb.deployers.EjbDeployer]        jndi:CalculatorSessionBean/sample.session.CalculatorSessionBeanLocal
22:15:26,046 INFO  [org.jboss.ejb.deployers.EjbDeployer]        jndi:CalJNDI
22:15:26,046 INFO  [org.jboss.ejb.deployers.EjbDeployer]        jndi:CalLocalJNDI
22:15:26,078 INFO  [org.jboss.ejb.EjbModule] Deploying CalculatorSessionBean
22:15:26,109 INFO  [org.jboss.ejb.plugins.local.BaseLocalProxyFactory] Bound EJB LocalHome 'CalculatorSessionBean' to jndi 'CalLocalJNDI
22:15:26,109 INFO  [org.jboss.proxy.ejb.ProxyFactory] Bound EJB Home 'CalculatorSessionBean' to jndi 'CalJNDI'
```

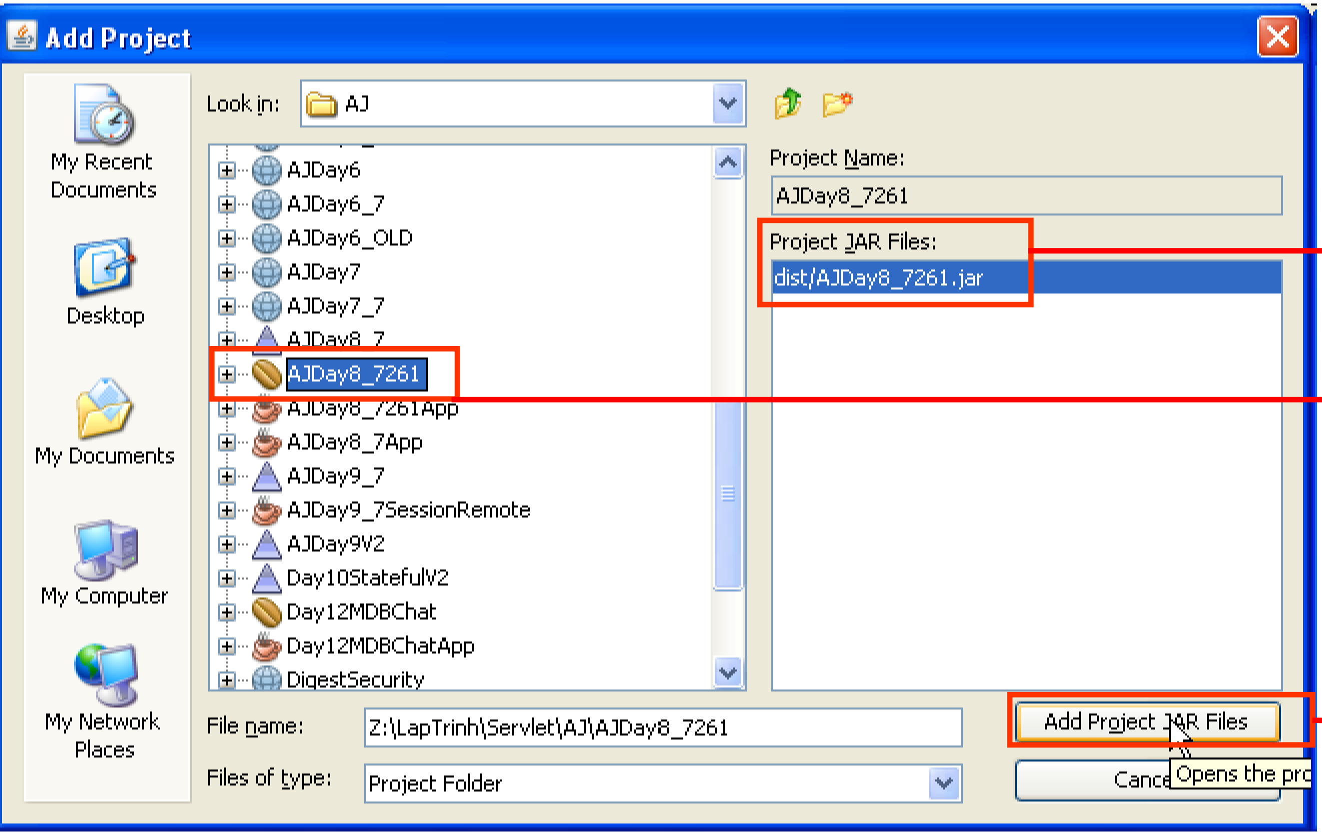
EJB Implementation

Creating the client application

- Create Java console application
- Add reference to EJB project mapping to invoke the remote method on application Server
  - Right click on library of client project/ click "Add Project …"



AJDay8_7261App
Source Packages
<default package>
Libraries
AJDay8_7261 - dist/AJDay8_7261.jar
JDK 1.7 (Default)



Add Project

Look in: AJ

AJDay6
AJDay6_7
AJDay6_OLD
AJDay7
AJDay7_7
AJDay8_7
AJDay8_7261
AJDay8_7261App
AJDay8_7App
AJDay9_7
AJDay9_7SessionRemote
AJDay9V2
Day10StatefulV2
Day12MDBChat
Day12MDBChatApp
DigestSecurity

Project Name: AJDay8_7261

Project JAR Files: dist/AJDay8_7261.jar

File name: Z:\LapTrinh\Servlet\AJ\AJDay8_7261

Files of type: Project Folder

Choose the jar file

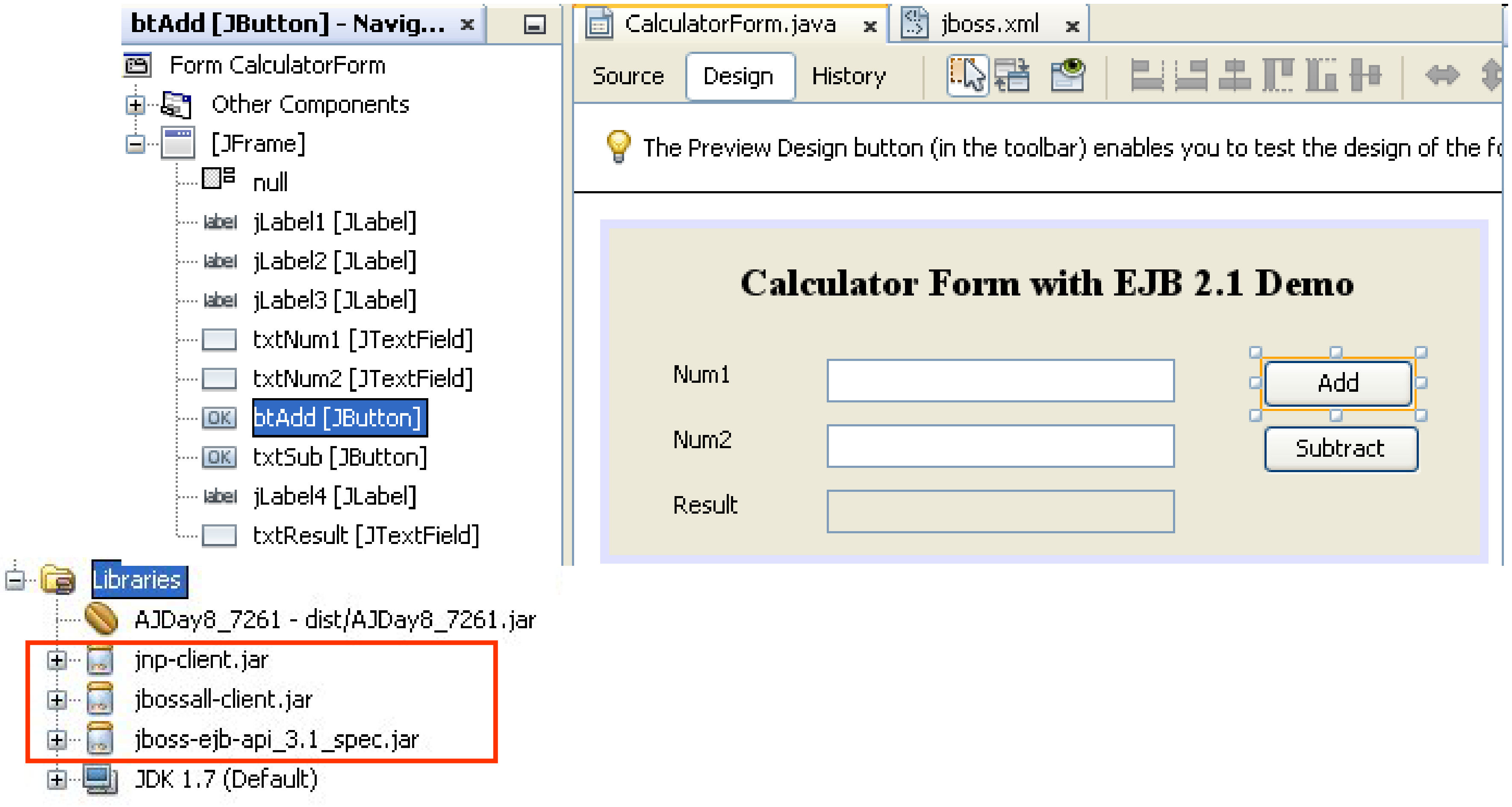
Choose EJB module

Click Add Project Jar File

EJB Implementation

Creating the client application

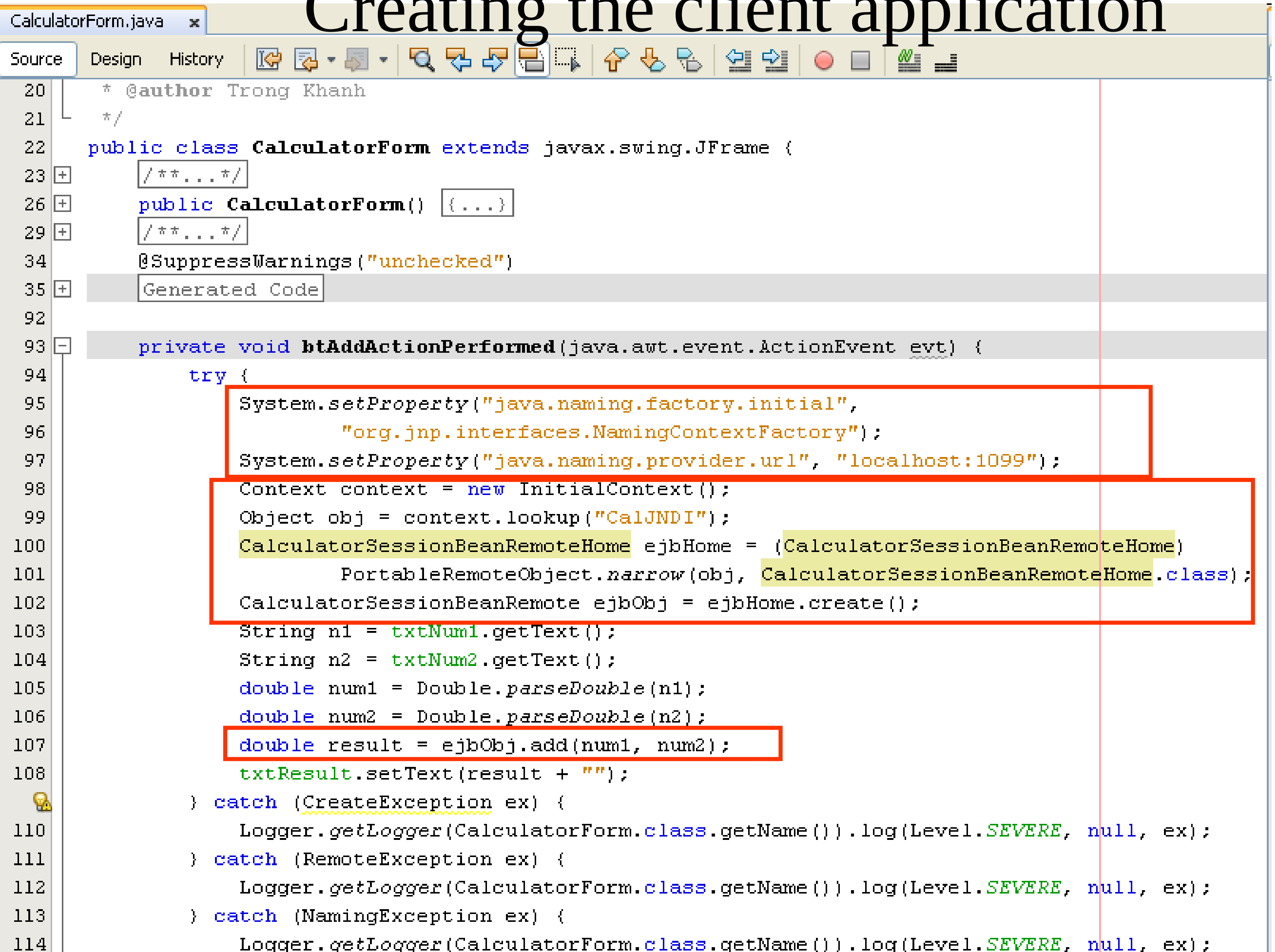
- Adding the code as following (**notes: addition the jbossall-client.jar, jnp-client.jar, and jboss-ejb-api_3.1_spec.jar from JBOSS_HOME\client to application project**)



The Preview Design button (in the toolbar) enables you to test the design of the fo

EJB Implementation

Creating the client application



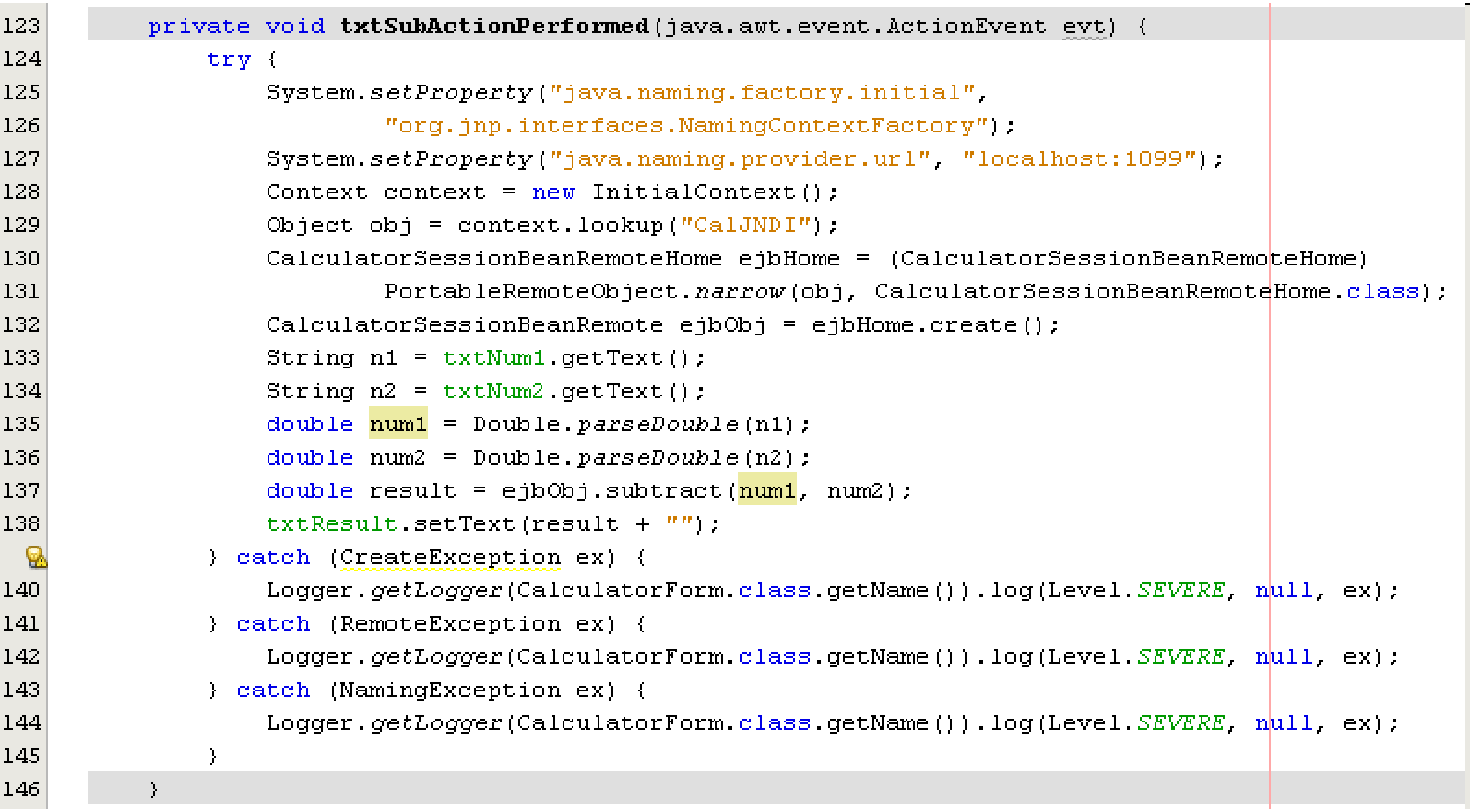
CalculatorForm.java

Source Design History

```
     * @author Trong Khanh
     */
public class CalculatorForm extends javax.swing.JFrame {
    /**...*/
    public CalculatorForm() {...}
    /**...*/
    @SuppressWarnings("unchecked")
    Generated Code

    private void btAddActionPerformed(java.awt.event.ActionEvent evt) {
        try {
            System.setProperty("java.naming.factory.initial",
                    "org.jnp.interfaces.NamingContextFactory");
            System.setProperty("java.naming.provider.url", "localhost:1099");
            Context context = new InitialContext();
            Object obj = context.lookup("CalJNDI");
            CalculatorSessionBeanRemoteHome ejbHome = (CalculatorSessionBeanRemoteHome)
                    PortableRemoteObject.narrow(obj, CalculatorSessionBeanRemoteHome.class);
            CalculatorSessionBeanRemote ejbObj = ejbHome.create();
            String n1 = txtNum1.getText();
            String n2 = txtNum2.getText();
            double num1 = Double.parseDouble(n1);
            double num2 = Double.parseDouble(n2);
            double result = ejbObj.add(num1, num2);
            txtResult.setText(result + "");
        } catch (CreateException ex) {
            Logger.getLogger(CalculatorForm.class.getName()).log(Level.SEVERE, null, ex);
        } catch (RemoteException ex) {
            Logger.getLogger(CalculatorForm.class.getName()).log(Level.SEVERE, null, ex);
        } catch (NamingException ex) {
            Logger.getLogger(CalculatorForm.class.getName()).log(Level.SEVERE, null, ex);
```

EJB Implementation

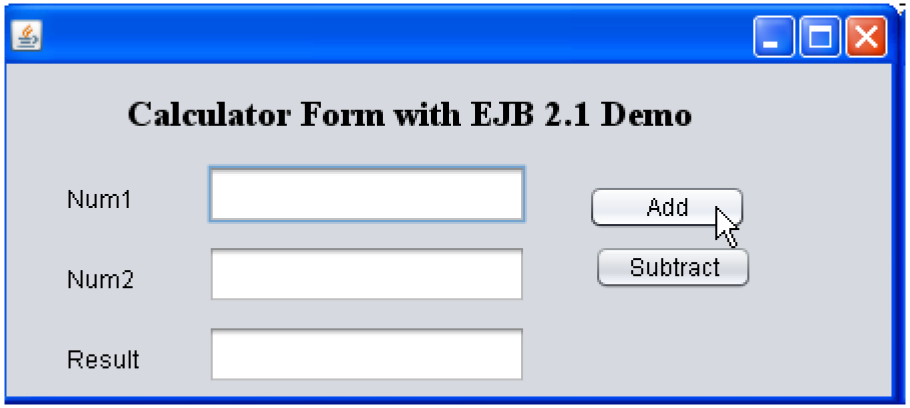
Creating the client application



```java
    private void txtSubActionPerformed(java.awt.event.ActionEvent evt) {
        try {
            System.setProperty("java.naming.factory.initial",
                    "org.jnp.interfaces.NamingContextFactory");
            System.setProperty("java.naming.provider.url", "localhost:1099");
            Context context = new InitialContext();
            Object obj = context.lookup("CalJNDI");
            CalculatorSessionBeanRemoteHome ejbHome = (CalculatorSessionBeanRemoteHome)
                    PortableRemoteObject.narrow(obj, CalculatorSessionBeanRemoteHome.class);
            CalculatorSessionBeanRemote ejbObj = ejbHome.create();
            String n1 = txtNum1.getText();
            String n2 = txtNum2.getText();
            double num1 = Double.parseDouble(n1);
            double num2 = Double.parseDouble(n2);
            double result = ejbObj.subtract(num1, num2);
            txtResult.setText(result + "");
        } catch (CreateException ex) {
            Logger.getLogger(CalculatorForm.class.getName()).log(Level.SEVERE, null, ex);
        } catch (RemoteException ex) {
            Logger.getLogger(CalculatorForm.class.getName()).log(Level.SEVERE, null, ex);
        } catch (NamingException ex) {
            Logger.getLogger(CalculatorForm.class.getName()).log(Level.SEVERE, null, ex);
        }
    }
```

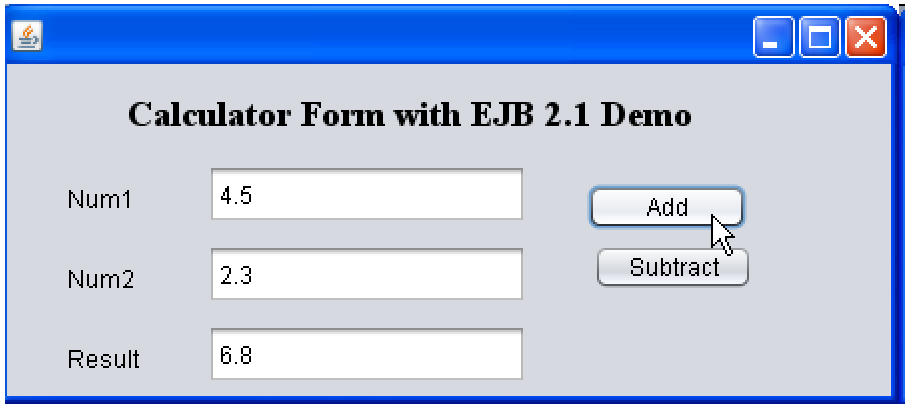
EJB Implementation

Creating the client application



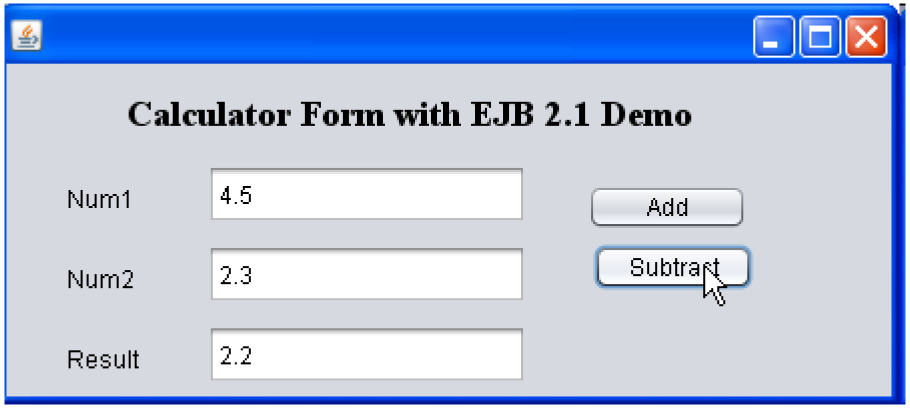
Calculator Form with EJB 2.1 Demo

Num1	
Num2	
Result	



Calculator Form with EJB 2.1 Demo

Num1	4.5
Num2	2.3
Result	6.8

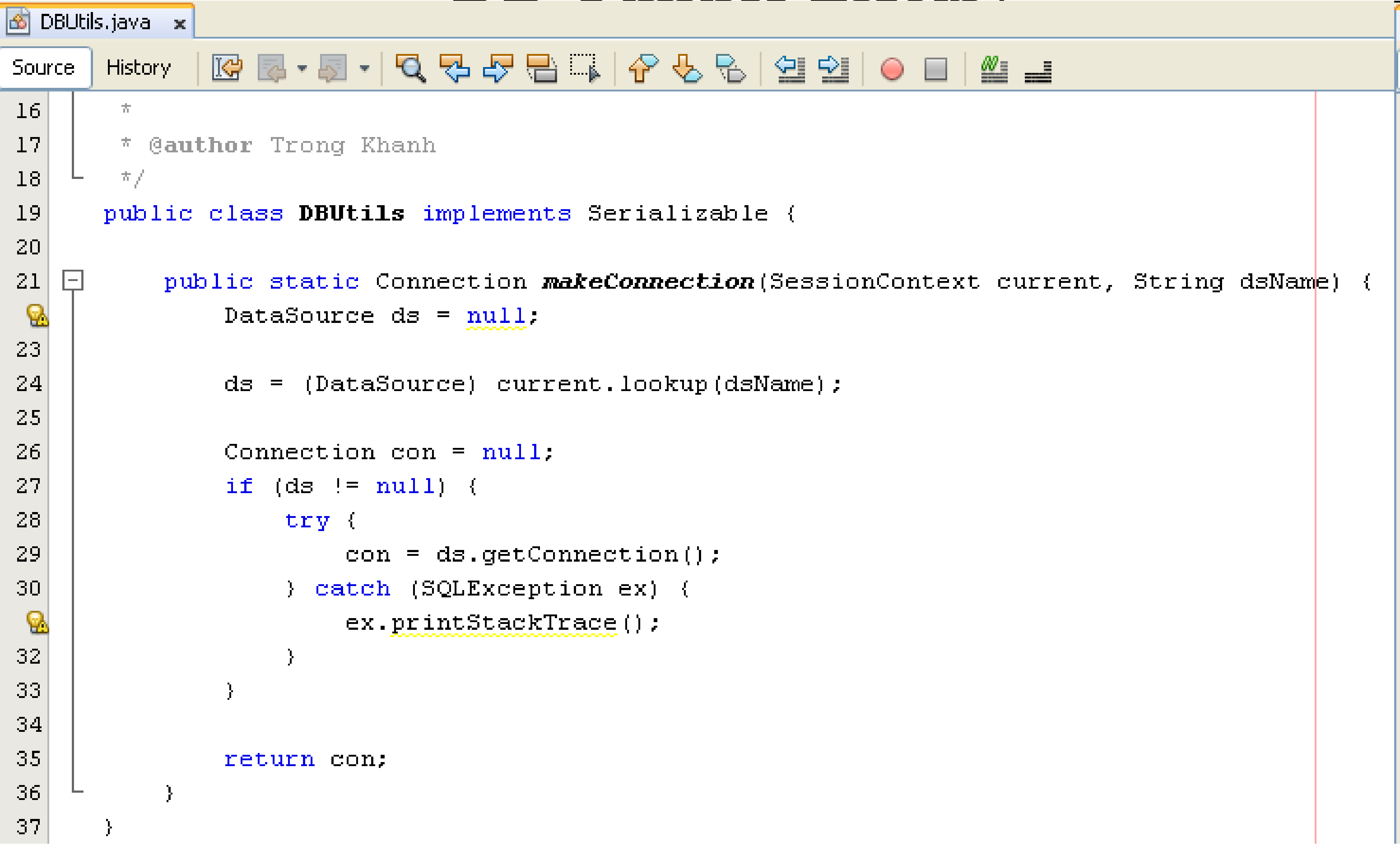


Calculator Form with EJB 2.1 Demo

Num1	4.5
Num2	2.3
Result	2.2

Build the simple enterprise application

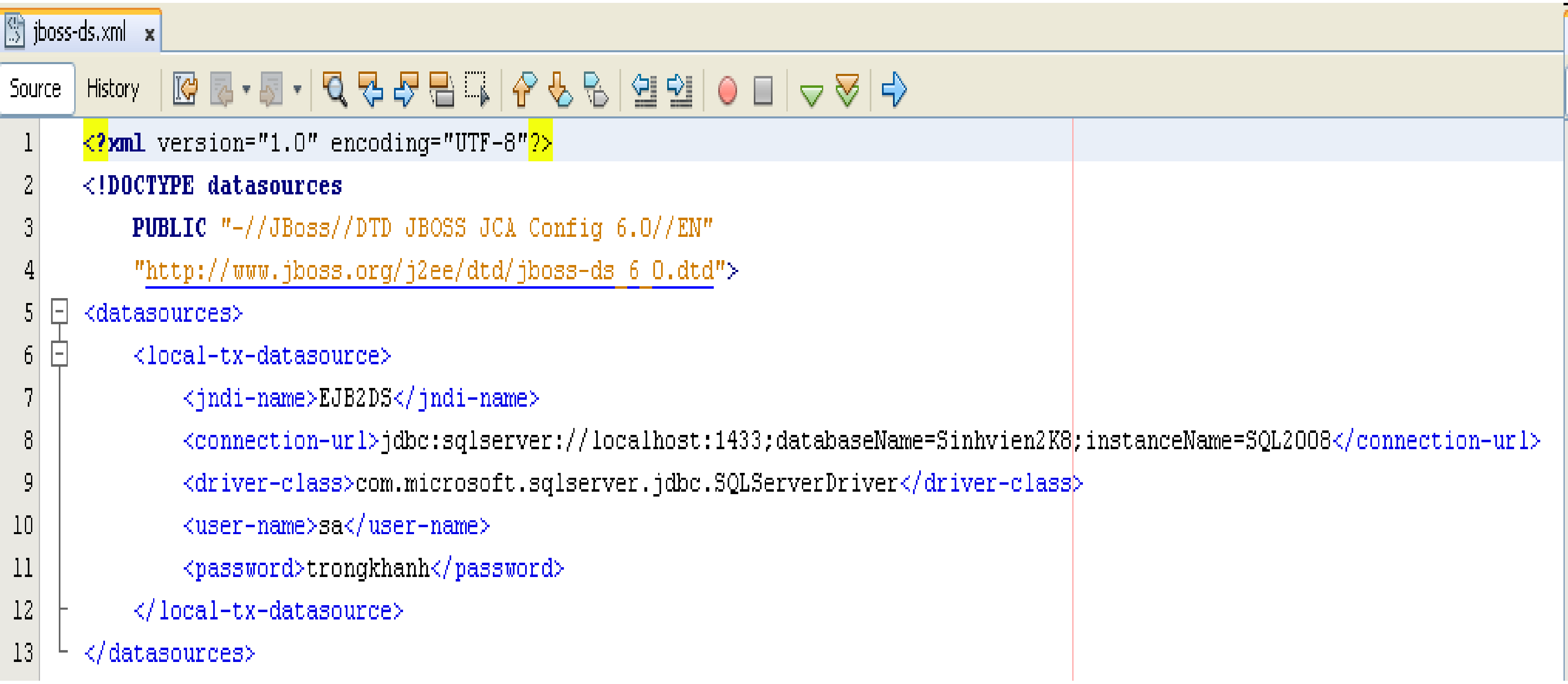
DB Utilities Library



```
 *
 * @author Trong Khanh
 */
public class DBUtils implements Serializable {

    public static Connection makeConnection(SessionContext current, String dsName) {
        DataSource ds = null;

        ds = (DataSource) current.lookup(dsName);

        Connection con = null;
        if (ds != null) {
            try {
                con = ds.getConnection();
            } catch (SQLException ex) {
                ex.printStackTrace();
            }
        }

        return con;
    }
}
```

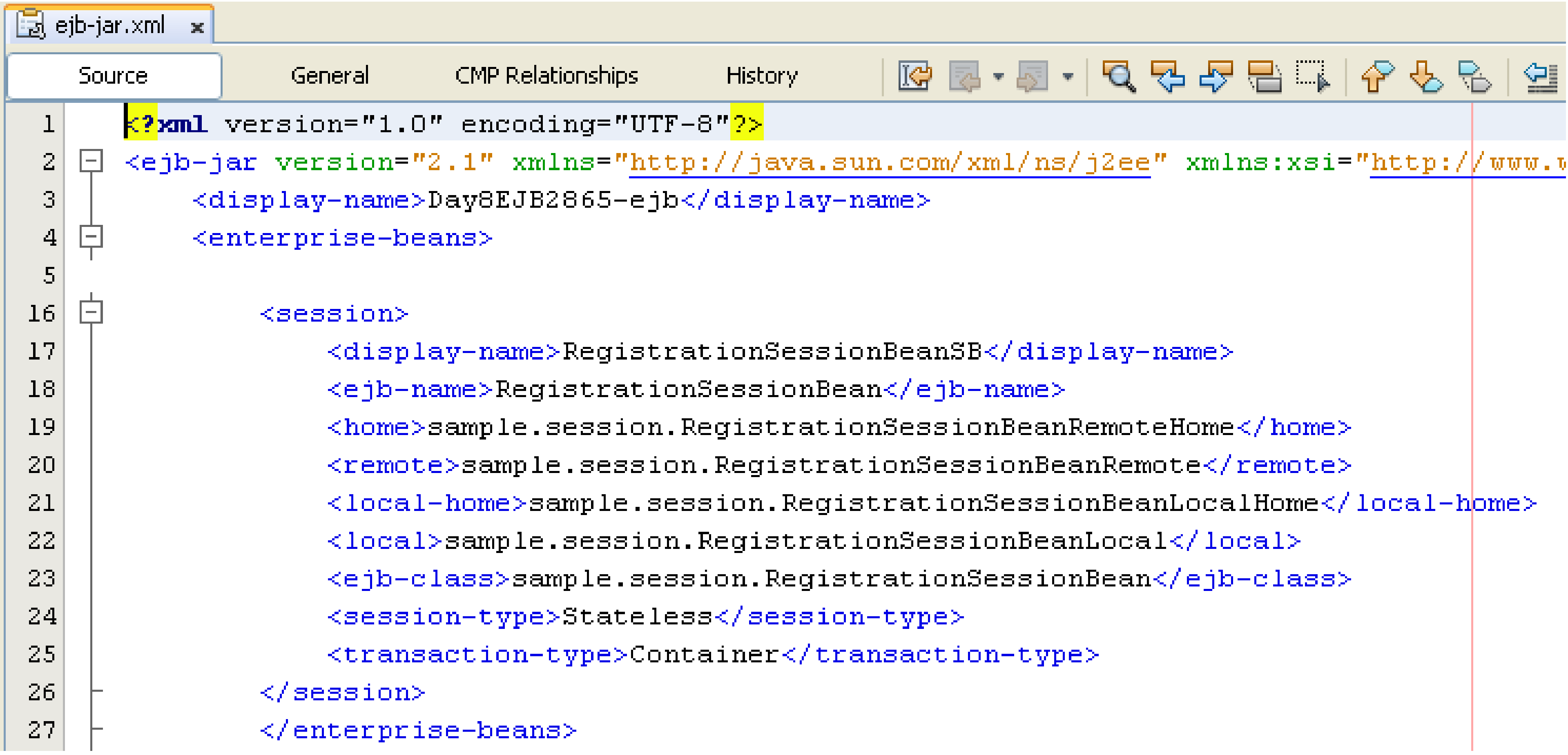
Build the simple enterprise application

Data Source Description



```xml
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE datasources
    PUBLIC "-//JBoss//DTD JBOSS JCA Config 6.0//EN"
    "http://www.jboss.org/j2ee/dtd/jboss-ds_6_0.dtd">
<datasources>
    <local-tx-datasource>
        <jndi-name>EJB2DS</jndi-name>
        <connection-url>jdbc:sqlserver://localhost:1433;databaseName=Sinhvien2K8;instanceName=SQL2008</connection-url>
        <driver-class>com.microsoft.sqlserver.jdbc.SQLServerDriver</driver-class>
        <user-name>sa</user-name>
        <password>trongkhanh</password>
    </local-tx-datasource>
</datasources>
```

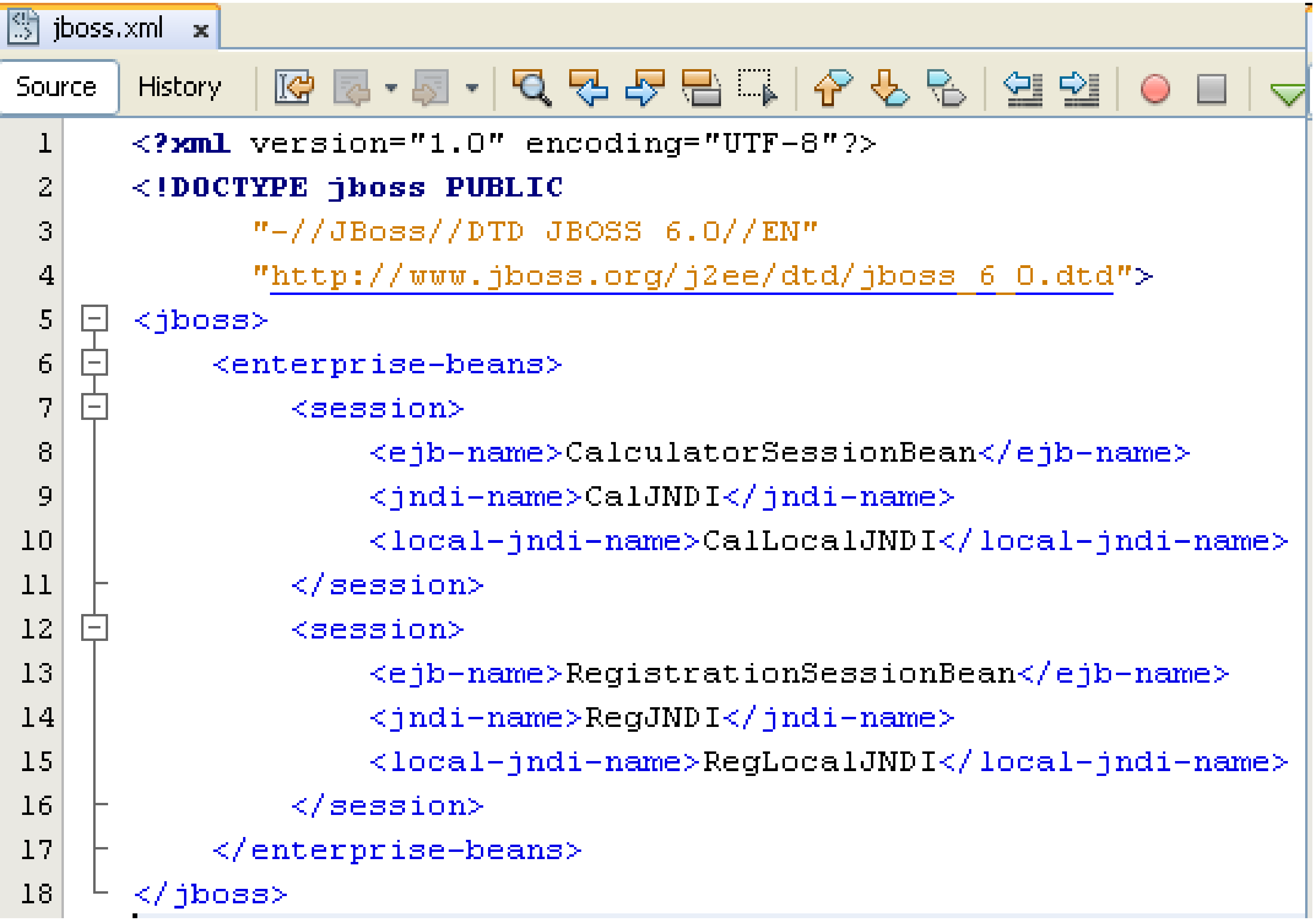
Build the simple enterprise application
EJB-JAR



```
<?xml version="1.0" encoding="UTF-8"?>
<ejb-jar version="2.1" xmlns="http://java.sun.com/xml/ns/j2ee" xmlns:xsi="http://www.w
    <display-name>Day8EJB2865-ejb</display-name>
    <enterprise-beans>

        <session>
            <display-name>RegistrationSessionBeanSB</display-name>
            <ejb-name>RegistrationSessionBean</ejb-name>
            <home>sample.session.RegistrationSessionBeanRemoteHome</home>
            <remote>sample.session.RegistrationSessionBeanRemote</remote>
            <local-home>sample.session.RegistrationSessionBeanLocalHome</local-home>
            <local>sample.session.RegistrationSessionBeanLocal</local>
            <ejb-class>sample.session.RegistrationSessionBean</ejb-class>
            <session-type>Stateless</session-type>
            <transaction-type>Container</transaction-type>
        </session>
        </enterprise-beans>
```

Build the simple enterprise application

JBoss



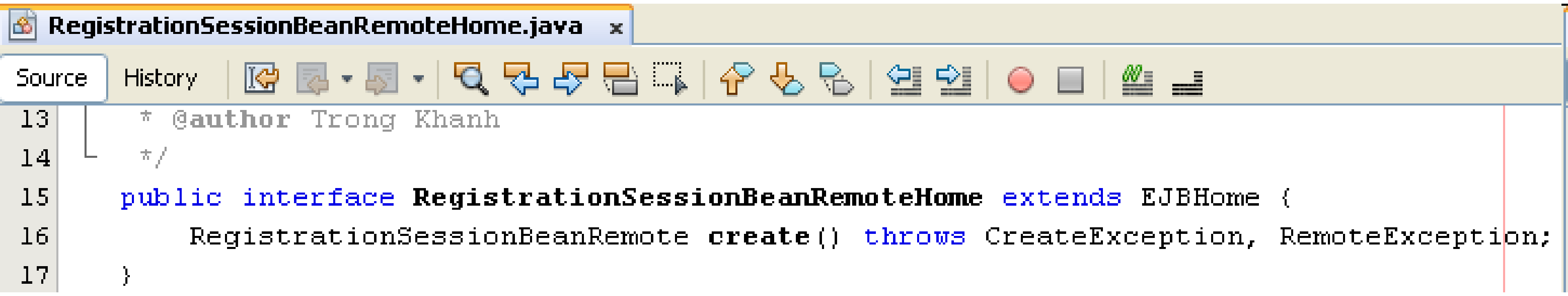
jboss.xml

Source History

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE jboss PUBLIC
        "-//JBoss//DTD JBOSS 6.0//EN"
        "http://www.jboss.org/j2ee/dtd/jboss_6_0.dtd">
<jboss>
    <enterprise-beans>
        <session>
            <ejb-name>CalculatorSessionBean</ejb-name>
            <jndi-name>CalJNDI</jndi-name>
            <local-jndi-name>CalLocalJNDI</local-jndi-name>
        </session>
        <session>
            <ejb-name>RegistrationSessionBean</ejb-name>
            <jndi-name>RegJNDI</jndi-name>
            <local-jndi-name>RegLocalJNDI</local-jndi-name>
        </session>
    </enterprise-beans>
</jboss>
```

Build the simple enterprise application

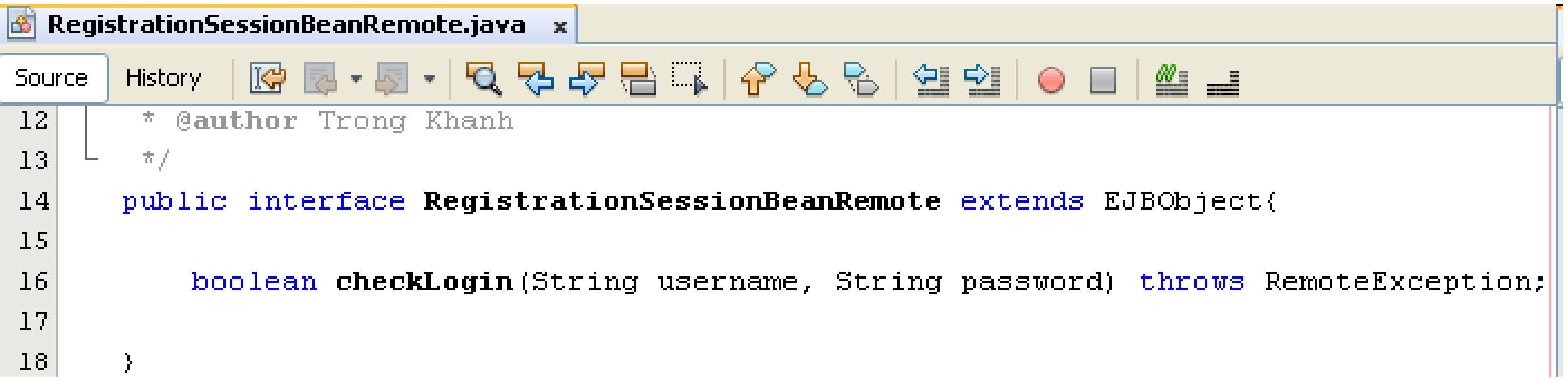
Remote



RegistrationSessionBeanRemoteHome.java

Source History

```
 * @author Trong Khanh
 */
public interface RegistrationSessionBeanRemoteHome extends EJBHome {
    RegistrationSessionBeanRemote create() throws CreateException, RemoteException;
}
```



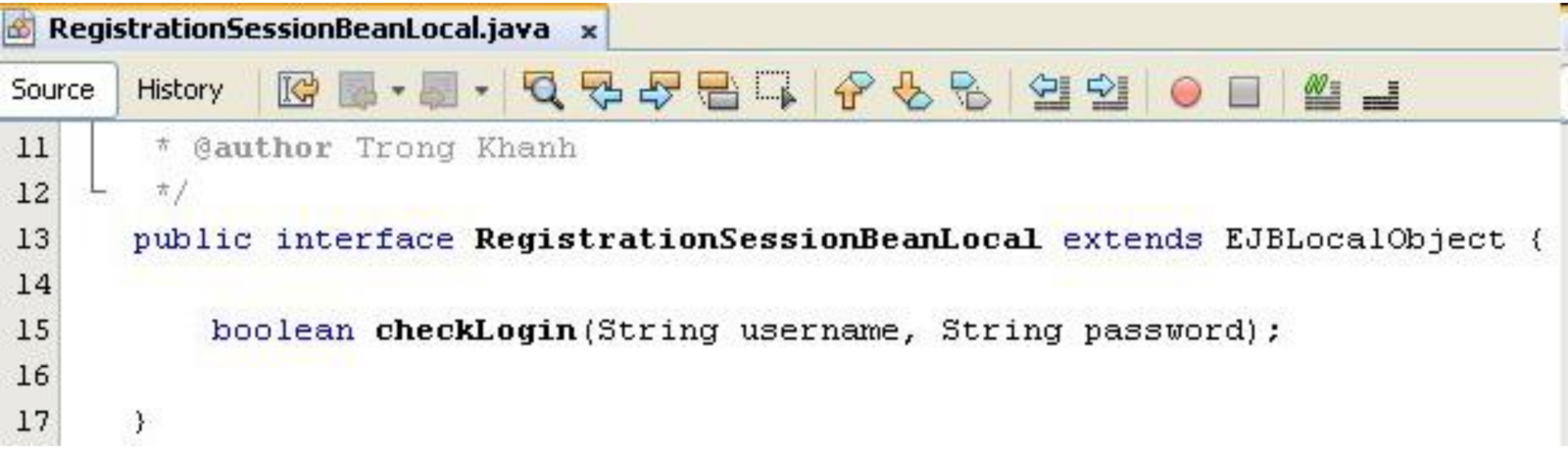
RegistrationSessionBeanRemote.java

Source History

```
 * @author Trong Khanh
 */
public interface RegistrationSessionBeanRemote extends EJBObject{

    boolean checkLogin(String username, String password) throws RemoteException;

}
```

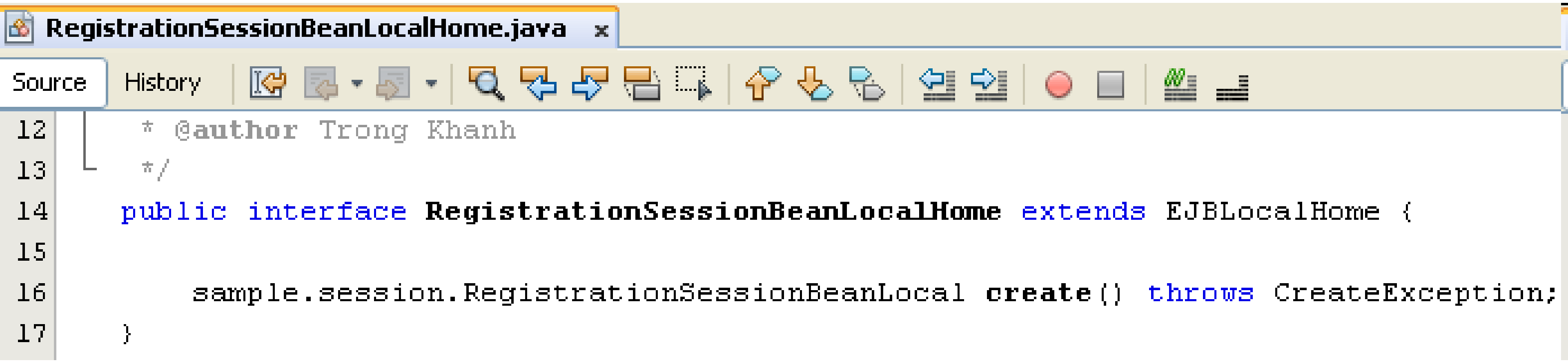
Build the simple enterprise application

Local



RegistrationSessionBeanLocal.java

```
 * @author Trong Khanh
 */
public interface RegistrationSessionBeanLocal extends EJBLocalObject {

    boolean checkLogin(String username, String password);

}
```

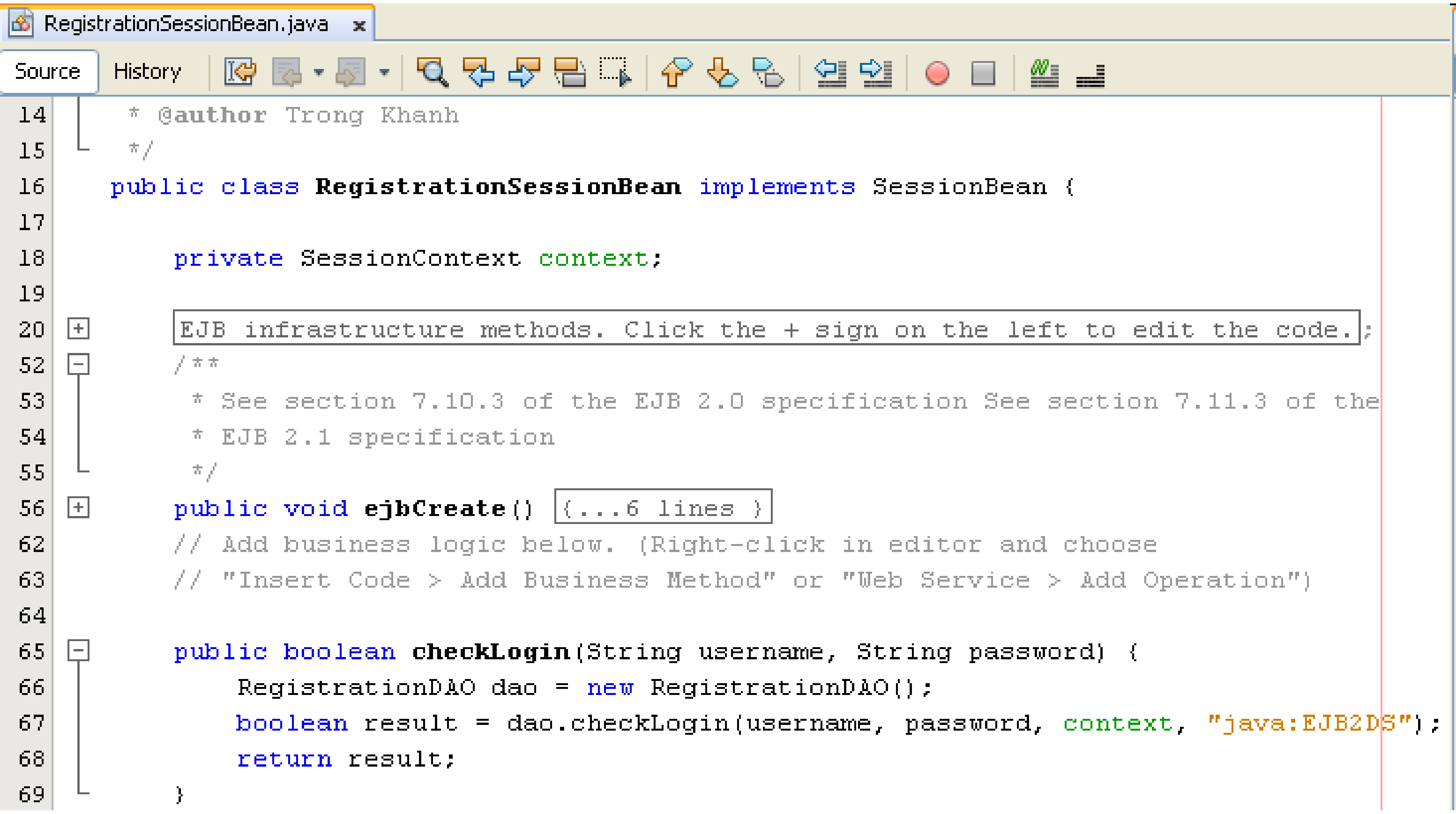


RegistrationSessionBeanLocalHome.java

```
 * @author Trong Khanh
 */
public interface RegistrationSessionBeanLocalHome extends EJBLocalHome {

    sample.session.RegistrationSessionBeanLocal create() throws CreateException;
}
```

Build the simple enterprise application

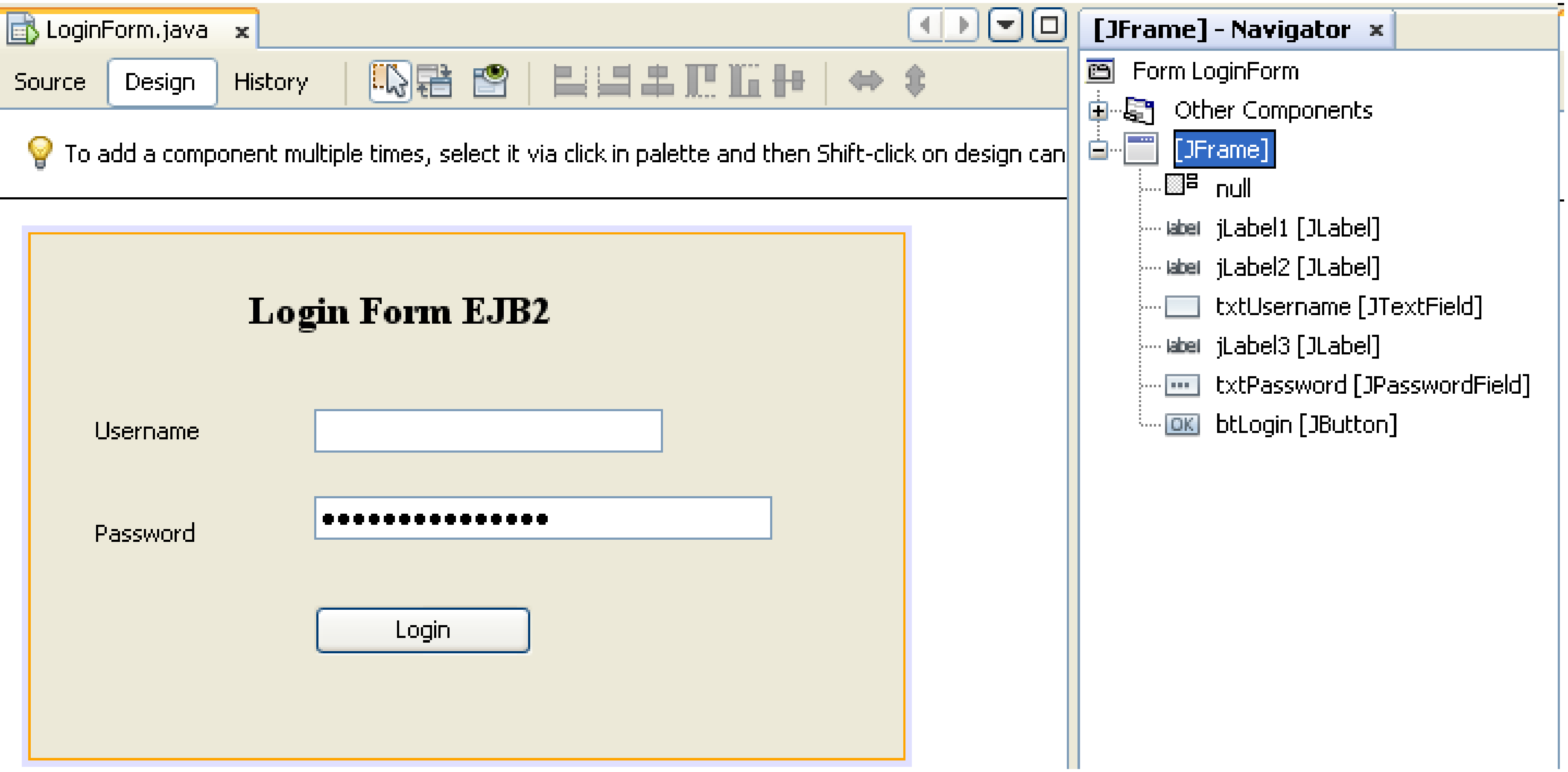
Bean



```
     * @author Trong Khanh
     */
    public class RegistrationSessionBean implements SessionBean {

        private SessionContext context;

        EJB infrastructure methods. Click the + sign on the left to edit the code.;
        /**
         * See section 7.10.3 of the EJB 2.0 specification See section 7.11.3 of the
         * EJB 2.1 specification
         */
        public void ejbCreate() {...6 lines }
        // Add business logic below. (Right-click in editor and choose
        // "Insert Code > Add Business Method" or "Web Service > Add Operation")

        public boolean checkLogin(String username, String password) {
            RegistrationDAO dao = new RegistrationDAO();
            boolean result = dao.checkLogin(username, password, context, "java:EJB2DS");
            return result;
        }
```

Build the simple enterprise application

Client Consume



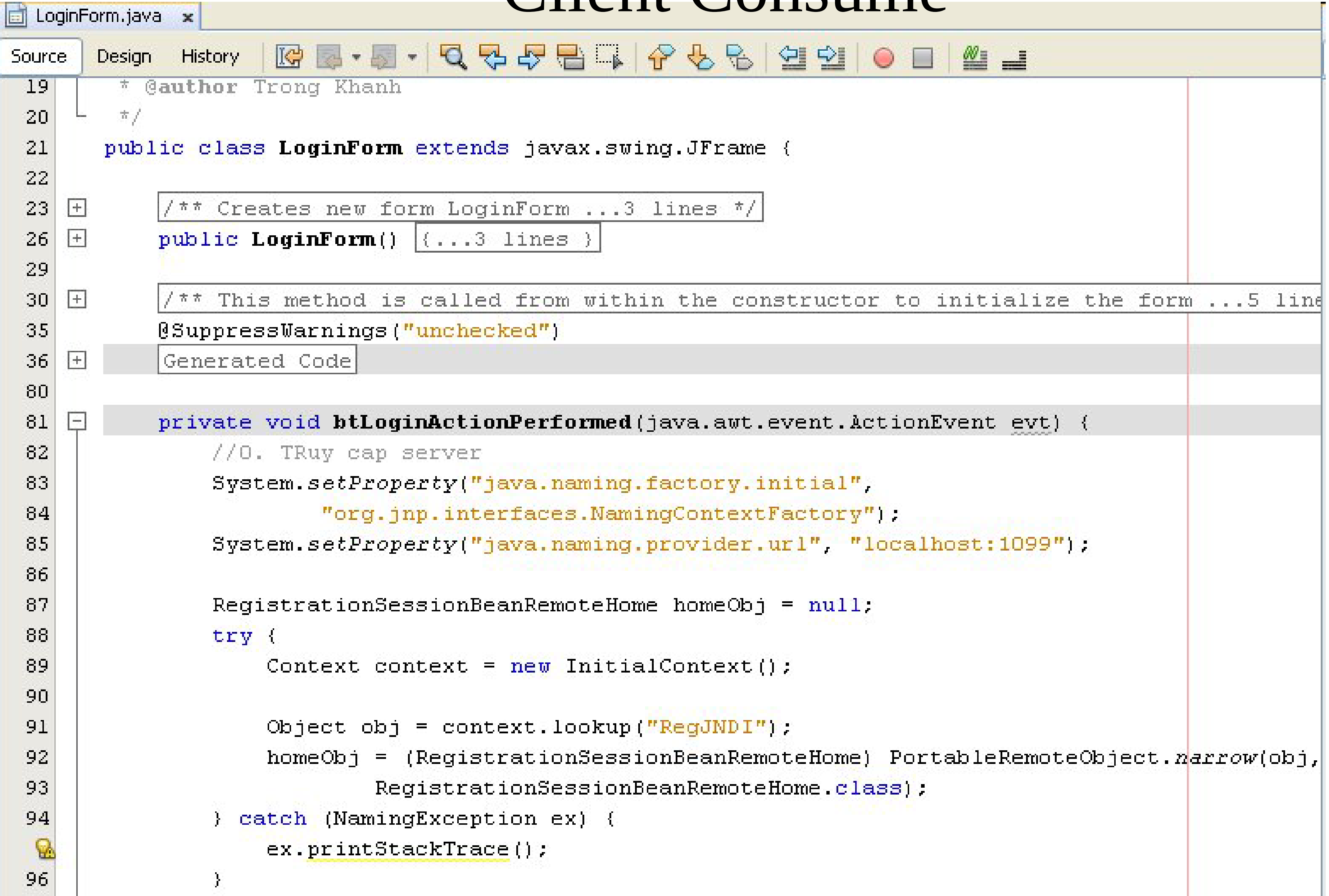
To add a component multiple times, select it via click in palette and then Shift-click on design can

[JFrame] - Navigator

```
Form LoginForm
  Other Components
  [JFrame]
    null
    jLabel1 [JLabel]
    jLabel2 [JLabel]
    txtUsername [JTextField]
    jLabel3 [JLabel]
    txtPassword [JPasswordField]
    btLogin [JButton]
```

Build the simple enterprise application

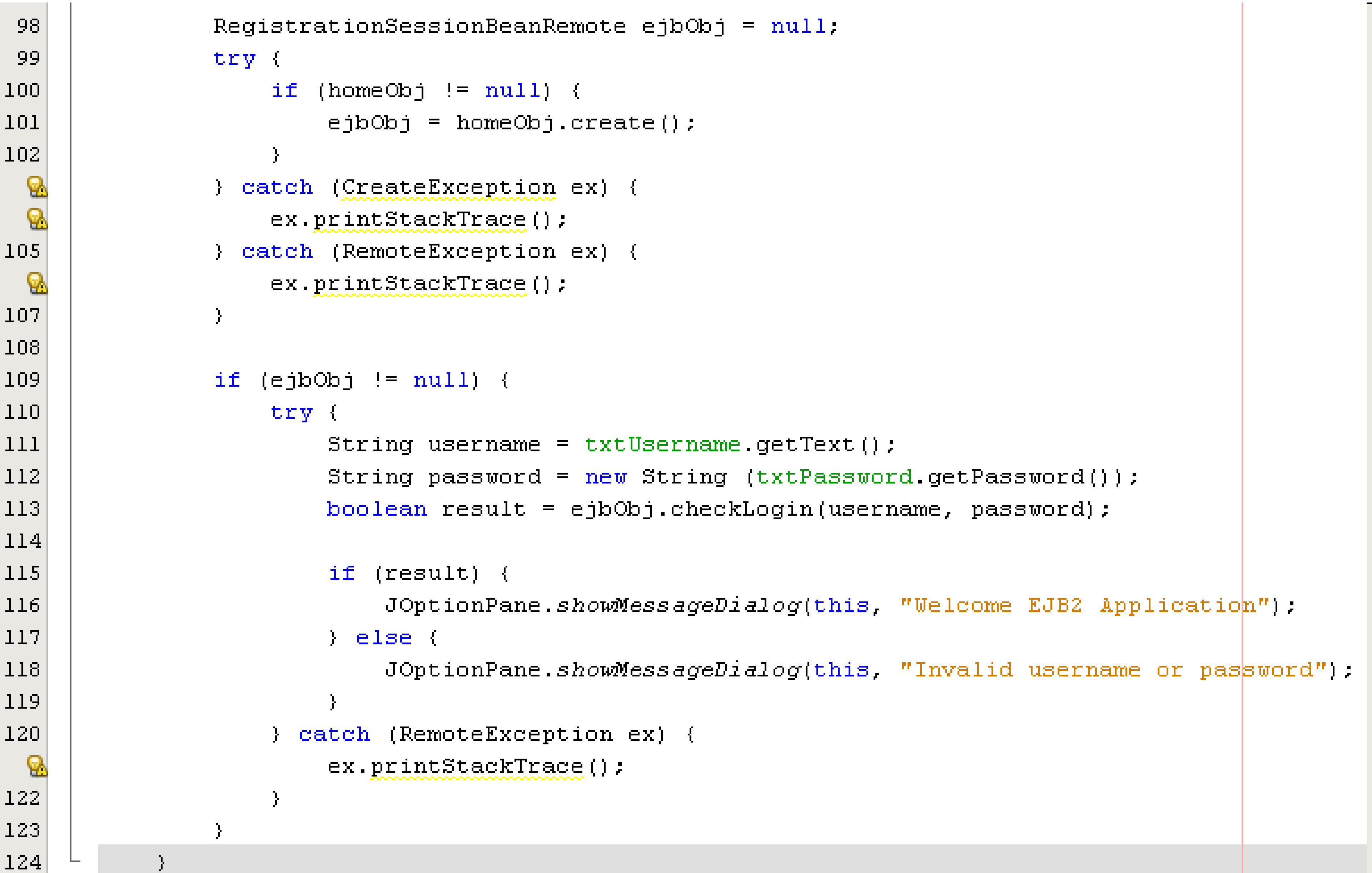
Client Consume



```
 * @author Trong Khanh
 */
public class LoginForm extends javax.swing.JFrame {

    /** Creates new form LoginForm ...3 lines */
    public LoginForm() {...3 lines }

    /** This method is called from within the constructor to initialize the form ...5 line
    @SuppressWarnings("unchecked")
    Generated Code

    private void btLoginActionPerformed(java.awt.event.ActionEvent evt) {
        //0. TRuy cap server
        System.setProperty("java.naming.factory.initial",
                "org.jnp.interfaces.NamingContextFactory");
        System.setProperty("java.naming.provider.url", "localhost:1099");

        RegistrationSessionBeanRemoteHome homeObj = null;
        try {
            Context context = new InitialContext();

            Object obj = context.lookup("RegJNDI");
            homeObj = (RegistrationSessionBeanRemoteHome) PortableRemoteObject.narrow(obj,
                    RegistrationSessionBeanRemoteHome.class);
        } catch (NamingException ex) {
            ex.printStackTrace();
        }
```

Build the simple enterprise application

Client Consume



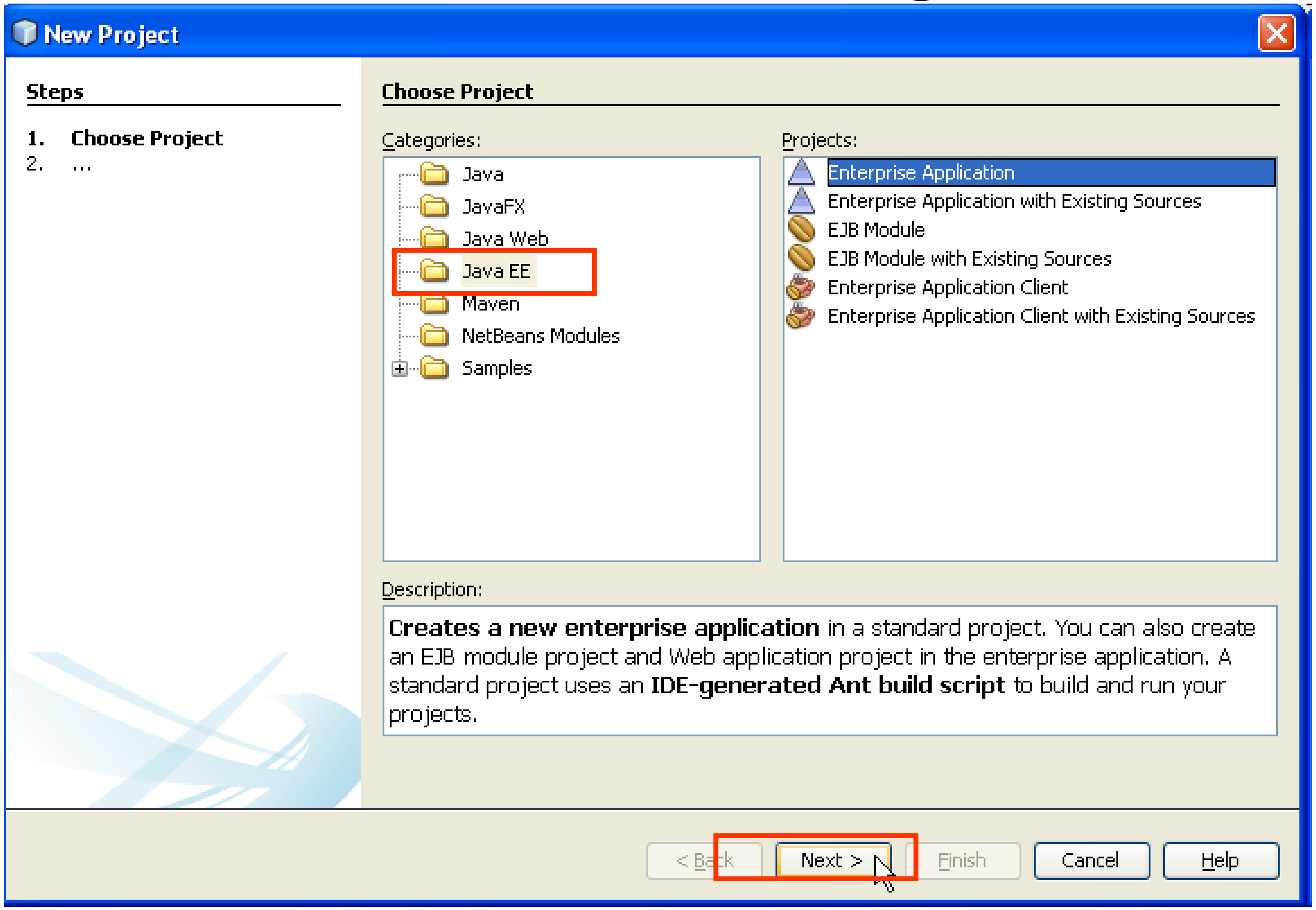
```
    RegistrationSessionBeanRemote ejbObj = null;
    try {
        if (homeObj != null) {
            ejbObj = homeObj.create();
        }
    } catch (CreateException ex) {
        ex.printStackTrace();
    } catch (RemoteException ex) {
        ex.printStackTrace();
    }

    if (ejbObj != null) {
        try {
            String username = txtUsername.getText();
            String password = new String (txtPassword.getPassword());
            boolean result = ejbObj.checkLogin(username, password);

            if (result) {
                JOptionPane.showMessageDialog(this, "Welcome EJB2 Application");
            } else {
                JOptionPane.showMessageDialog(this, "Invalid username or password");
            }
        } catch (RemoteException ex) {
            ex.printStackTrace();
        }
    }
}
```

EJB Implementation

Enterprise Application Development Process

- **Step 1:** Creating a new Enterprise Application project (EJB and Web Client – ear file)
- **Step 2:** Creating the new corresponding bean depending on your purpose.
- **Step 3:** Building/ Modifying the business/callback methods on Beans
- **Step 4:** Mapping the JNDI to beans
- **Step 5:** Creating the GUI to consumes EJB on web modules
- **Step 6:** Building and Deploying Enterprise application on Application Server
- **Step 7:** Executing the Enterprise Application

EJB Implementation
Creating


New Project

Steps
1. Choose Project
2. ...

Choose Project

Categories: Java, JavaFX, Java Web, Java EE, Maven, NetBeans Modules, Samples

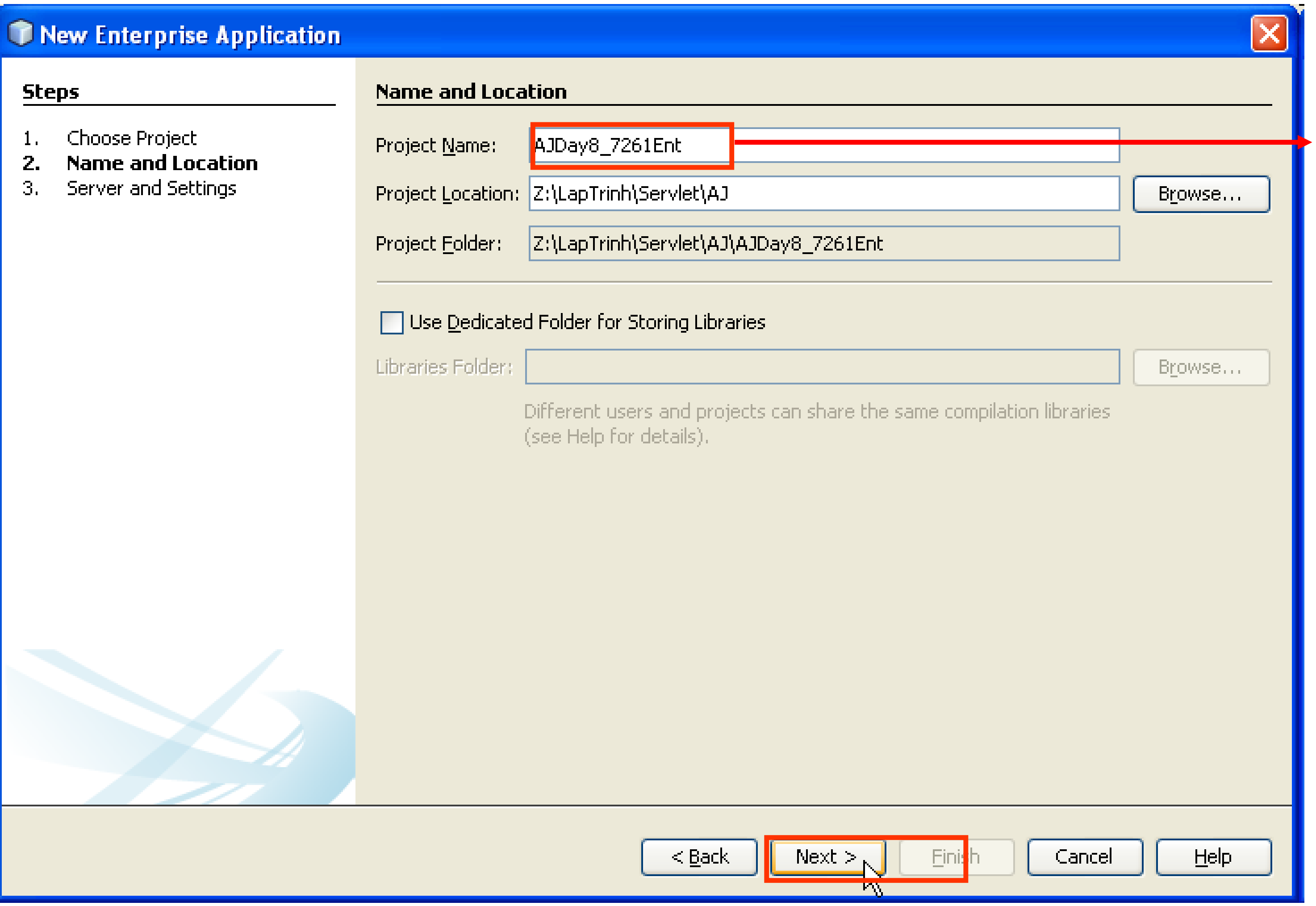
Projects: Enterprise Application, Enterprise Application with Existing Sources, EJB Module, EJB Module with Existing Sources, Enterprise Application Client, Enterprise Application Client with Existing Sources

Description:
Creates a new enterprise application in a standard project. You can also create an EJB module project and Web application project in the enterprise application. A standard project uses an **IDE-generated Ant build script** to build and run your projects.

< Back | Next > | Finish | Cancel | Help

- Click Next Button.
- Then type the Project Name, then click Next button

EJB Implementation
Creating


New Enterprise Application

Steps
1. Choose Project
2. **Name and Location**
3. Server and Settings

Name and Location

Project Name: AJDay8_7261Ent

Project Location: Z:\LapTrinh\Servlet\AJ

Project Folder: Z:\LapTrinh\Servlet\AJ\AJDay8_7261Ent

☐ Use Dedicated Folder for Storing Libraries

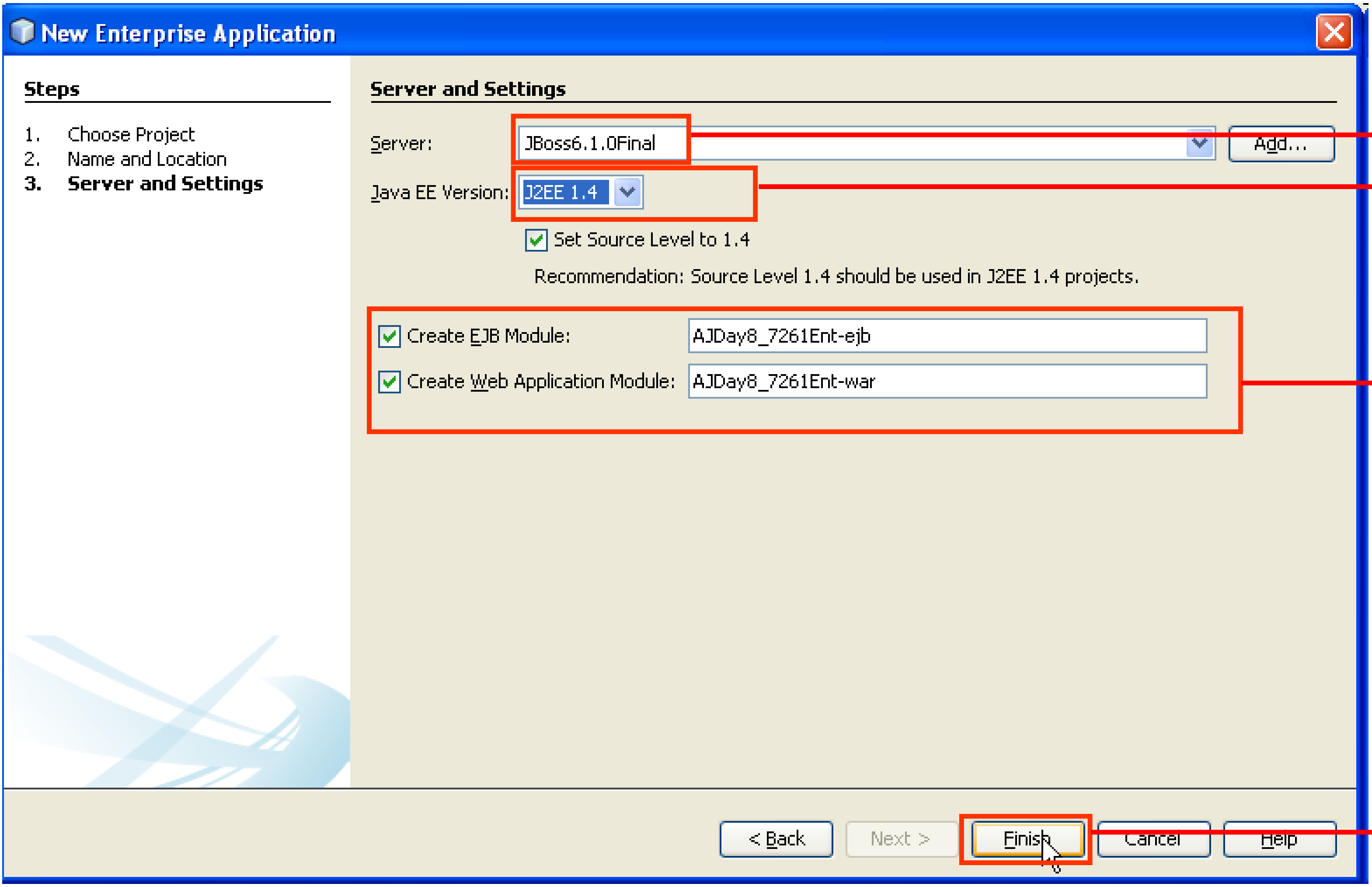
Libraries Folder:

Different users and projects can share the same compilation libraries (see Help for details).

Fill your project name

- Click Next Button.

EJB Implementation
Creating



New Enterprise Application

Steps
1. Choose Project
2. Name and Location
3. **Server and Settings**

Server and Settings

Server: JBoss6.1.0Final

Java EE Version: J2EE 1.4

✓ Set Source Level to 1.4

Recommendation: Source Level 1.4 should be used in J2EE 1.4 projects.

✓ Create EJB Module: AJDay8_7261Ent-ejb

✓ Create Web Application Module: AJDay8_7261Ent-war

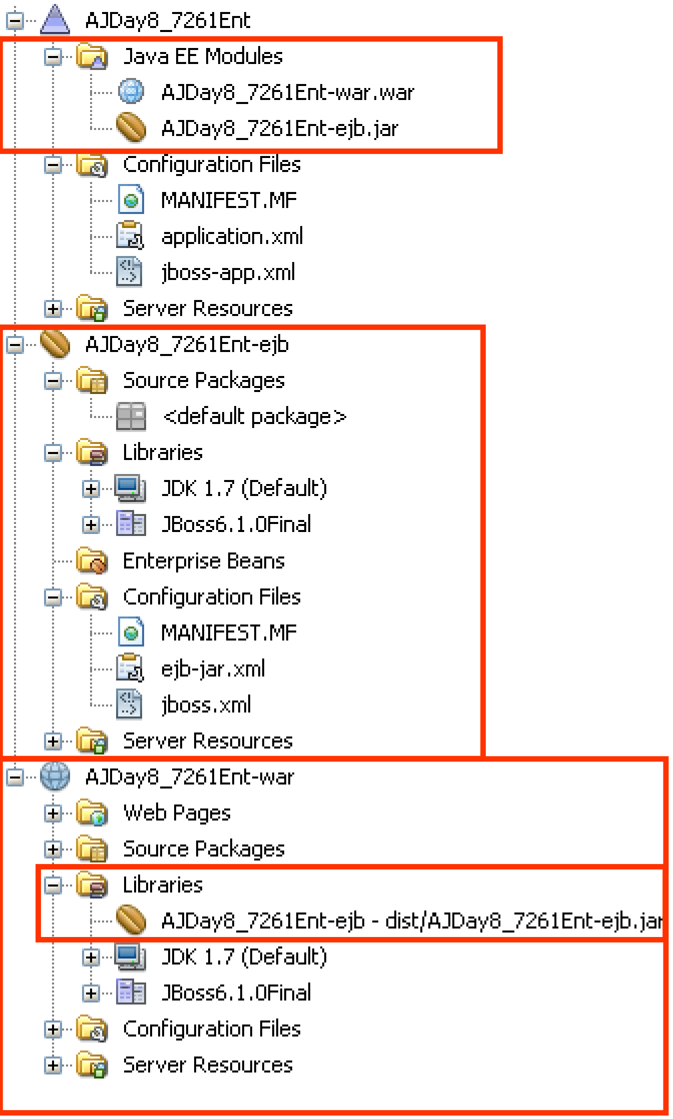
Choose the Jboss 4.2.3

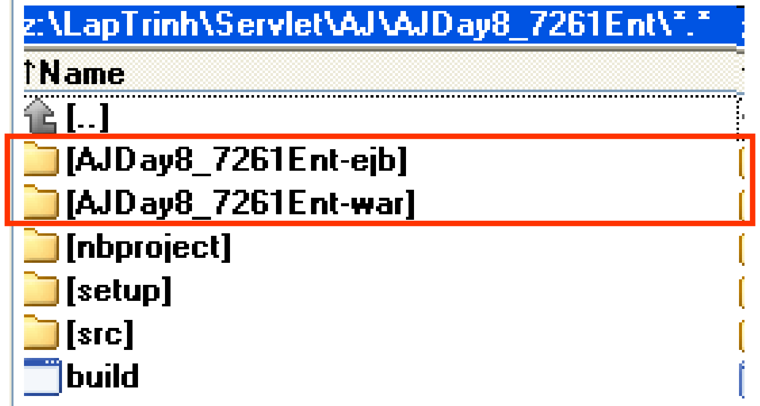
Choose J2EE 1.4

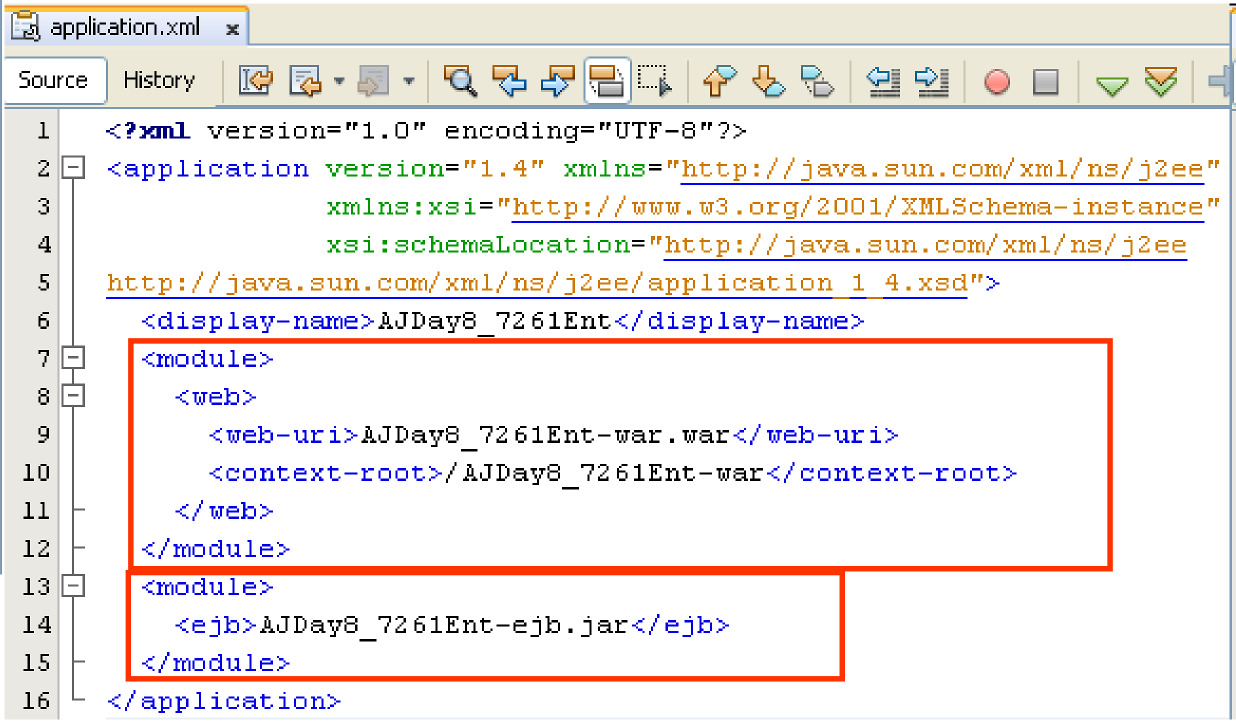
Don’t change anything that is default by tools

Click Finish Button

EJB Implementation
Creating


```
AJDay8_7261Ent
  Java EE Modules
    AJDay8_7261Ent-war.war
    AJDay8_7261Ent-ejb.jar
  Configuration Files
    MANIFEST.MF
    application.xml
    jboss-app.xml
  Server Resources
AJDay8_7261Ent-ejb
  Source Packages
    <default package>
  Libraries
    JDK 1.7 (Default)
    JBoss6.1.0Final
  Enterprise Beans
  Configuration Files
    MANIFEST.MF
    ejb-jar.xml
    jboss.xml
  Server Resources
AJDay8_7261Ent-war
  Web Pages
  Source Packages
  Libraries
    AJDay8_7261Ent-ejb - dist/AJDay8_7261Ent-ejb.jar
    JDK 1.7 (Default)
    JBoss6.1.0Final
  Configuration Files
  Server Resources
```


```
z:\LapTrinh\Servlet\AJ\AJDay8_7261Ent\*.*
↑Name
[..]
[AJDay8_7261Ent-ejb]
[AJDay8_7261Ent-war]
[nbproject]
[setup]
[src]
build
```



```
<?xml version="1.0" encoding="UTF-8"?>
<application version="1.4" xmlns="http://java.sun.com/xml/ns/j2ee"
             xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
             xsi:schemaLocation="http://java.sun.com/xml/ns/j2ee
http://java.sun.com/xml/ns/j2ee/application_1_4.xsd">
  <display-name>AJDay8_7261Ent</display-name>
  <module>
    <web>
      <web-uri>AJDay8_7261Ent-war.war</web-uri>
      <context-root>/AJDay8_7261Ent-war</context-root>
    </web>
  </module>
  <module>
    <ejb>AJDay8_7261Ent-ejb.jar</ejb>
  </module>
</application>
```

EJB Implementation

Next Steps

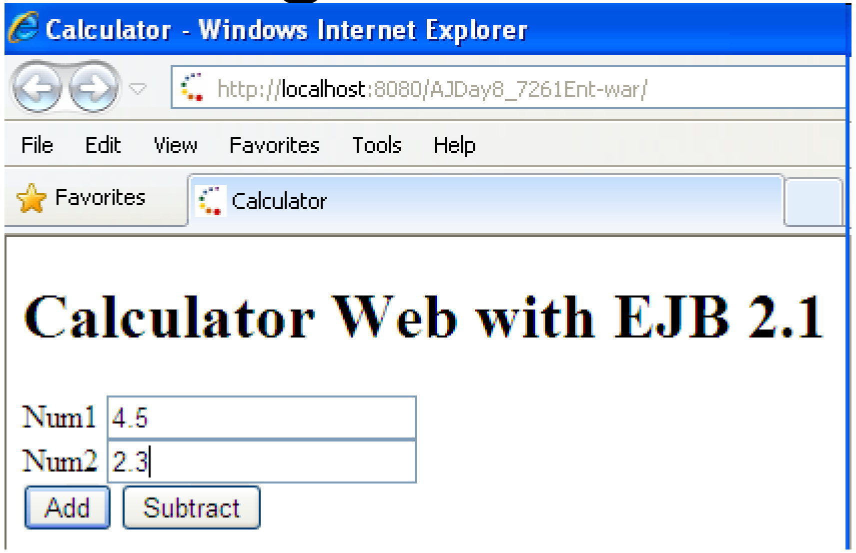
- **Step 2:** Creating the new corresponding bean
- **Step 3:** Building/ Modifying the business/callback methods on Beans
- **Step 4:** Mapping the JNDI to beans

Creating stateless bean as whole steps in previous tutorials in EJB Development process on the Xxx-ejb module

EJB Implementation

Creating GUI with Web Page and consumes

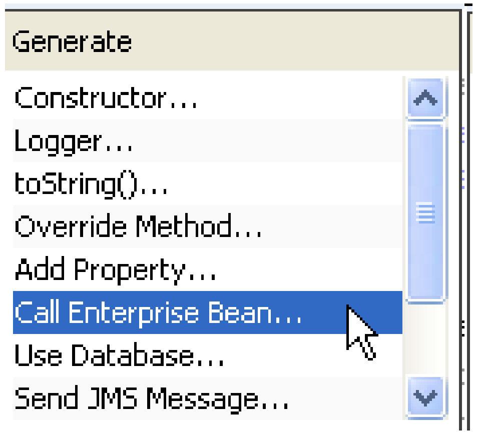
- Creating the GUI application


Calculator - Windows Internet Explorer
http://localhost:8080/AJDay8_7261Ent-war/
File Edit View Favorites Tools Help
Favorites
Calculator

Calculator Web with EJB 2.1

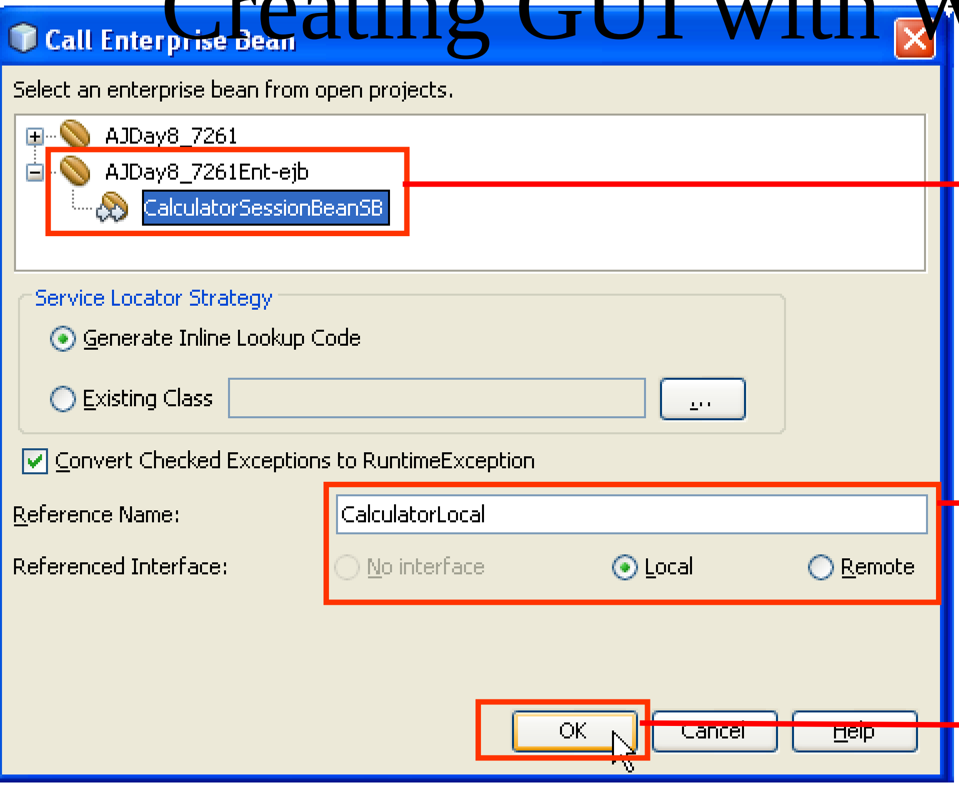
Num1 4.5
Num2 2.3

- Creating the Servlet to process and consume the EJB
  - Creating the reference to the EJB on the coding by right click on code
  - Then choose Insert Code, click Call Enterprise Bean …



EJB Implementation

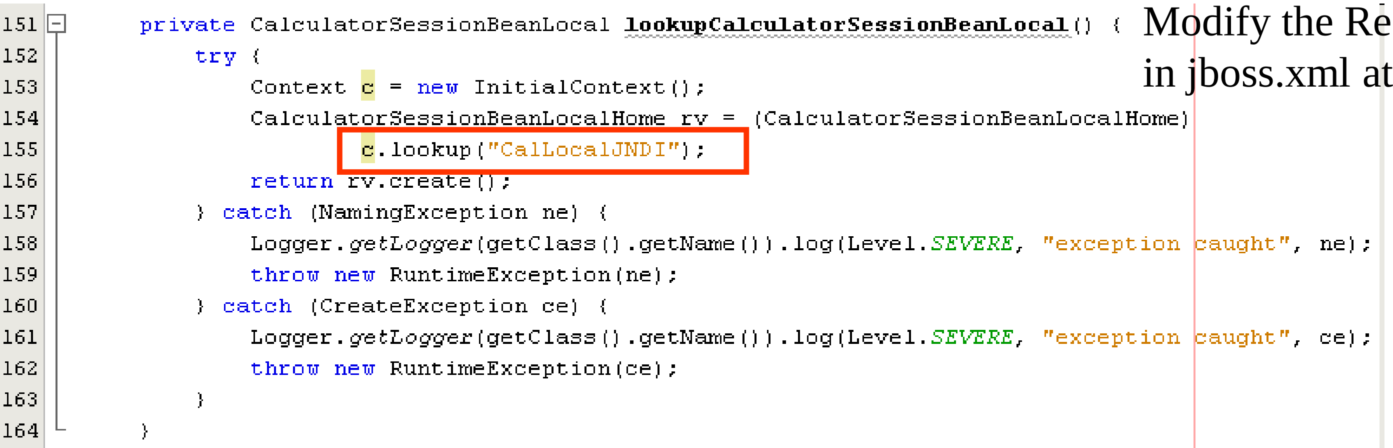
Creating GUI with Web Page and consumes



Choose the appropriate bean

Modify the Reference Name, then choose the scope reference of the Bean

Click Ok Button

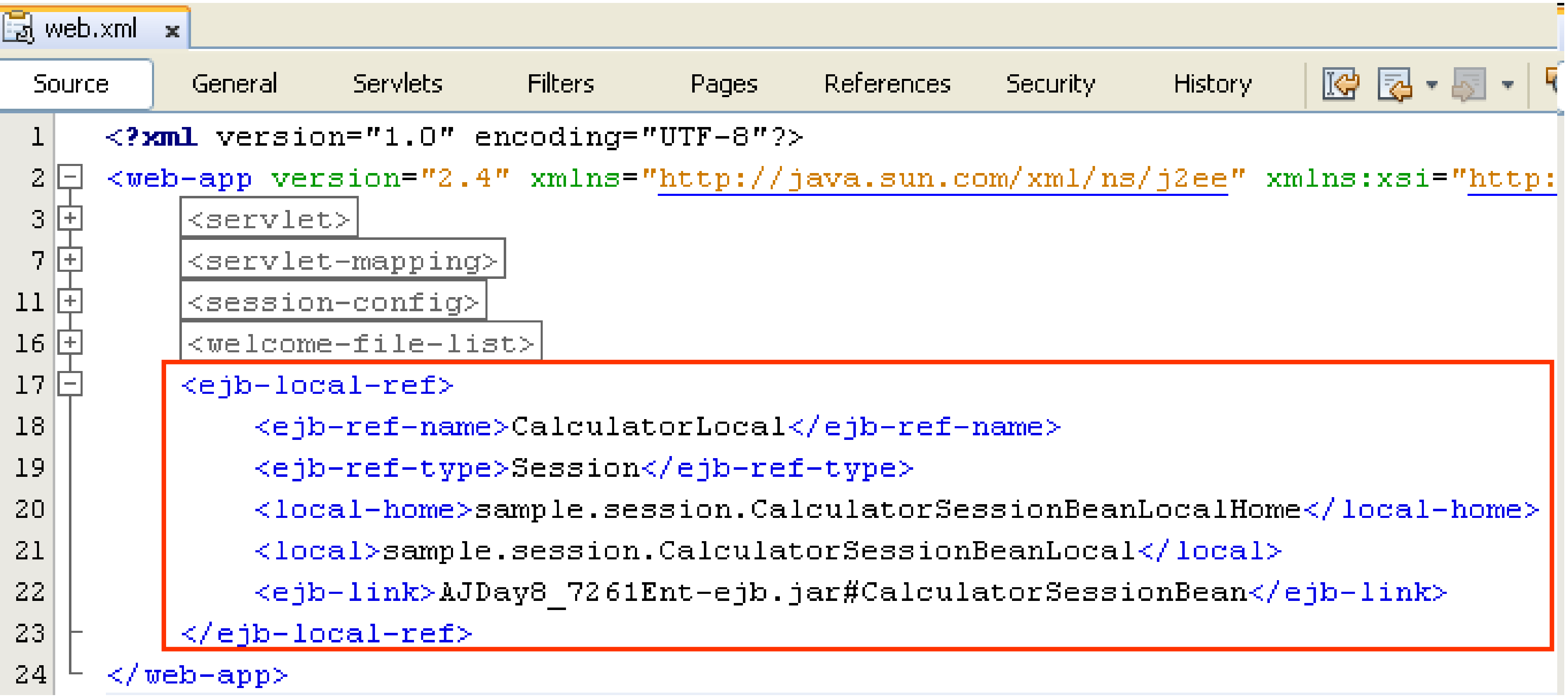


```
    private CalculatorSessionBeanLocal lookupCalculatorSessionBeanLocal() {
        try {
            Context c = new InitialContext();
            CalculatorSessionBeanLocalHome rv = (CalculatorSessionBeanLocalHome)
                    c.lookup("CalLocalJNDI");
            return rv.create();
        } catch (NamingException ne) {
            Logger.getLogger(getClass().getName()).log(Level.SEVERE, "exception caught", ne);
            throw new RuntimeException(ne);
        } catch (CreateException ce) {
            Logger.getLogger(getClass().getName()).log(Level.SEVERE, "exception caught", ce);
            throw new RuntimeException(ce);
        }
    }
```

Modify the Reference Name that is named in jboss.xml at <[local-]jndi-name> tag

EJB Implementation

Creating GUI with Web Page and consumes

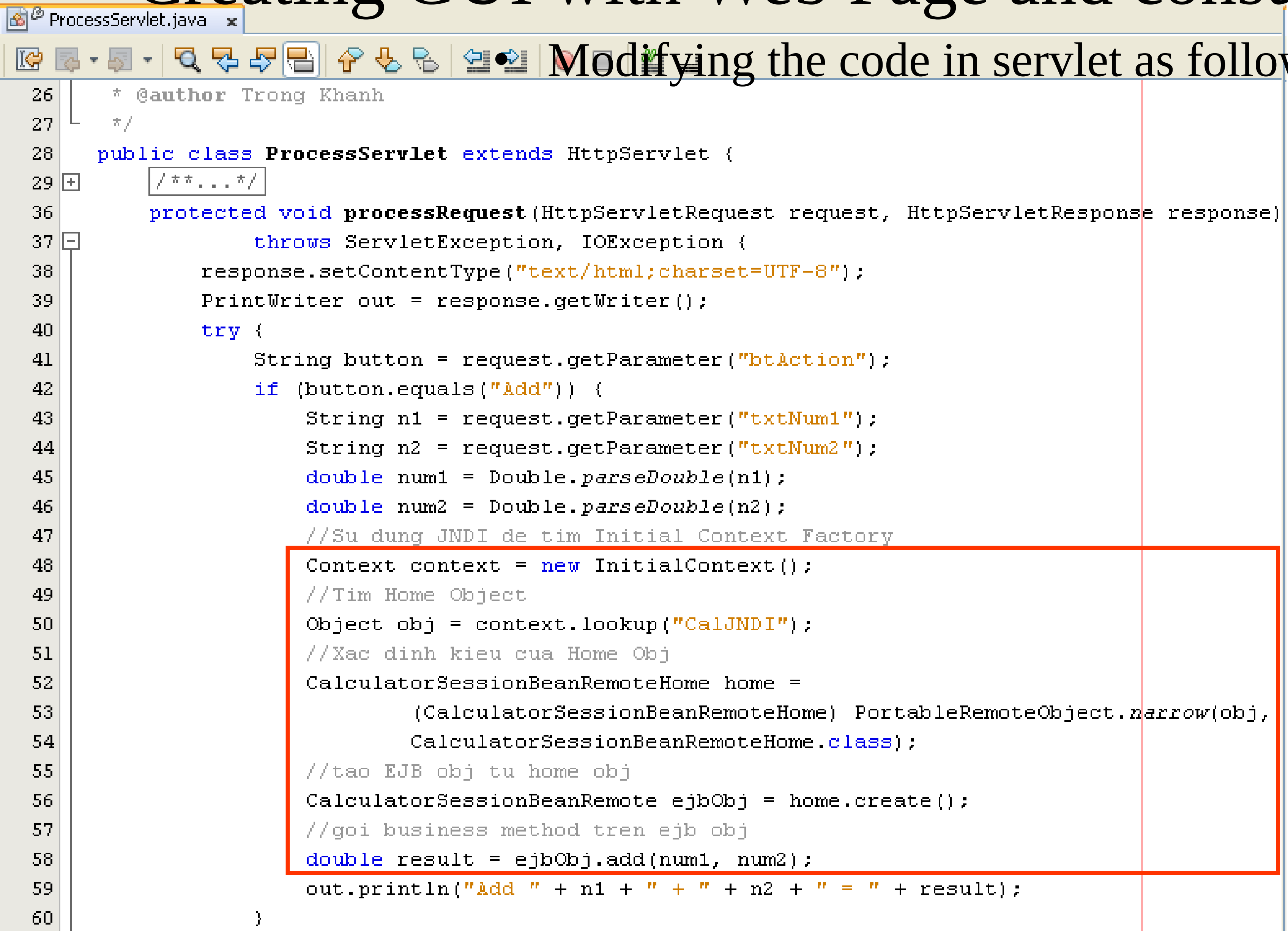


```
<?xml version="1.0" encoding="UTF-8"?>
<web-app version="2.4" xmlns="http://java.sun.com/xml/ns/j2ee" xmlns:xsi="http:
    <servlet>
    <servlet-mapping>
    <session-config>
    <welcome-file-list>
    <ejb-local-ref>
        <ejb-ref-name>CalculatorLocal</ejb-ref-name>
        <ejb-ref-type>Session</ejb-ref-type>
        <local-home>sample.session.CalculatorSessionBeanLocalHome</local-home>
        <local>sample.session.CalculatorSessionBeanLocal</local>
        <ejb-link>AJDay8_7261Ent-ejb.jar#CalculatorSessionBean</ejb-link>
    </ejb-local-ref>
</web-app>
```

EJB Implementation

Creating GUI with Web Page and consumes

Modifying the code in servlet as following

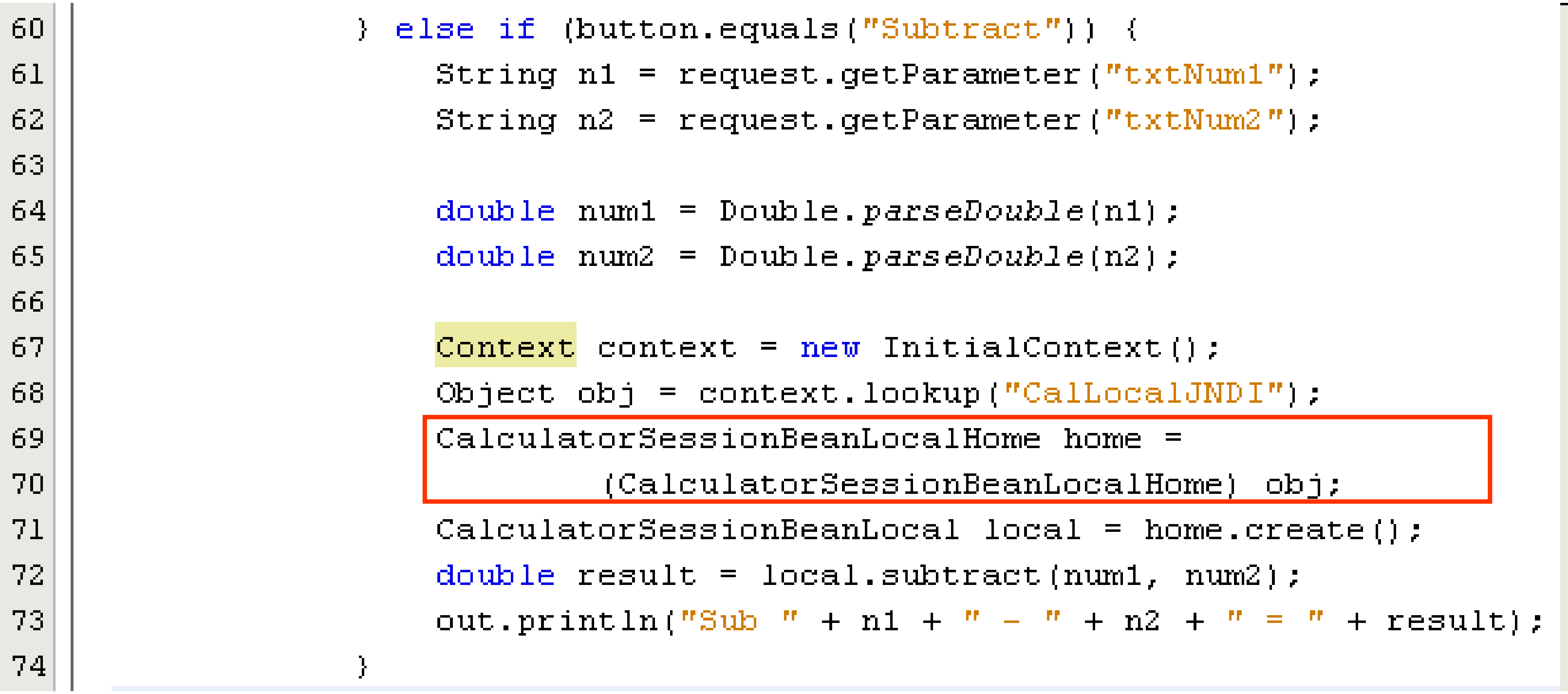


ProcessServlet.java

```java
 * @author Trong Khanh
 */
public class ProcessServlet extends HttpServlet {
    /**...*/
    protected void processRequest(HttpServletRequest request, HttpServletResponse response)
            throws ServletException, IOException {
        response.setContentType("text/html;charset=UTF-8");
        PrintWriter out = response.getWriter();
        try {
            String button = request.getParameter("btAction");
            if (button.equals("Add")) {
                String n1 = request.getParameter("txtNum1");
                String n2 = request.getParameter("txtNum2");
                double num1 = Double.parseDouble(n1);
                double num2 = Double.parseDouble(n2);
                //Su dung JNDI de tim Initial Context Factory
                Context context = new InitialContext();
                //Tim Home Object
                Object obj = context.lookup("CalJNDI");
                //Xac dinh kieu cua Home Obj
                CalculatorSessionBeanRemoteHome home =
                        (CalculatorSessionBeanRemoteHome) PortableRemoteObject.narrow(obj,
                        CalculatorSessionBeanRemoteHome.class);
                //tao EJB obj tu home obj
                CalculatorSessionBeanRemote ejbObj = home.create();
                //goi business method tren ejb obj
                double result = ejbObj.add(num1, num2);
                out.println("Add " + n1 + " + " + n2 + " = " + result);
            }
```

EJB Implementation

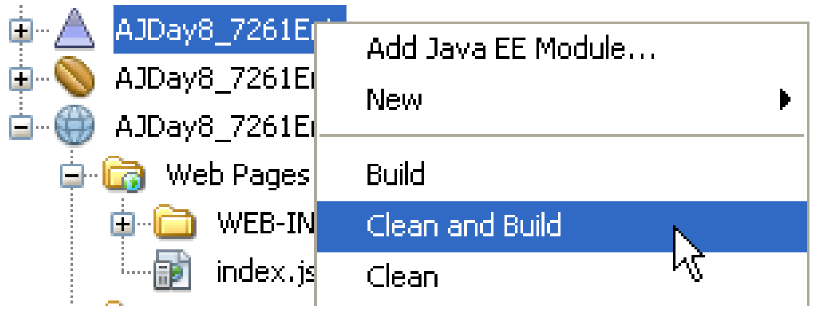
Creating GUI with Web Page and consumes

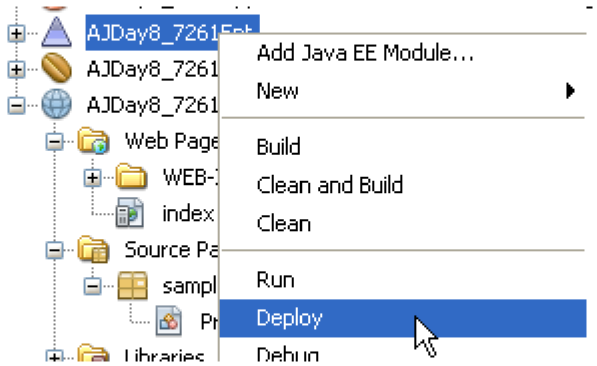


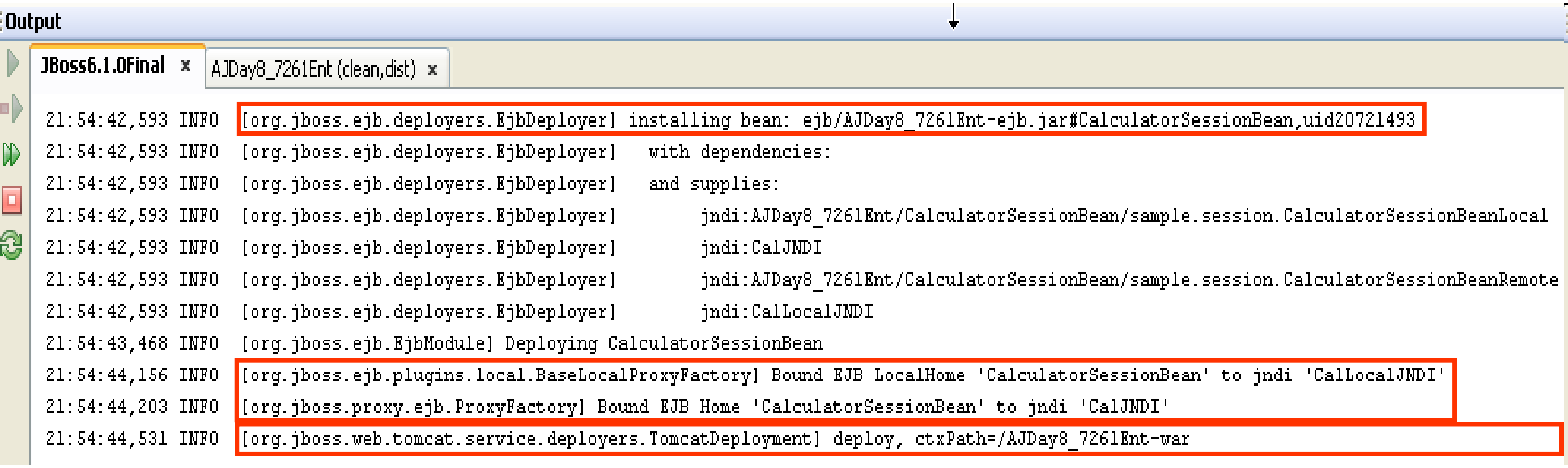
```
            } else if (button.equals("Subtract")) {
                String n1 = request.getParameter("txtNum1");
                String n2 = request.getParameter("txtNum2");

                double num1 = Double.parseDouble(n1);
                double num2 = Double.parseDouble(n2);

                Context context = new InitialContext();
                Object obj = context.lookup("CalLocalJNDI");
                CalculatorSessionBeanLocalHome home =
                        (CalculatorSessionBeanLocalHome) obj;
                CalculatorSessionBeanLocal local = home.create();
                double result = local.subtract(num1, num2);
                out.println("Sub " + n1 + " - " + n2 + " = " + result);
            }
```

EJB Implementation

Building, Deploying, and Executing

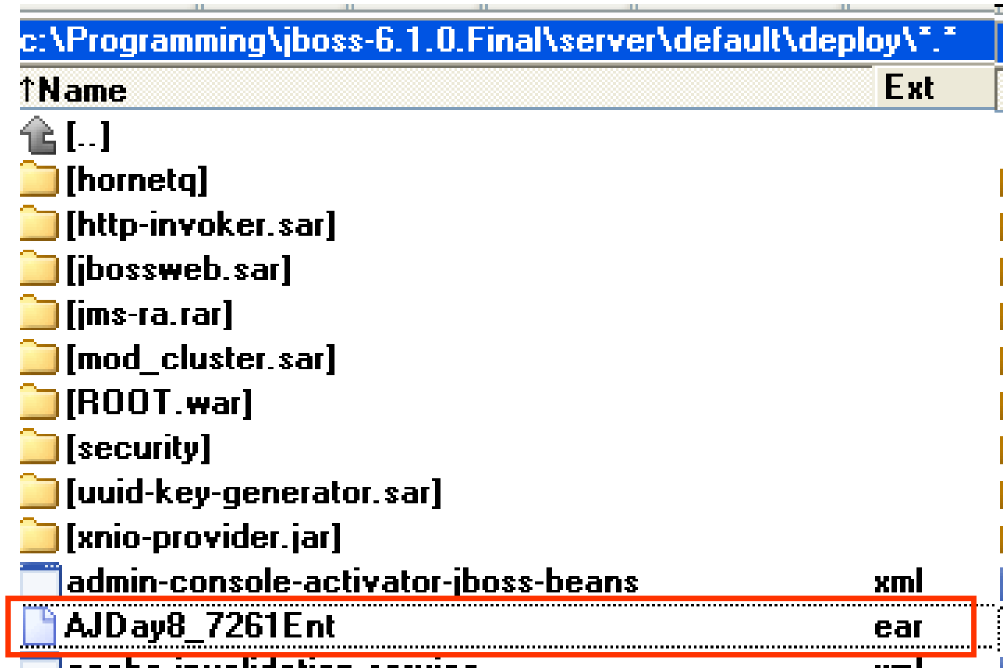




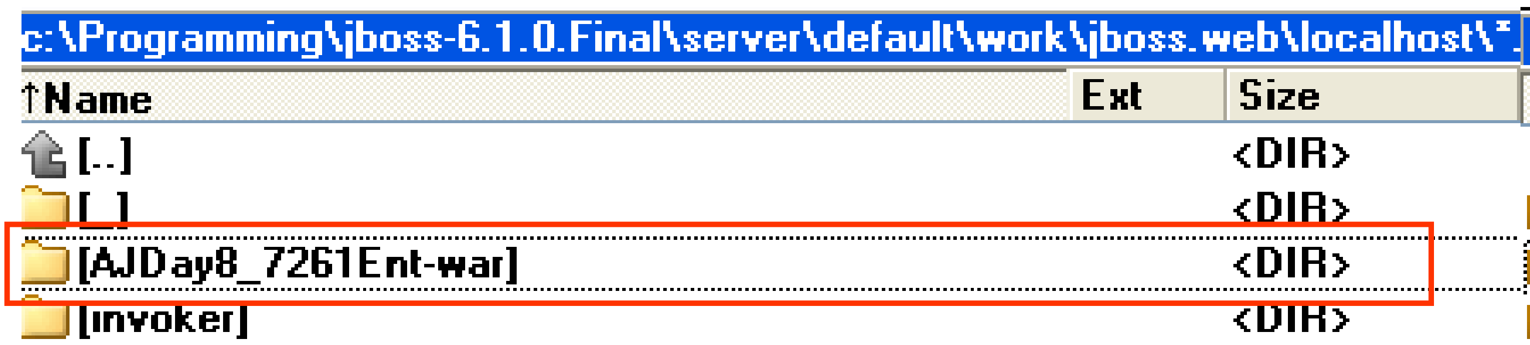


```
21:54:42,593 INFO  [org.jboss.ejb.deployers.EjbDeployer] installing bean: ejb/AJDay8_7261Ent-ejb.jar#CalculatorSessionBean,uid20721493
21:54:42,593 INFO  [org.jboss.ejb.deployers.EjbDeployer]   with dependencies:
21:54:42,593 INFO  [org.jboss.ejb.deployers.EjbDeployer]   and supplies:
21:54:42,593 INFO  [org.jboss.ejb.deployers.EjbDeployer]        jndi:AJDay8_7261Ent/CalculatorSessionBean/sample.session.CalculatorSessionBeanLocal
21:54:42,593 INFO  [org.jboss.ejb.deployers.EjbDeployer]        jndi:CalJNDI
21:54:42,593 INFO  [org.jboss.ejb.deployers.EjbDeployer]        jndi:AJDay8_7261Ent/CalculatorSessionBean/sample.session.CalculatorSessionBeanRemote
21:54:42,593 INFO  [org.jboss.ejb.deployers.EjbDeployer]        jndi:CalLocalJNDI
21:54:43,468 INFO  [org.jboss.ejb.EjbModule] Deploying CalculatorSessionBean
21:54:44,156 INFO  [org.jboss.ejb.plugins.local.BaseLocalProxyFactory] Bound EJB LocalHome 'CalculatorSessionBean' to jndi 'CalLocalJNDI'
21:54:44,203 INFO  [org.jboss.proxy.ejb.ProxyFactory] Bound EJB Home 'CalculatorSessionBean' to jndi 'CalJNDI'
21:54:44,531 INFO  [org.jboss.web.tomcat.service.deployers.TomcatDeployment] deploy, ctxPath=/AJDay8_7261Ent-war
```

EJB Implementation
Building, Deploying, and Executing

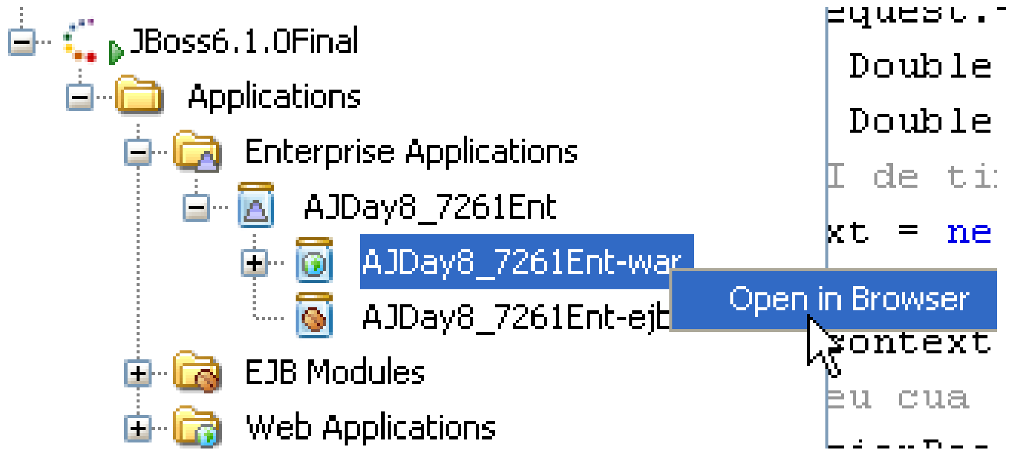


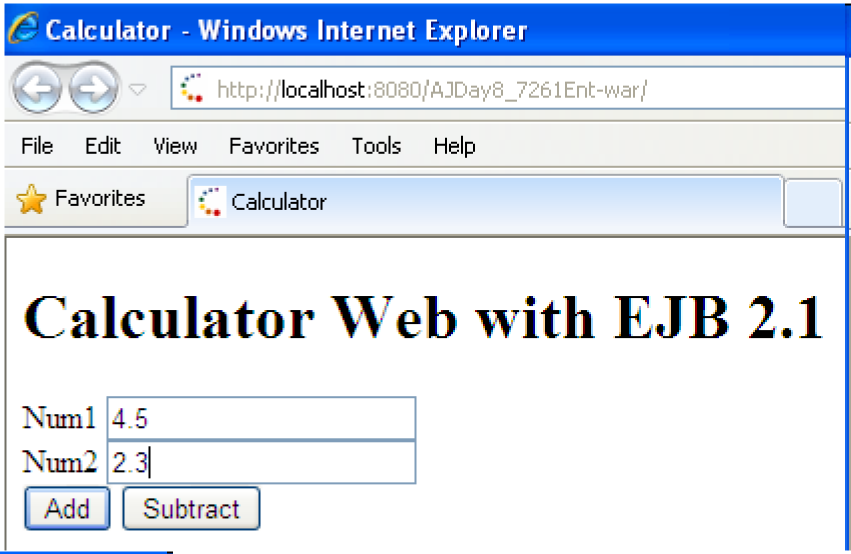
```
c:\Programming\jboss-6.1.0.Final\server\default\deploy\*.*
↑Name                                          Ext
[..]
[hornetq]
[http-invoker.sar]
[jbossweb.sar]
[jms-ra.rar]
[mod_cluster.sar]
[ROOT.war]
[security]
[uuid-key-generator.sar]
[xnio-provider.jar]
admin-console-activator-jboss-beans            xml
AJDay8_7261Ent                                 ear
```



```
c:\Programming\jboss-6.1.0.Final\server\default\work\jboss.web\localhost\*.*
↑Name                              Ext     Size
[..]                                       <DIR>
[_]                                        <DIR>
[AJDay8_7261Ent-war]                       <DIR>
[invoker]                                  <DIR>
```

EJB Implementation
Building, Deploying, and Executing

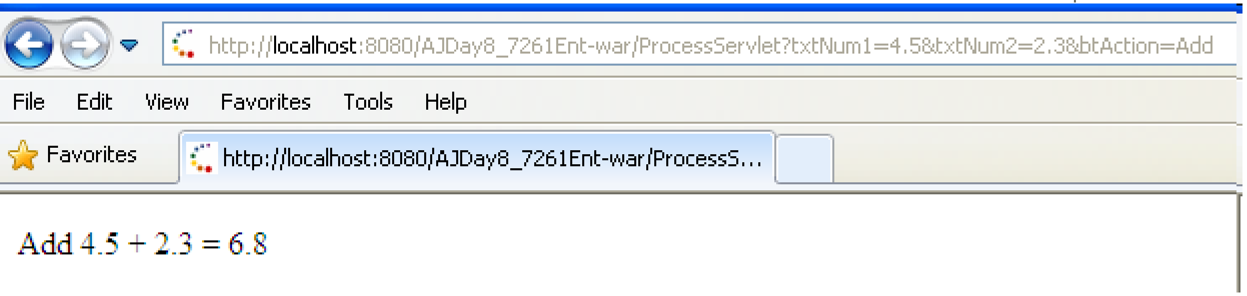



Calculator - Windows Internet Explorer
File Edit View Favorites Tools Help
Favorites
Calculator
Add
Subtract

http://localhost:8080/AJDay8_7261Ent-war/

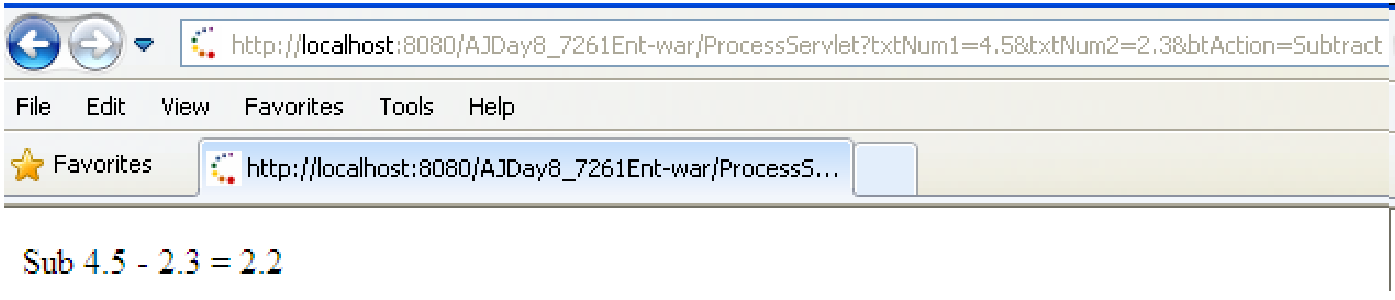
Calculator Web with EJB 2.1

Num1 4.5
Num2 2.3



http://localhost:8080/AJDay8_7261Ent-war/ProcessServlet?txtNum1=4.5&txtNum2=2.3&btAction=Add

Add 4.5 + 2.3 = 6.8



http://localhost:8080/AJDay8_7261Ent-war/ProcessServlet?txtNum1=4.5&txtNum2=2.3&btAction=Subtract

Sub 4.5 - 2.3 = 2.2

Build the simple enterprise application Web Requirements

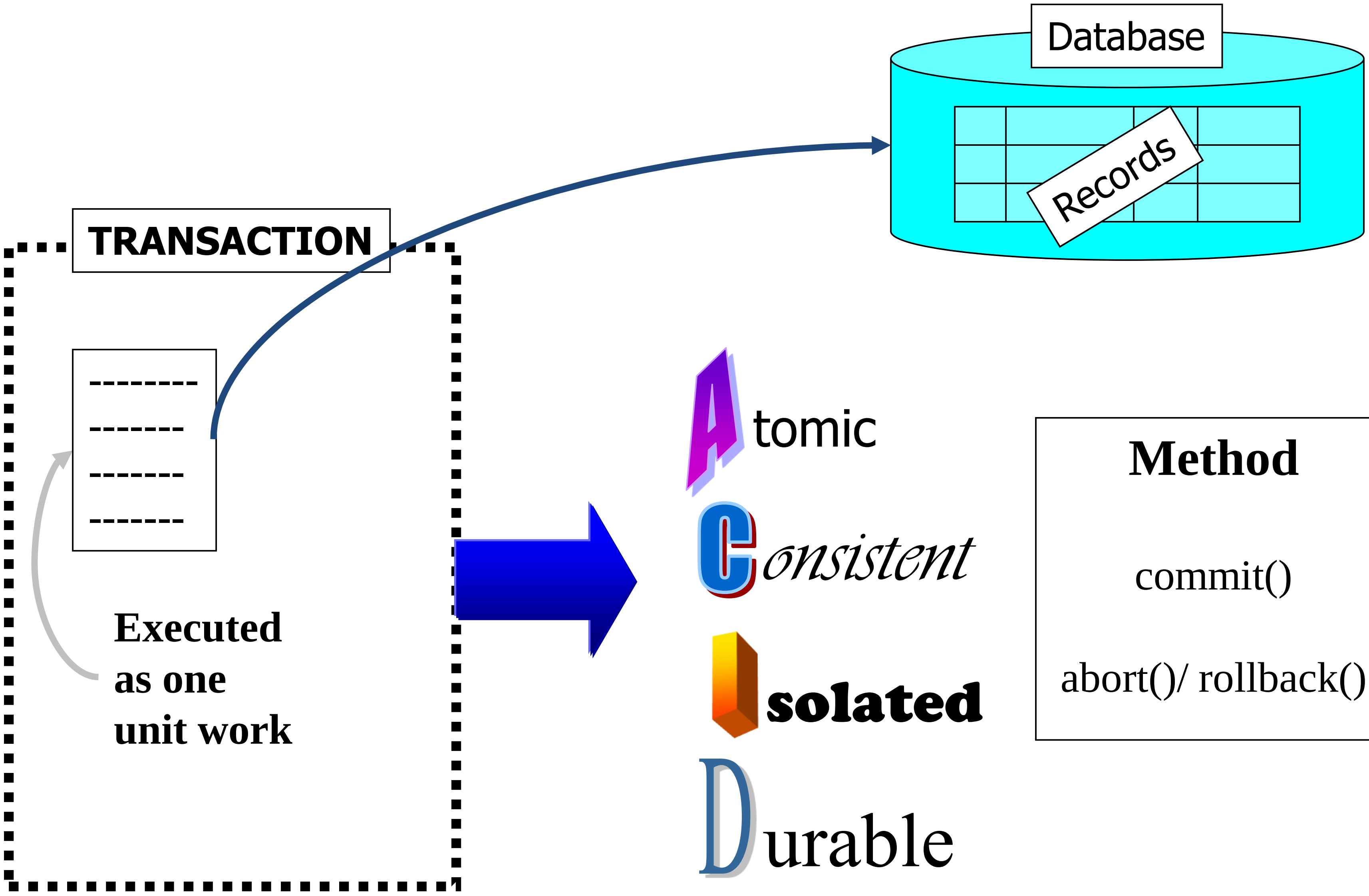
- **Take your self. It is easy**

Appendix – EJB Container

- **Acts** as an **interface between** an **enterprise bean and client**
- **Provides** following **services**
  - Security
  - Transaction Management
  - Persistence
  - Life Cycle management
  - Remote Client Connectivity
- **Responsible** for **providing several APIs**
  - J2SE API
  - EJB Standard Extension
  - JDBC Standard Extension
  - JNDI Standard Extension
  - JMS Standard Extension
  - JavaMail Standard Extension (for Sending mail only)
  - JAXP (Java API for XML Processing)
  - JTA Standard Extension (Only UserTransaction interface)

Enterprise Java Beans

Transactions



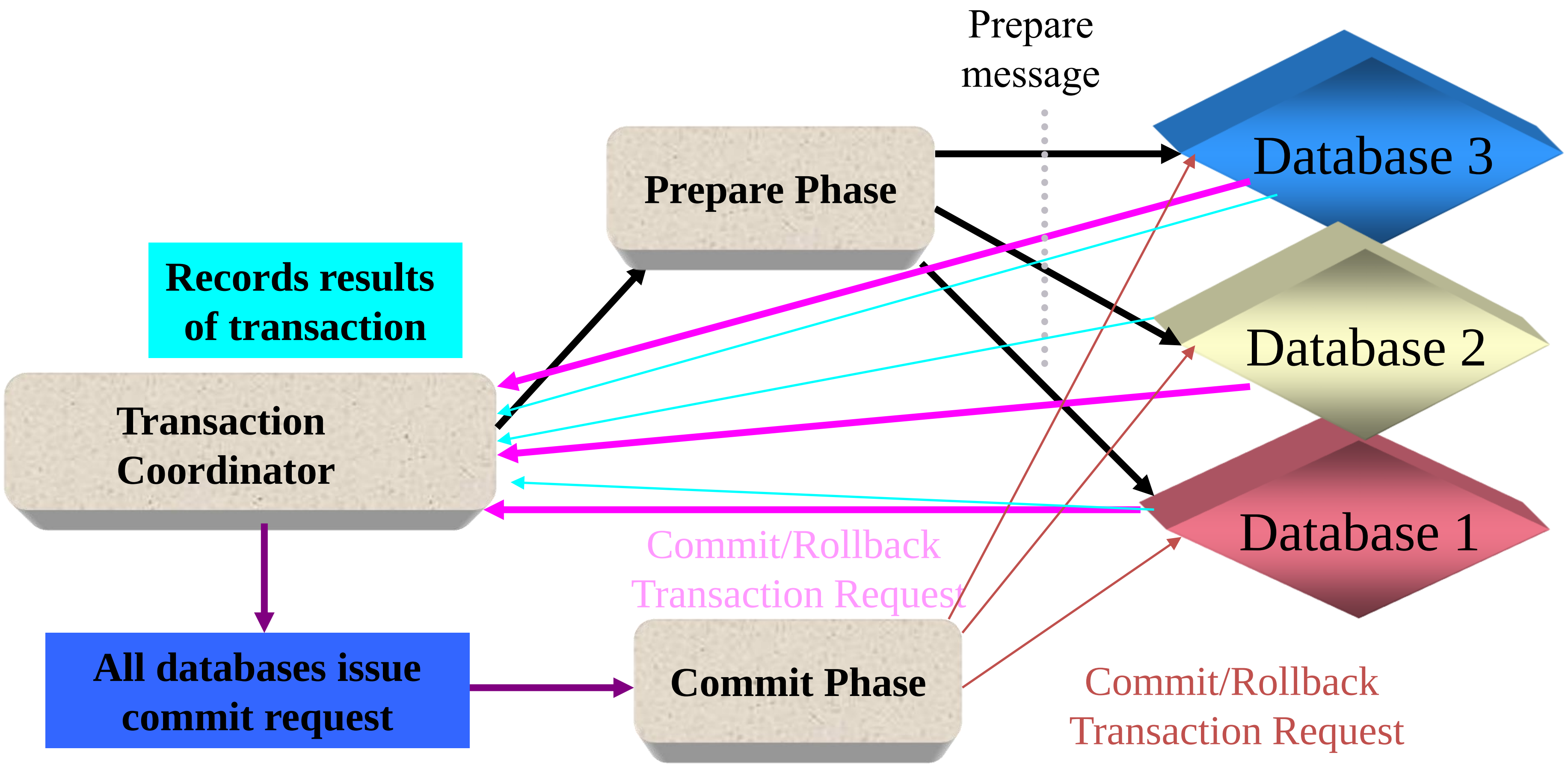
Method

commit()

abort()/ rollback()

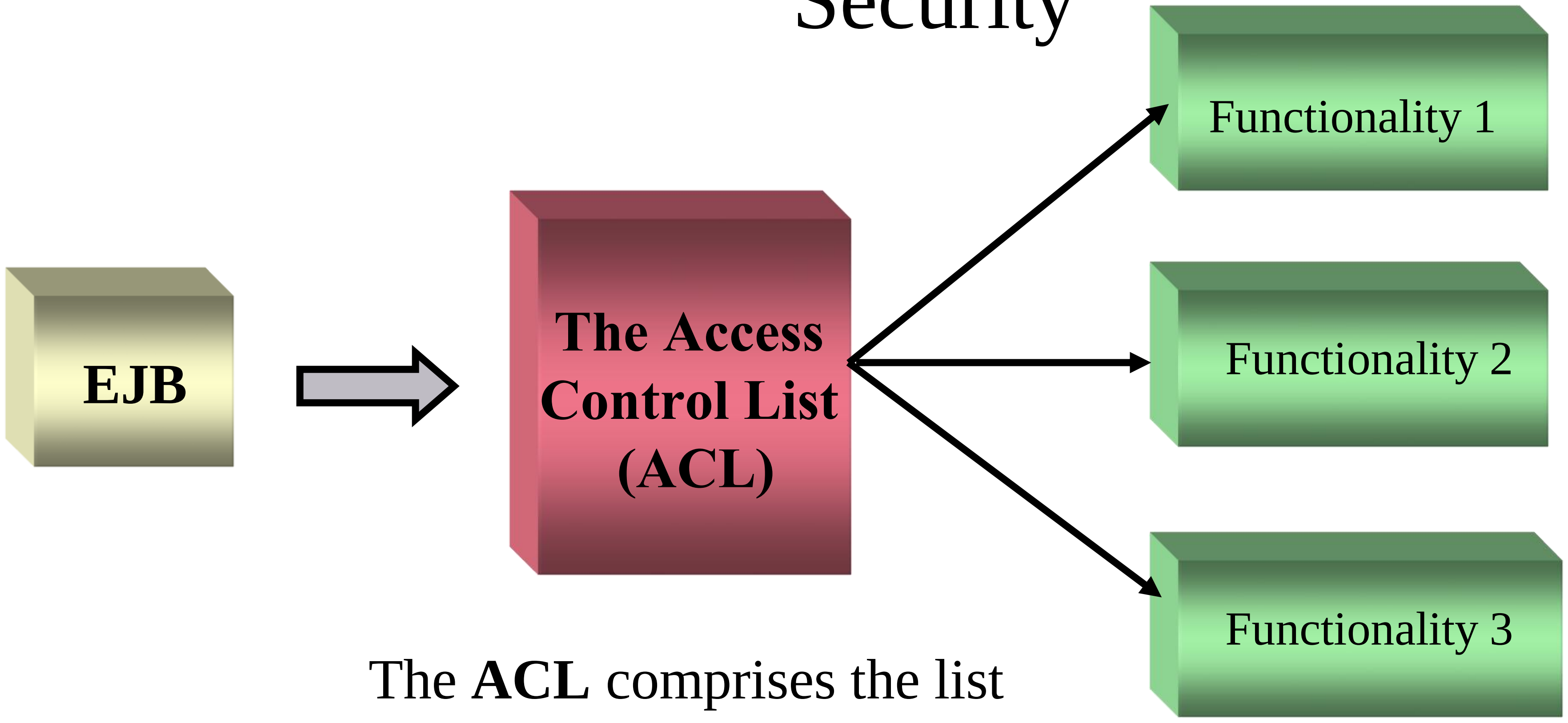
Enterprise Java Beans

Two phase Commit Protocol


Prepare message
Prepare Phase
Database 3
Database 2
Database 1
Records results of transaction
Transaction Coordinator
Commit/Rollback Transaction Request
All databases issue commit request
Commit Phase
Commit/Rollback Transaction Request

Enterprise Java Beans

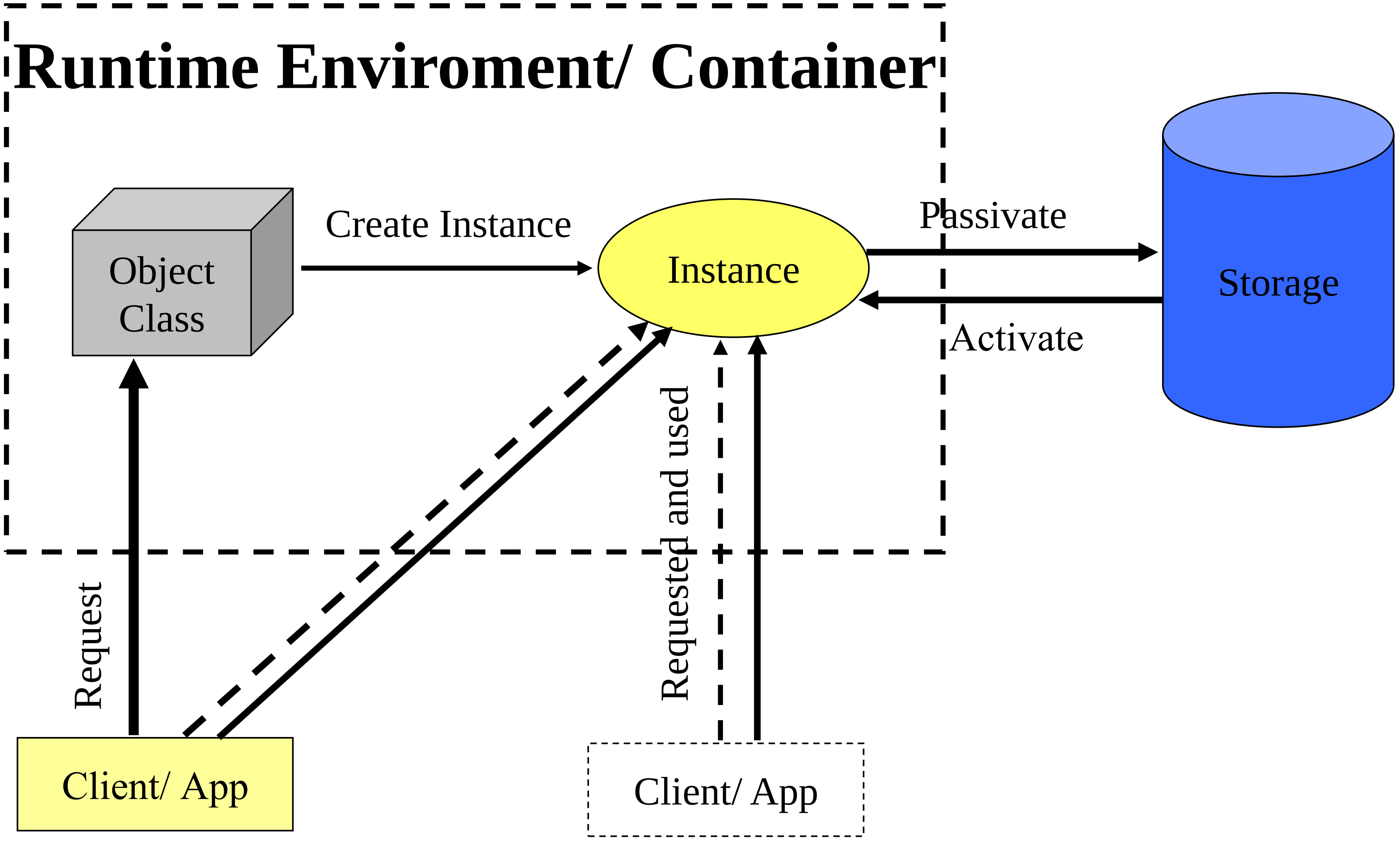
Security



The **ACL** comprises the list of persons who are allowed to access particular sections of functionality.

Enterprise Java Beans

Persistent

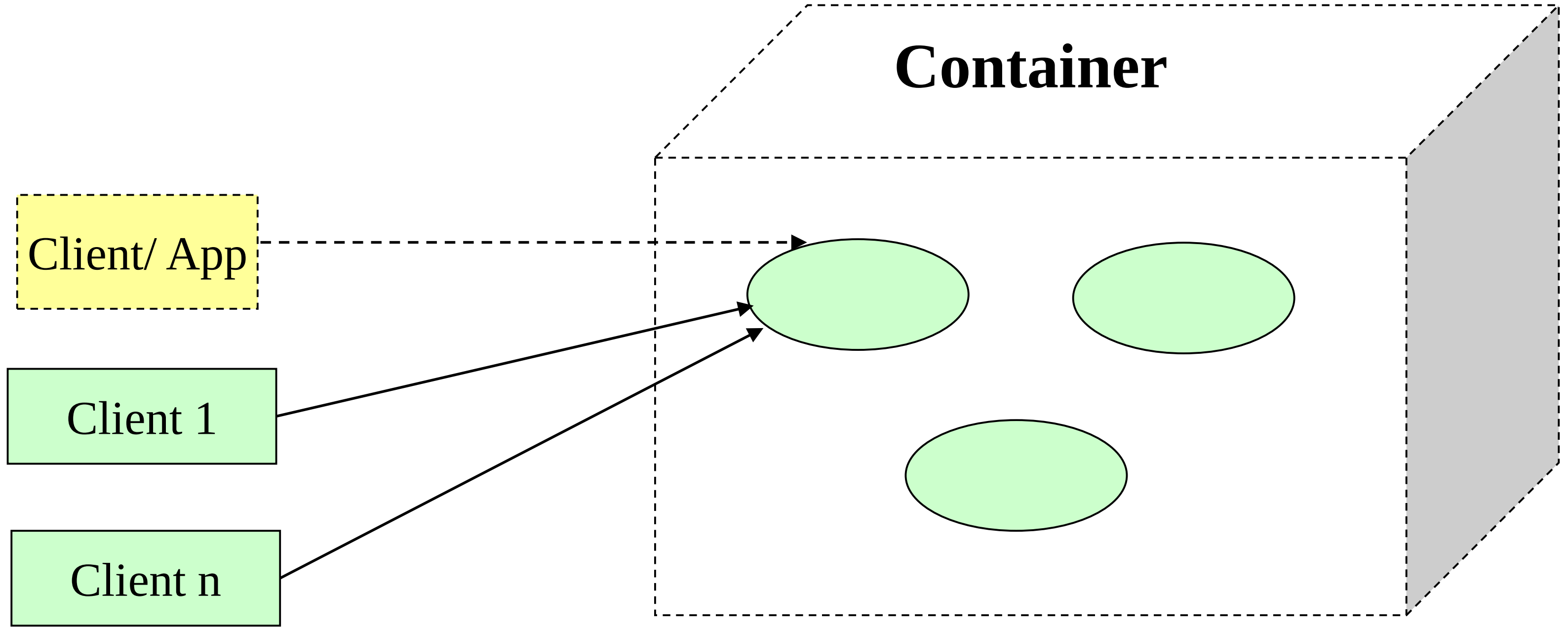


Persistence can be defined as saving the state of an object to a constant storage.

Enterprise Java Beans

Management of Multiple Instance

- Instance Passivation
- Instance Pooling
  - **Advantages**: reduces the memory allocation and garbage-collection cycles
- Database Connection Pooling



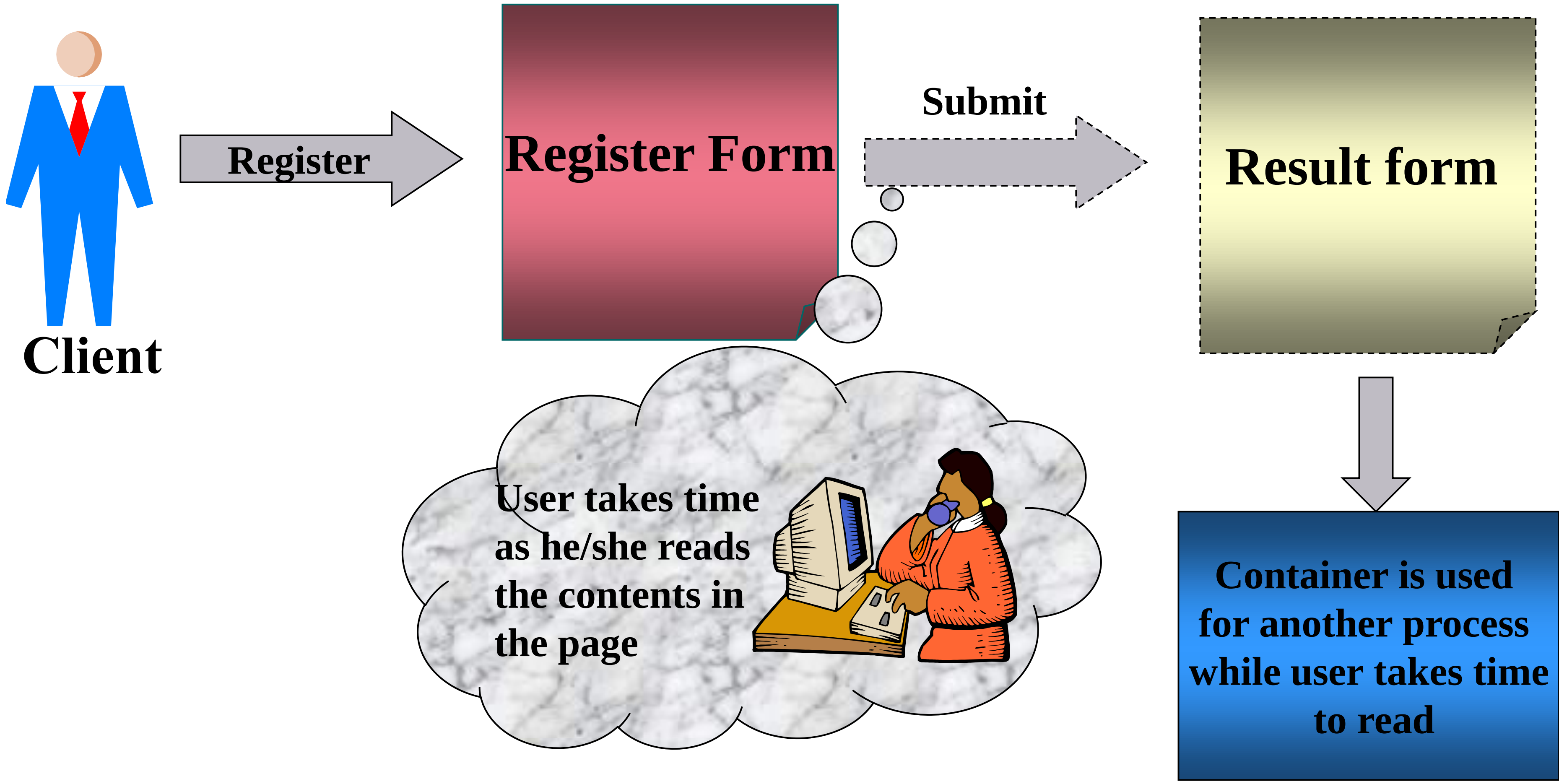
Enterprise Java Beans

Resource and lifecycle Management

- Management of resources **enhances the scalability** of a multi-tier architecture.
- The container **provides resource-management services** for resources such as:
  - Threads
  - Socket Connections
  - Database Connections
- EJB Container **responsible the life cycle** of the bean (control the life of the bean).
  - **Notes: The life time of the bean is managed by EJB server**
- EJB Container **instantiates, destroys and reuses** the beans required.
- EJB Container **supports instance pooling.**

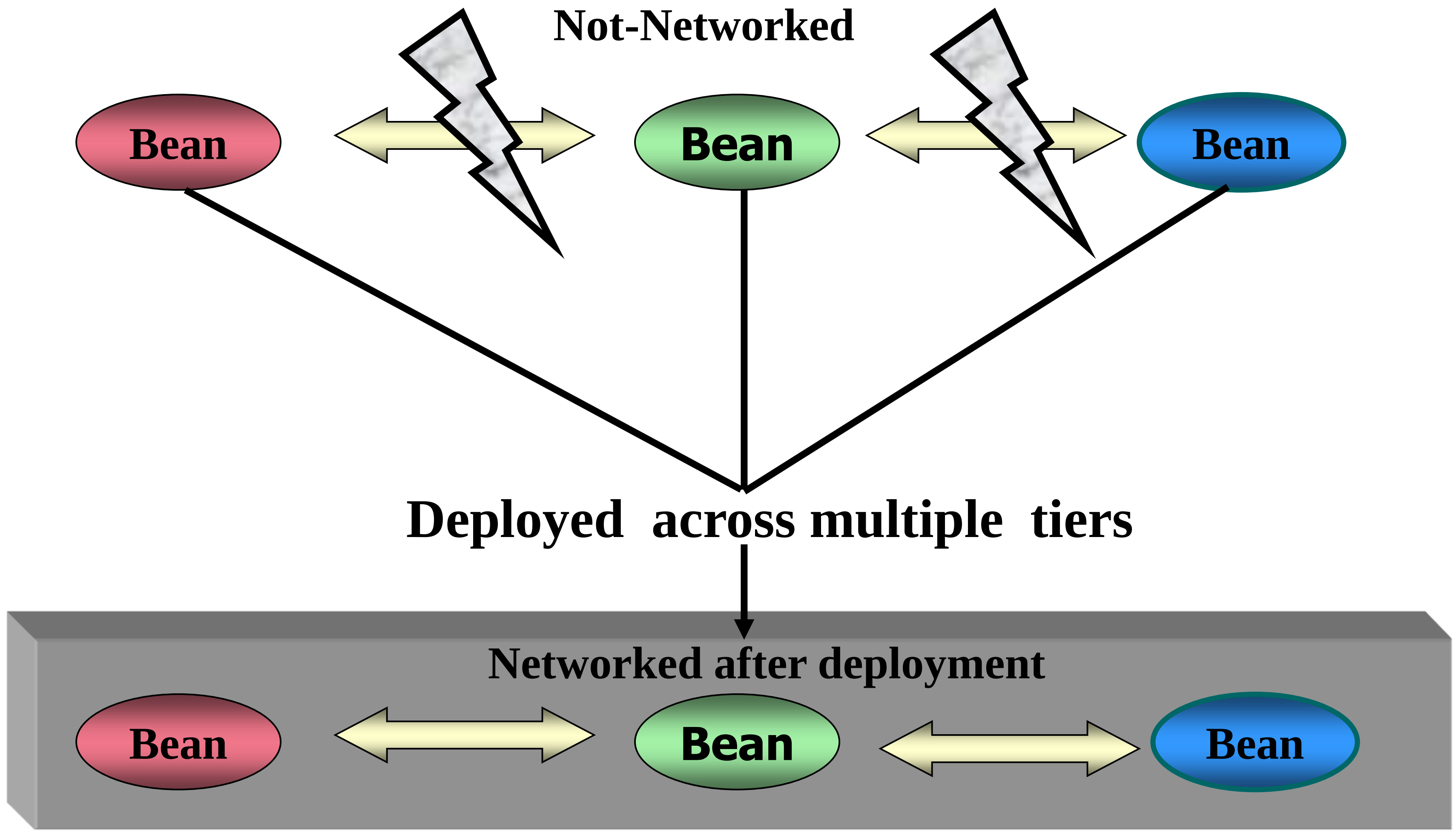
Enterprise Java Beans

State Management


Client
Register
Register Form
Submit
Result form
User takes time as he/she reads the contents in the page
Container is used for another process while user takes time to read

Enterprise Java Beans

Remote Accessibility



Enterprise Java Beans

Location Transparency

- Clients **do not know where** the components are, and whether these components are local or remote
- **Advantages**
  - **Reusable**
  - Vendors can provide value additions in terms of
    - Ability to perform maintenance on a system connected to a network because location transparency **allows a different system provide components for a particular client**
    - **Install new software**
    - **Upgrade the components on a system**
  - When a **system crashes**, the **requests** are **redirected** to **another** system **without the client getting to know about the crash.**

Enterprise Java Beans

Components of EJB

- The Enterprise Java Bean is a **server-side component** that is **employed on a distributed multi-tier environment**.
- EJB does **not allow multithreading** (single thread)
- Important Object of EJB is Bean
- **Types**
  - **Session Bean** – **Represents business process without** having **persistent storage** mechanism
    - Stateless Session Bean
    - Stateful Session Bean
  - **Entity Bean** – **Persists across multiple sessions** and **multiple clients** & Having **persistence storage** mechanism
    - Bean-managed Persistence [BMP]
    - Container-managed Persistence [CMP]
  - **Message-driven Bean** – **Asynchronous messaging between components** of EJB.

Appendix

J2EE Terminologies in J2EE design patterns

- **Service Locator**
  - **Implement** and **encapsulate** service and component lookup
  - **Hides** the implementation details of the lookup mechanism and encapsulates related dependencies

  →**Transparently locate business components and services in a uniform manner (ex: EJB Home Interface)**

- **Business Delegate**
  - **Encapsulate** access to a business service
  - **Hides** the implementation details of the business service, such as lookup and access mechanisms

  →**Hide clients from the complexity of remote communication with business service components**

- **Abstract Factory**
  - Provides a way to **encapsulate a group of individual factories** that have a common theme

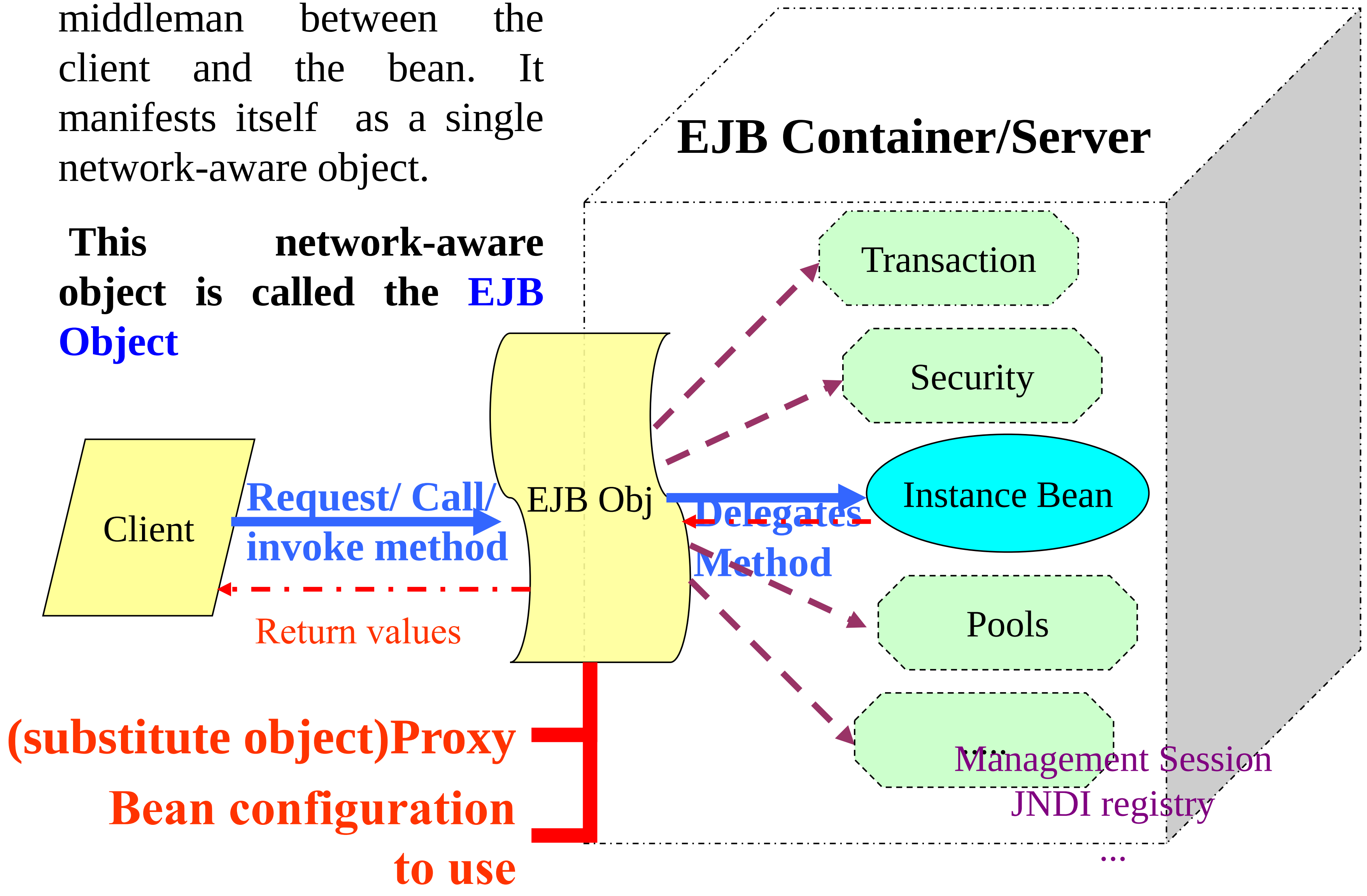
  →**Separates the details of implementation of a set of objects from their general usage (ex: EJBHome interface)**

What Constitutes an EJB?

EJB Objects

The container is the middleman between the client and the bean. It manifests itself as a single network-aware object.

This network-aware object is called the EJB Object



What Constitutes an EJB?

EJB Objects

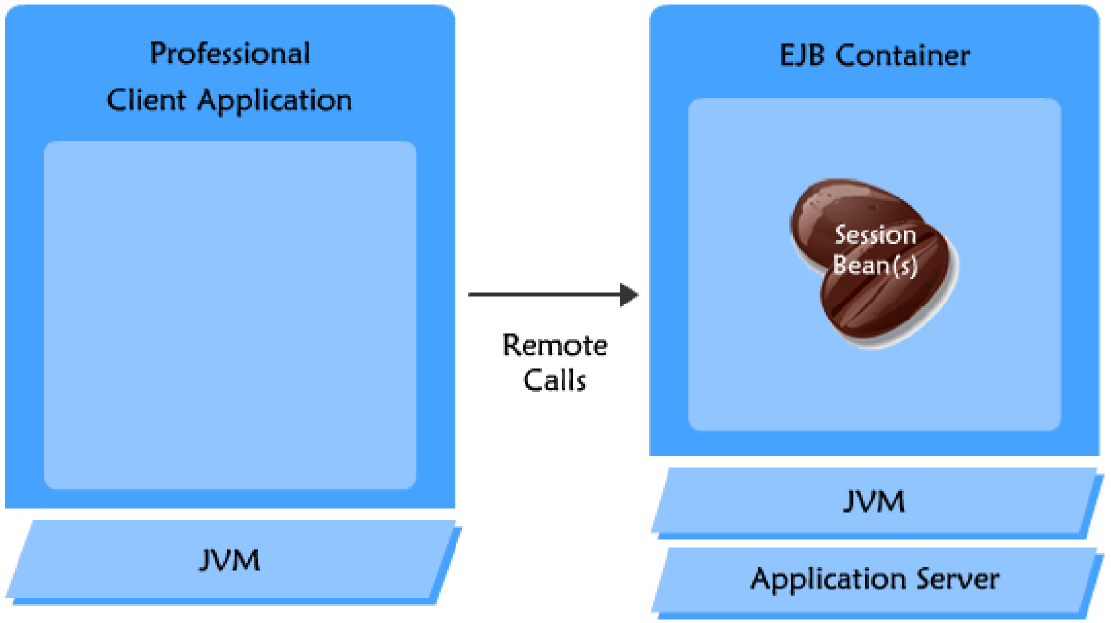
- Interface **javax.ejb.EJBObject**

Methods	**Descriptions**
getEJBHome()	**Retrieves** the **reference** to the corresponding Home Object
getPrimaryKey()	**Return** the **Primary Key** for EJB Object (Entity Bean)
remove()	**Destroy** EJB Object (**delete** the bean from the underlying persistent store, means delete a record on DB – Entity Bean)
getHandle()	Obtain the **handle** (is a persistent reference to the EJB Object) for the EJB Object
isIdentical()	Checks whether two EJB Objects are similar

- Relationship between Java RMI and EJB Objects
  - public interface javax.ejb.EJBObject **extends java.rmi.Remote** (*The physical location of remote object is hidden from the Client RMI*)
  - Can be called from a different JVM
  - **Offers Location Transparency** (Portability of Client Code)

What Constitutes an EJB?
Remote Interface

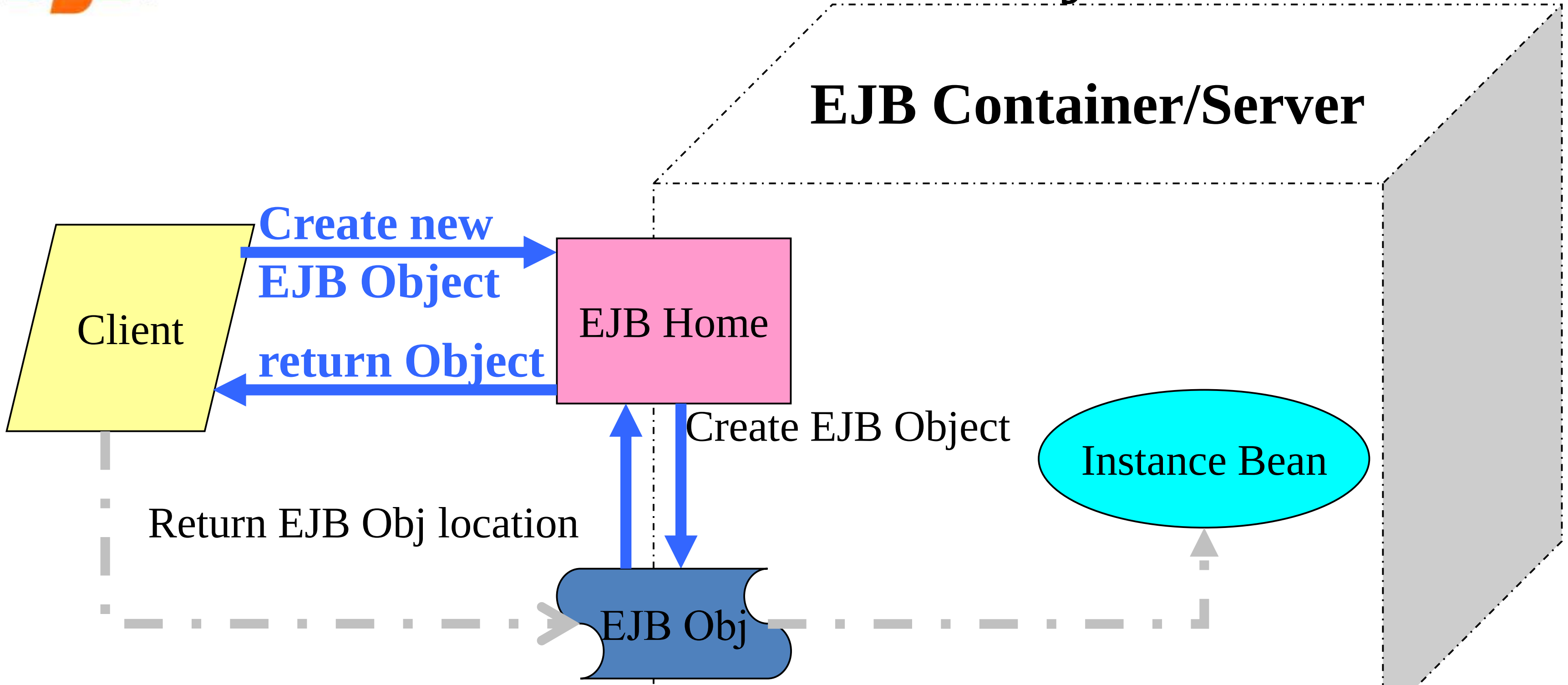
- **Is used when** the **client application runs** on a **separate JVM than** the **one that** is **used to run** the **Session beans** in an EJB Container
  - The **method invocation** in remote business interfaces are **received from networked clients**
  - The method **parameters and** the **return values** are **copied** and is **known** as **call-by-value**



What Constitutes an EJB?
Local Interface

- EJB 2.0 can **expose** their **methods to clients through new Local** Interface
- Standard Java interface which **allows the beans to expose its methods** to other bean **reside within the same container** (local clients)
- **Eleminate** the **overhead** of the **remote method call** (java.rmi.RemoteException)
- Is used when the application **uses the same JVM to run both the client application** and the **Session beans**
  - The method **parameters** and the **return values** are **not copied** and **hence**, it is known as **call-by-reference**
  - Speed up in processing and efficiency
- **Not inherit from RMI** (extends javax.ejb.EJBLocalObject)

Home Objects



- Client code will request for an object from **the EJB Object Factory**, which know as **the home object** (instantiates EJB Object)
- **Responsibilities**
  - Create (Instantiate) EJB Objects
  - Initial information for EJB Object s
  - Find or search for existing EJB Objects(Entity Bean)
  - Remove EJB Objects (deletes the bean from the underlying persistent store)
  - Select EJB Objects (Entity Bean)

What Constitutes an EJB?

Home Objects

- Interface javax.ejb.EJBHome (extends java.rmi.Remote)

Methods	Descriptions
getEJBMetaData()	**Retrieve information** about **EJB** (Beans' information) that are **being worked on**. The information received is encapsulated in the EJBMetaData object, which returns the method.
remove()	**Destroy EJB Object** following - **Passing** the **javax.ejb.Handle object**, which **remove EJB Object** that is based on the already retrieved EJB Handle - **Passing a primary key** to **remove beans** (**one record**) from the **underlying persistent store.**

Appendix

J2EE Terminologies in J2EE design patterns

- **Transfer Object**
  - A serializable class that **groups related attributes, forming a composite value**
  - A class is used as **the return type of a remote business method**
  - Clients receive instances of this class by calling coarse-grained business methods, and then locally access the fine-grained values within the transfer object. Fetching multiple values in one server roundtrip decreases network traffic and minimizes latency and server resource usage.
- **Session Façade**
  - A higher-level business component contains and centralizes complex interactions between lower-level business components
  - Is implemented as a session enterprise bean.
    - It **provides** clients with **a single interface** for the functionality of an application or application subset.
    - It also **decouples lower-level business components** from one another, making designs more flexible and comprehensible

APPLICATION/EJB SERVER

- Provides **many services**
  - **Network connectivity** to the container
  - **Instance Passivation** – Temporarily swap out a bean from memory storage
  - **Instance Pooling** – Multiple clients share same instance
  - **Database Connection Pooling** – Contains a set of database connection
  - **Precached Instances** – Maintains cache, which contains information about the state of the EJB
- **Other** services
  - Runtime Environment
  - Support the containers interaction
  - Process and Thread Management
  - Receive and process requests
  - System Resource Management

Enterprise Java Beans
Session Beans

- **Survive only as long as** the client exists.
- Are created solely in response to a call made by the client.
- Are **used to implement business logic, business rules and the workflow**
  - **Ex**: Check login, computation, Document process, book tickets
- **Are not shareable between clients** (only one client can deal with that particular session bean)
- **Stateless Session Bean**
  - **Single** Request
  - **Stateless**
  - **Redirect** the **others bean** when the errors occur.
  - **Ex**: check Login
- **Stateful Session Bean**
  - **Multiple** requests (The life cycle is very complex)
  - **Keep track**
  - **Persistence**
  - **Ex**: Shopping Cart

Enterprise Java Beans

Entity Beans

- DB Model: Entity beans are the **object representations of the underlying data and provide access to data**.
- The components **are persistent**.
- **Have a long life** because they can be reconstructed by reading the data back from the permanent DB.
- Data in Relational DB can be treated as **real objects** and an entire chunk of data from DB can be read at once into an entity bean component. (Allow the transformation of the data in the DB into Java Objects)
- EJB Container **synchronous** between EJB and DB
- **BMP –** Bean managed Persistent Entity Bean
  - **The developer has to write** the code (**CRUD**) to interpret the fields stored in the memory to an underlying DB
- **CMP –** Container managed Persistent Entity Bean
  - The **container perform** all the operations
  - The **developer** has to **describe** that needs to persist and inform the container
  - The developer **concentrates** the **business processes**.

Enterprise Java Beans

Message Driven Beans

- New type in EJB Version 2.0
- Process **messages asynchronously** (The bean acts a a message listener)
- **Communication** between software components/ application (onMessage(Message msg) method)
- **Similar t**o Stateless session bean
- Created and Controller by Container.
- Do **not** have **a home and remote interface**.
- Support both container managed (which may delivered message within a transaction context) and bean managed transactions.

JNDI

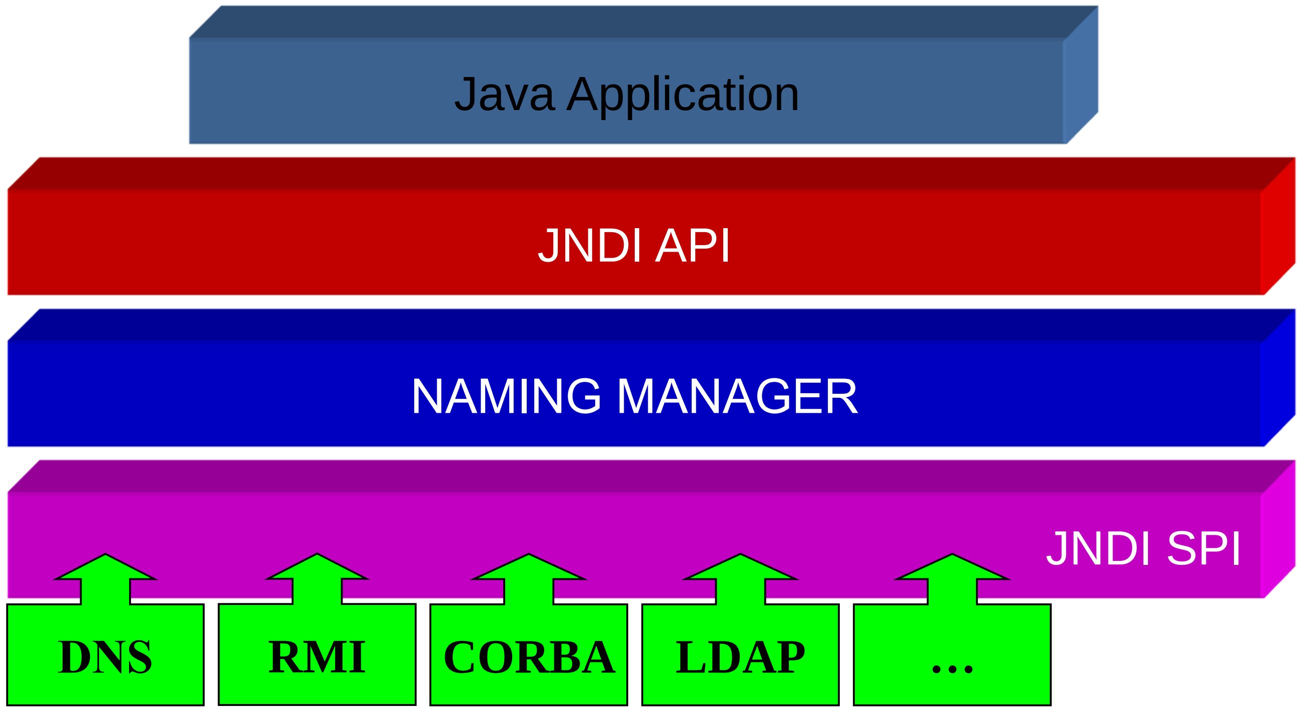
Overview

- **A naming service** (which has its own set of rules for creating valid names) allows you **finding an object** in a system based on the **name associated with the object** which is called **"binding"**.
- **A directory service** is an **extension of a naming service** (an object is also associated with a name, which can be look up, and allowed to have attributes)
- Java Naming and Directory Interface (**JNDI**) is a **specification** for accessing naming and directory services
- Java Naming and Directory Interface **provides the naming and directory functionality** to Java applications.
- Provides **a standard interface to locate** the components, users, networks, and services placed **across the network**.
- **Bridges the gap between directory services** and makes it possible for the developer to write portable naming and directory services
- JNDI **abstracts the code from a directory service and allows the user to plug in a different directory services**. (without changing the service code)

JNDI
Overview

- JNDI provides **javax.naming.*** interface
- JNDI separate two parts
  - **JNDI API**
  - **JNDI SPI**
- Naming Concepts of JNDI
  - **Atomic**: It's a simple and basic name. Ex: Windows
  - **Compound**: the collection of one or more atomic names.
    - Ex: C:\Windows\System32
  - **Composite**: A name has multiple naming system.
    - Ex: http://localhost:8080/JSP/index.html

JNDI Architecture

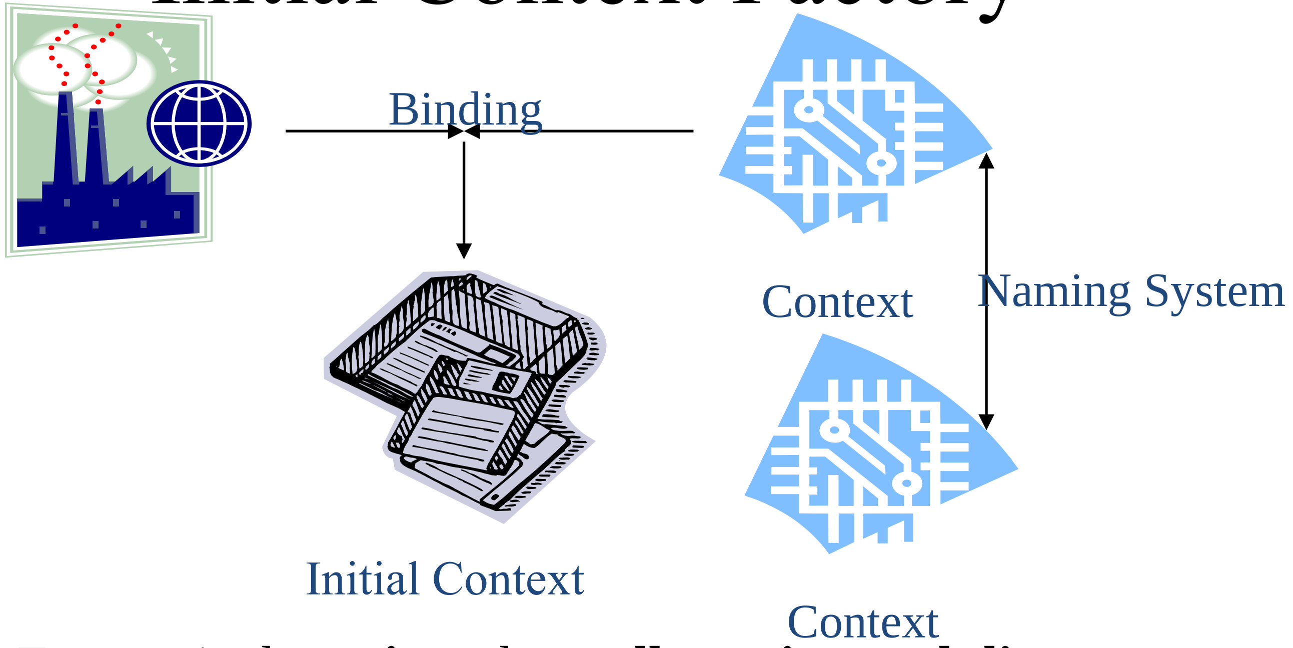


Accessor Naming Directory services through APIs

allows Naming and Directory vendors can plugin transparency

JNDI

Initial Context Factory



- Initial Context Factory is the **point** where **all naming and directory operations** are **first performed**.
- When the initial context **is acquired**, all information **pertaining** to this must be provided to JNDI.
- The **internal storage** of JNDI **emulates tree data structure**. Each InitialContext **acts like an internal node** and **each reference to the resources acts like the leaves**
- The directory context or directory object is another type of context. It is used to **define methods for inspecting** and **modifying attributes** associated with a *directory object.*