



EJB

enterprise java beans

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About the Tutorial

Enterprise Java Beans (EJB) is a development architecture for building highly scalable and robust enterprise level applications to be deployed on J2EE compliant Application Server such as JBOSS, Web Logic etc.

EJB 3.0 is being a great shift from EJB 2.0 and makes development of EJB based applications quite easy.

This tutorial is developed to provide a comprehensive understanding about the EJB concepts helpful to create and deploy an enterprise level application up and running.

Audience

This tutorial is designed for Software Professionals as well as for all those who are willing to learn EJB Programming. This tutorial will give you a great understanding about EJB Programming concepts in simple and easy steps.

Prerequisites

Before proceeding with this tutorial, you should have a basic understanding of Java programming language, text editor, and execution of programs etc. Because we are going to develop enterprise-based applications using EJB, it will be good, if you have understanding on other technologies like Database Servers, Application Servers.

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Table of Contents

About the Tutorial.....	i
Audience	i
Prerequisites	i
Copyright & Disclaimer.....	i
Table of Contents	ii
 1. EJB – OVERVIEW.....	 1
Types.....	1
Benefits.....	1
 2. EJB – ENVIRONMENT SETUP.....	 2
System Requirement.....	2
 3. EJB – CREATE APPLICATION.....	 7
Create Project	7
Create a Sample EJB	9
Build the Project.....	11
Start the Application Server	12
Deploy the Project	13
Create Client to Access EJB	15
Run Client to Access EJB	18
 4. EJB – STATELESS BEAN.....	 20
Steps to Create a Stateless EJB	20
Example Application	21
EJBComponent (EJB Module)	21
EJBTester (EJB Client)	23
Run Client to Access EJB	26

Run Client Again to Access EJB	27
5. EJB – STATEFUL BEAN.....	29
Steps to Create Stateful EJB	29
Example Application	30
EJBComponent (EJB Module)	30
EJBTester (EJB Client)	32
Run Client to Access EJB	36
Run Client Again to Access EJB	36
6. EJB – PERSISTENCE	38
Create Table	38
Create Entity Class.....	38
Create DataSource and Persistence Unit	39
Create Stateless EJB having EntityManager Instance	40
Example Application	41
EJBComponent (EJB Module)	41
EJBTester (EJB Client)	45
Run Client to Access EJB	48
Run Client Again to Access EJB	49
7. EJB – MESSAGE DRIVEN BEANS	50
Create Queue	50
Create Message Driven Bean.....	51
Example Application	52
EJBComponent (EJB Module)	52
EJBTester (EJB Client)	54
Run Client to Access EJB	57
8. EJB – ANNOTATIONS	59

9. EJB – CALLBACKS	62
Example Application	63
EJBComponent (EJB Module)	63
EJBTester (EJB Client)	70
Run Client to Access EJB	74
10. EJB – TIMER SERVICE	76
Steps to Create Timer	76
Steps to Use Timer	76
Example Application	77
EJBComponent (EJB Module)	77
EJBTester (EJB Client)	79
Run Client to Access EJB	81
11. EJB – DEPENDENCY INJECTION	82
Steps to Use @EJB.....	82
Steps to use @Resource	83
Example Application	83
EJBComponent (EJB Module)	83
EJBTester (EJB Client)	85
Run Client to Access EJB	88
12. EJB – INTERCEPTORS	90
Example Application	91
EJBComponent (EJB Module)	92
JBoss Application Server Log Output	93
EJBTester (EJB Client)	93
Run Client to Access EJB	97

13. EJB – EMBEDDABLE OBJECTS.....	99
Example Application	100
EJBComponent (EJB Module)	100
EJBTester (EJB Client)	105
Run Client to Access EJB	109
14. EJB – BLOBS/CLOBS	111
Example Application	111
EJBComponent (EJB Module)	112
EJBTester (EJB Client)	116
Run Client to Access EJB	120
15. EJB – TRANSACTIONS.....	121
Container Managed Transactions.....	121
Bean Managed Transactions	123
16. EJB – SECURITY	125
Important Terms of Security	125
Container Managed Security	125
Security Configuration.....	126
17. EJB – JNDI BINDINGS	128
18. EJB – ENTITY RELATIONSHIPS	131
Create Tables	131
Create Entity Classes	132
Example Application	133
EJBComponent (EJB Module)	133
EJBTester (EJB Client)	138
Run Client to Access EJB	142

19. EJB – ACCESS DATABASE.....	144
Create Table	144
Create a Model Class.....	144
Create Stateless EJB	145
Example Application	145
EJBComponent (EJB Module)	146
EJBTester (EJB Client)	150
Run Client to Access EJB	153
20. EJB – QUERY LANGUAGE	155
Create Table	155
Create a Model Class.....	155
Create Stateless EJB	156
Example Application	156
EJBComponent (EJB Module)	157
EJBTester (EJB Client)	160
Run Client to Access EJB	163
21. EJB – EXCEPTION HANDLING	165
How Does EJB Container Handle Exceptions?	165
Handling Application Exception.....	165
Handling System Exception	166
22. EJB – WEB SERVICES.....	168
Example Application	168
Create Client to Access EJB as Web Service	170
Run the Client	174
23. EJB – PACKAGING APPLICATIONS	176

1. EJB – OVERVIEW

EJB stands for **E**nterprise **J**ava **B**eans. EJB is an essential part of a J2EE platform. J2EE platform has component based architecture to provide multi-tiered, distributed and highly transactional features to enterprise level applications.

EJB provides an architecture to develop and deploy component based enterprise applications considering robustness, high scalability, and high performance. An EJB application can be deployed on any of the application server compliant with the J2EE 1.3 standard specification.

We'll be discussing EJB 3.0 in detail in this tutorial.

Types

EJB is primarily divided into three categories; following table lists their names with brief descriptions:

Type	Description
Session Bean	Session bean stores data of a particular user for a single session. It can be stateful or stateless . It is less resource intensive as compared to entity bean. Session bean gets destroyed as soon as user session terminates.
Entity Bean	Entity beans represent persistent data storage. User data can be saved to database via entity beans and later on can be retrieved from the database in the entity bean.
Message Driven Bean	Message driven beans are used in context of JMS (Java Messaging Service). Message Driven Beans can consumes JMS messages from external entities and act accordingly.

Benefits

Following are the important benefits of EJB:

- Simplified development of large-scale enterprise level application.
- Application Server/EJB container provides most of the system level services like transaction handling, logging, load balancing, persistence mechanism, exception handling, and so on. Developer has to focus only on business logic of the application.

- EJB container manages life cycle of EJB instances, thus developer needs not to worry about when to create/delete EJB objects.

2. EJB – ENVIRONMENT SETUP

EJB is a framework for Java, so the very first requirement is to have a **Java Development Kit** (JDK) installed in your machine.

System Requirement

JDK	1.5 or above.
Memory	no minimum requirement.
Disk Space	no minimum requirement.
Operating System	no minimum requirement.

Step 1 - Verify Java Installation in Your System

Now open console and execute the following **java** command.

OS	Task	Command
Windows	Open Command Console	c:\> java -version
Linux	Open Command Terminal	\$ java -version
Mac	Open Terminal	machine:~ joseph\$ java -version

Let's verify the output for all the operating systems:

OS	Output
Windows	java version "1.6.0_21" Java(TM) SE Runtime Environment (build 1.6.0_21-b11) Java HotSpot(TM) 64-Bit Server VM (build 23.21-b01, mixed mode)
Linux	java version "1.6.0_21" Java(TM) SE Runtime Environment (build 1.6.0_21-b11) Java HotSpot(TM) 64-Bit Server VM (build 23.21-b01, mixed mode)
Mac	java version "1.6.0_21" Java(TM) SE Runtime Environment (build 1.6.0_21-b11) Java HotSpot(TM) 64-Bit Server VM (build 23.21-b01, mixed mode)

If you do not have Java installed, install the Java Software Development Kit (SDK) from <http://www.oracle.com/technetwork/java/javase/downloads/index.html>.

We are assuming that Java 1.6.0_21 as installed version for this tutorial.

Step 2 – Set JAVA Environment

Set the **JAVA_HOME** environment variable to point the base directory location where Java is installed on your system. For example,

OS	Output
Windows	Set the environment variable JAVA_HOME to C:\Program Files\Java\jdk1.6.0_21
Linux	export JAVA_HOME=/usr/local/java-current
Mac	export JAVA_HOME=/Library/Java/Home

Append Java compiler location to System Path.

OS	Output
Windows	Append the string ;C:\Program Files\Java\jdk1.6.0_21\bin to the end of the system variable, Path.
Linux	export PATH=\$PATH:\$JAVA_HOME/bin/
Mac	not required

Verify Java Installation using **java -version** command explained above.

Step 3 – Download and Install NetBeans IDE

Download the latest version of NetBeans IDE from <https://netbeans.org/downloads/index.html>. At the time of writing this tutorial, I downloaded *Netbeans 7.3*, which comes bundled with JDK 1.7 using the following link <http://www.oracle.com/technetwork/java/javase/downloads/index.html>

OS	Installer name
Windows	Netbeans 7.3
Linux	Netbeans 7.3
Mac	Netbeans 7.3

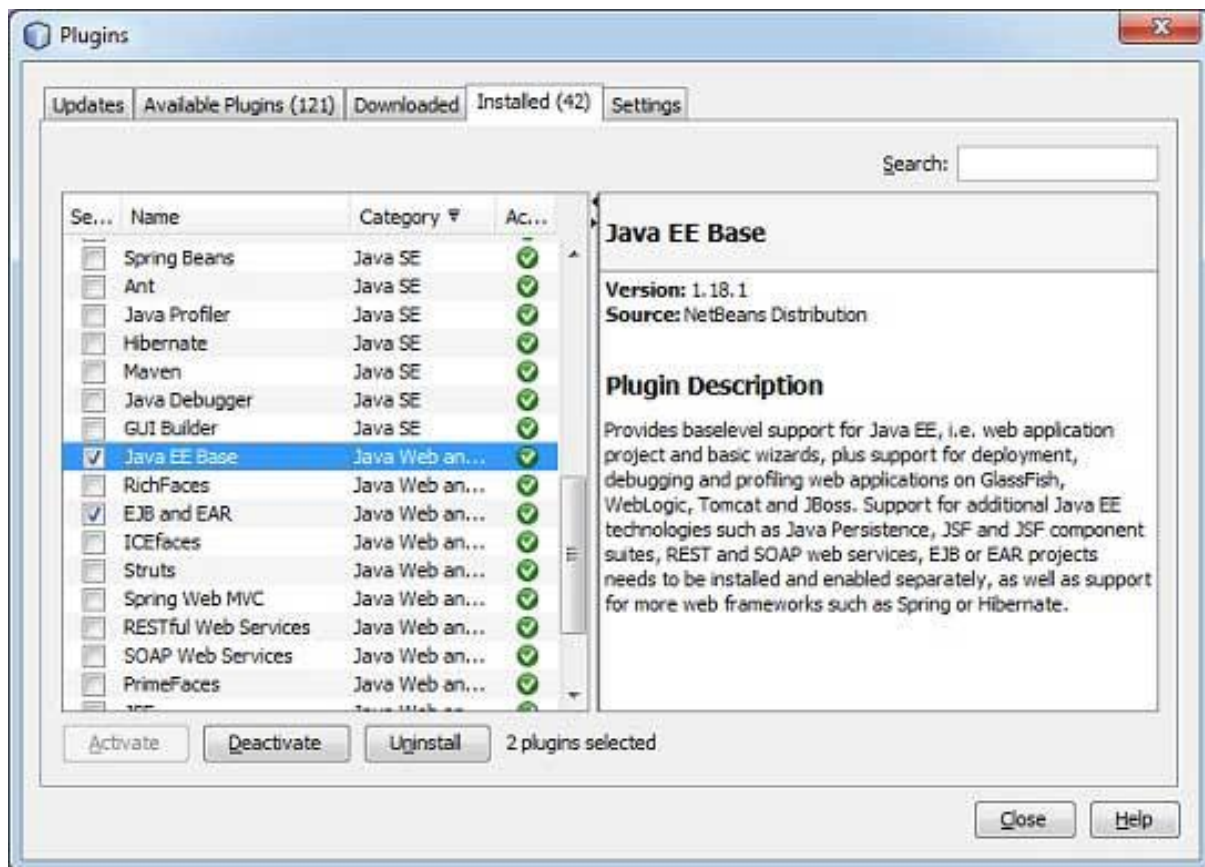
Step 4 – Set up JBoss Application Server

You can download the latest version of JBoss Server from <http://www.jboss.org/jbossas/downloads/>. Download the archive as per the platform. Extract the Jboss to any location on your machine.

OS	File name
Windows	jboss-5.1.0.GA-jdk6.zip
Linux	jboss-5.1.0.GA-src.tar.gz
Mac	jboss-5.1.0.GA-src.tar.gz

Step 5 – Configure JEE Plugins to Netbeans

Open Plugin window using Tools > Plugins. Open "Available Plugin" tab and select "Java EE Base" and "EJB and EAR" under "Java Web and EE" category. Click install button. Netbeans will download and install the respective plugins. Verify plugins installation using "Installed" tab (as shown in the image given below).

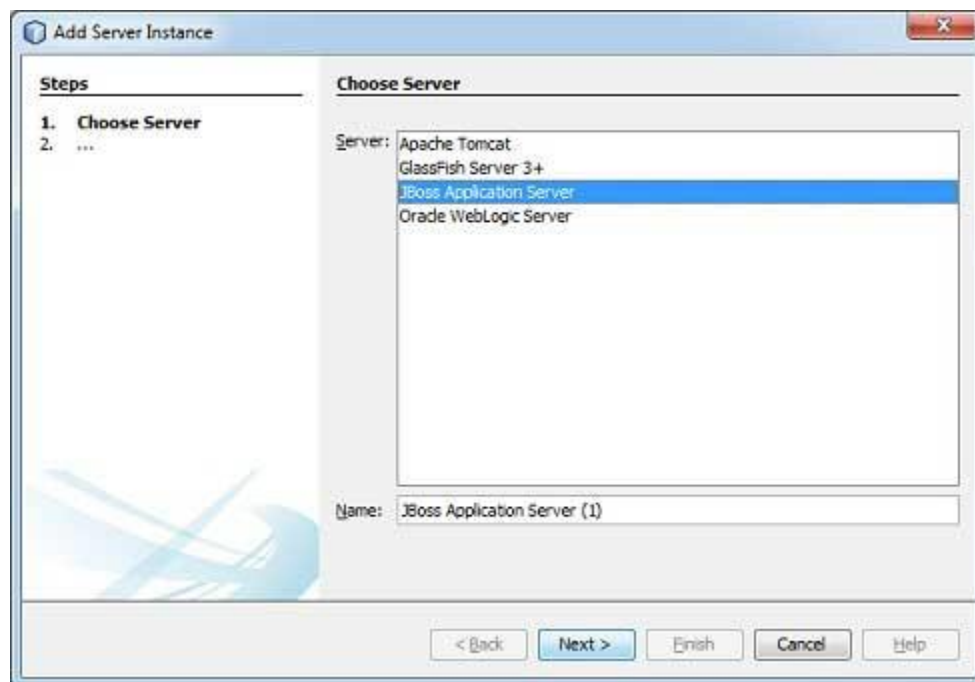


Step 6 – Configure JBoss Server in Netbeans

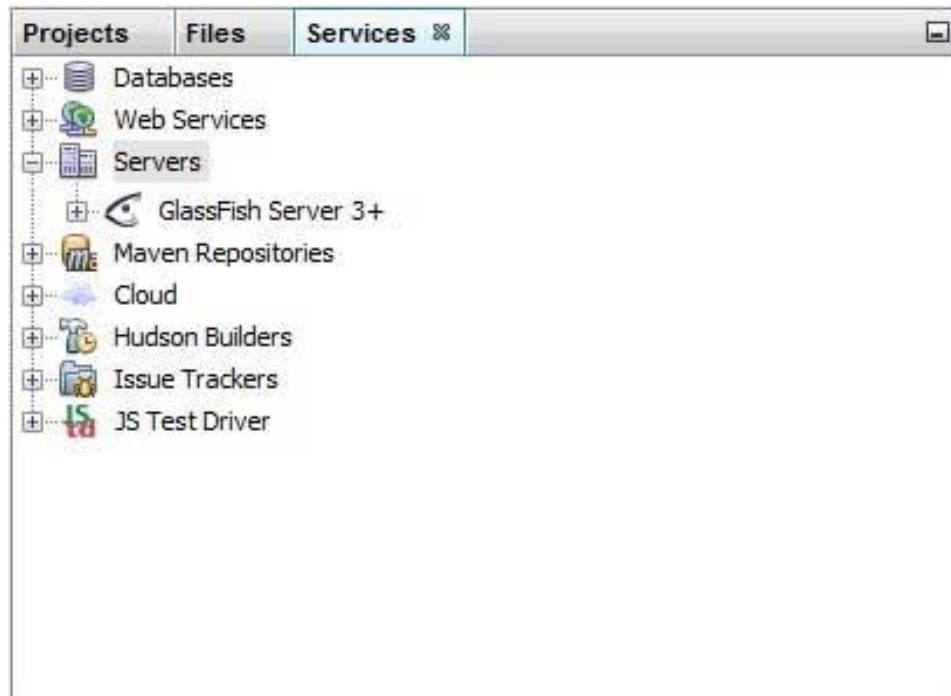
Go to Services tab and right click on servers to add a new server.



Add Server Instance wizard will open. Select JBoss and in next step enter the relevant details to configure server in netbeans.



Once everything is configured, you will see the following screen.



Step 7 – Install Database Server (PostGreSql)

Download latest version of PostGreSql database server from <http://www.postgresql.org/download/>. At the time of writing this tutorial, I downloaded *PostGreSql 9.2*

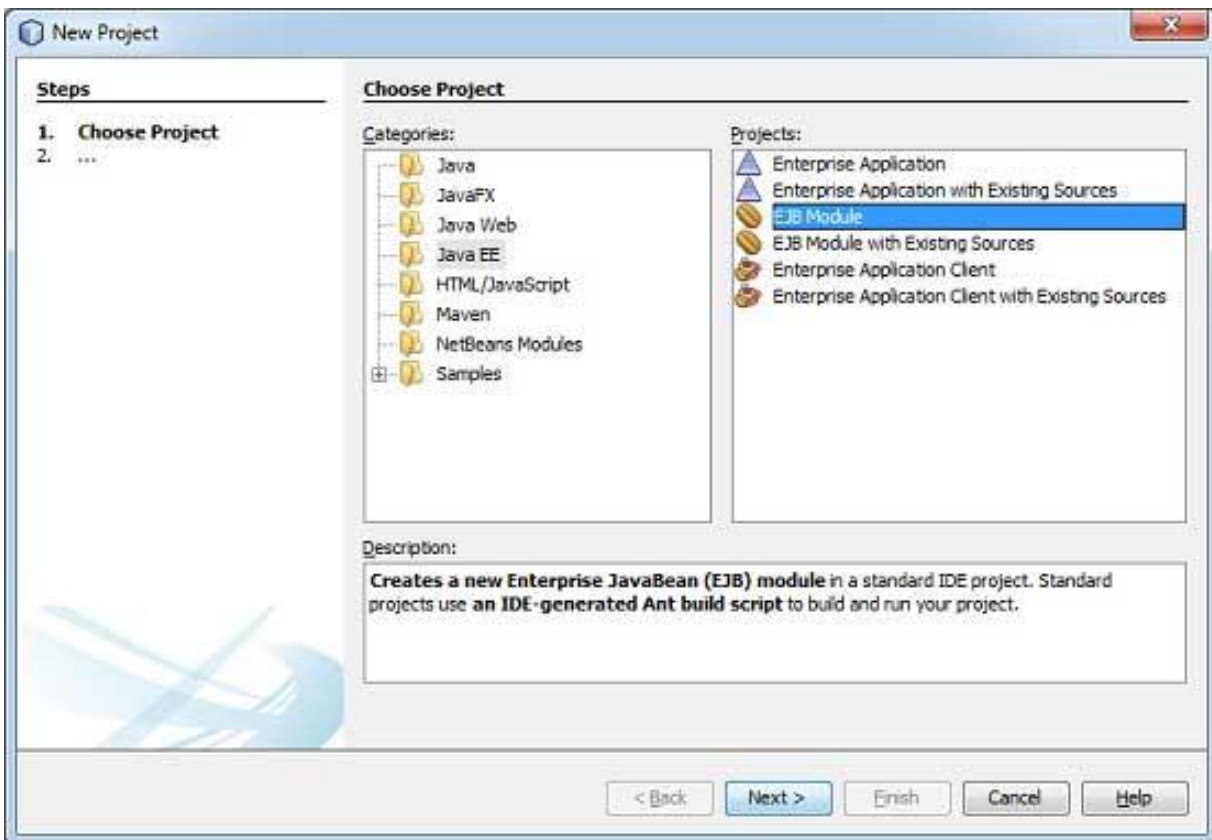
OS	Installer name
Windows	PostGreSql 9.2
Linux	PostGreSql 9.2
Mac	PostGreSql 9.2

3. EJB – CREATE APPLICATION

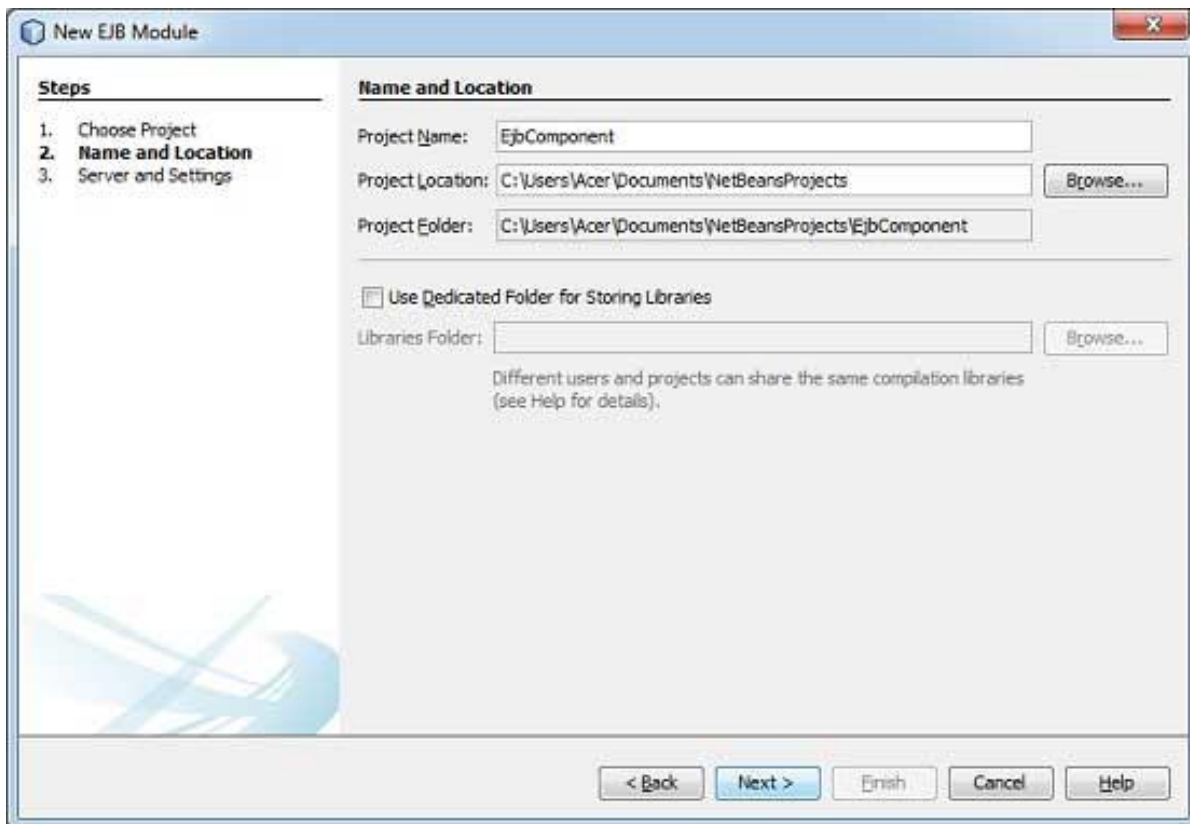
To create a simple EJB module, we will use NetBeans, "New project" wizard. In the example given below, We will create an EJB module project named Component.

Create Project

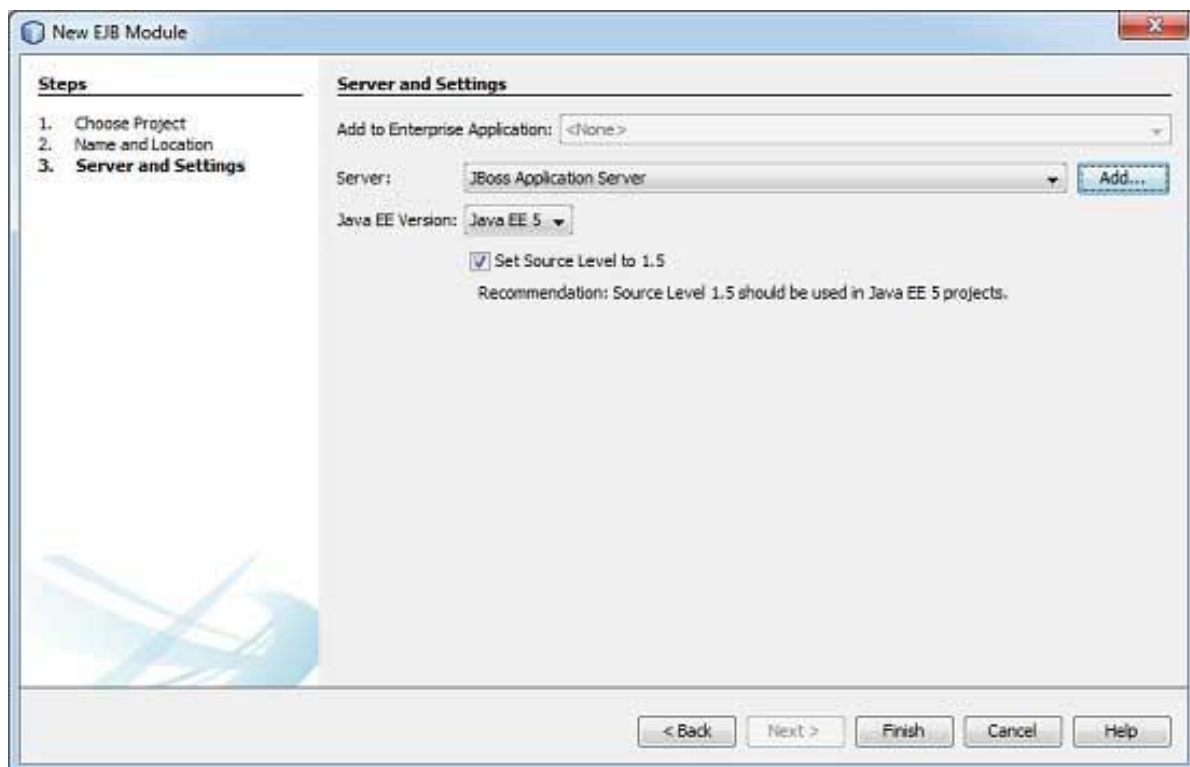
In NetBeans IDE, select **File > New Project >**. You will see the following screen.



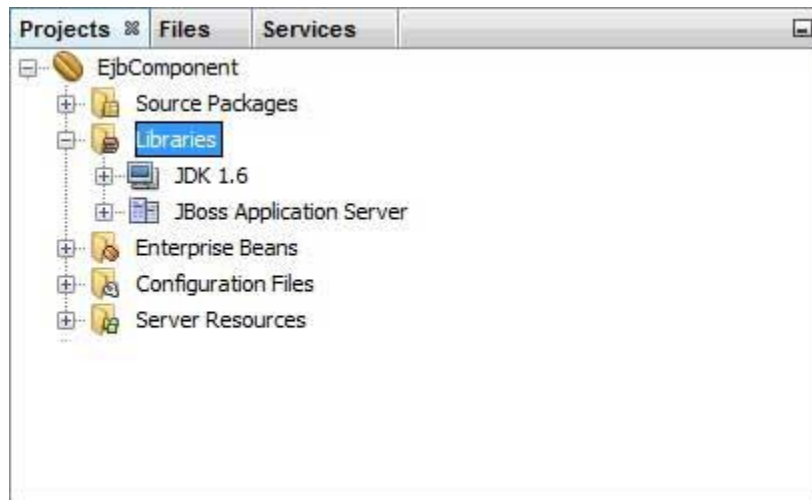
Select project type under category **Java EE**, Project type as **EJB Module**. Click **Next >** button. You will see the following screen.



Enter project name and location. Click **Next >** button. You will see the following screen.



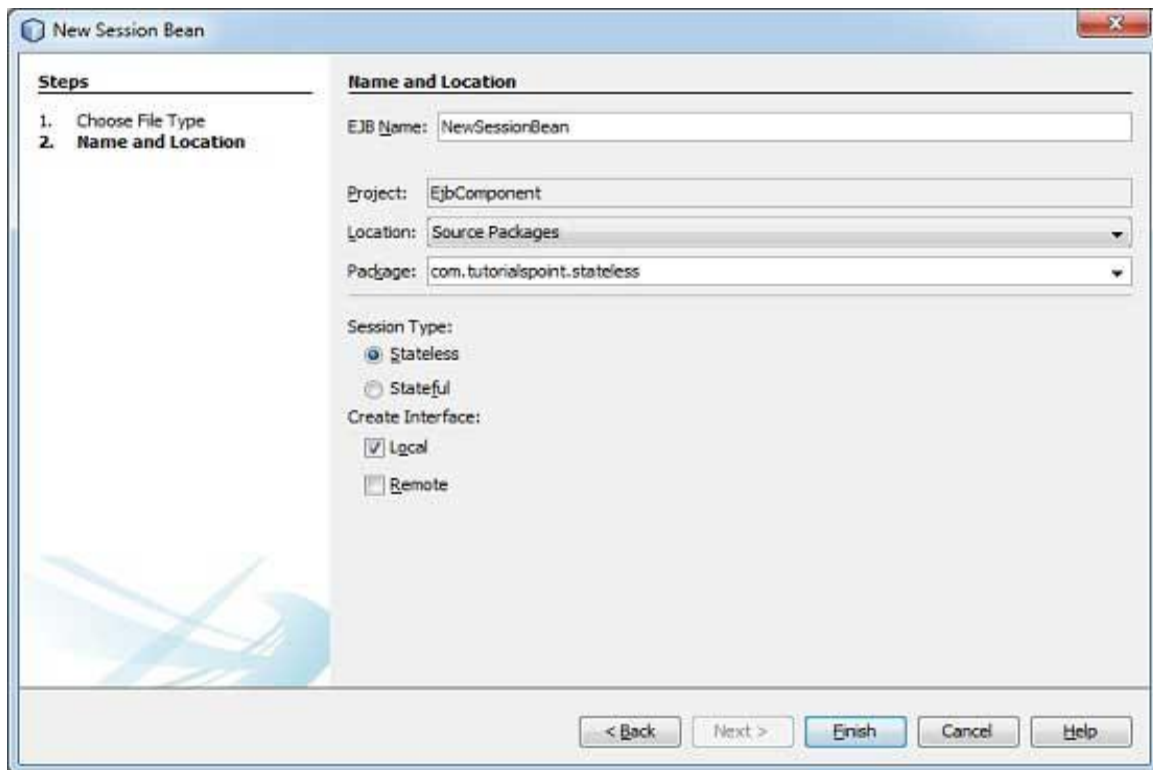
Select Server as **JBoss Application Server**. Click **Finish** button. You will see the following project created by NetBeans.



Create a Sample EJB

To create a simple EJB, we will use NetBeans "New" wizard. In the example given below, We will create a stateless EJB class named `librarySessionBean` under `EjbComponent` project.

Select project `EjbComponent` in project explorer window and right click on it. Select, **New > Session Bean**. You will see the **New Session Bean** wizard.



Enter session bean name and package name. Click **Finish** button. You will see the following EJB classes created by NetBeans.

- **LibrarySessionBean** - stateless session bean
- **LibrarySessionBeanLocal** - local interface for session bean

I am changing local interface to remote interface as we are going to access our EJB in a console based application. Remote/Local interface is used to expose business methods that an EJB has to implement.

LibrarySessionBeanLocal is renamed to LibrarySessionBeanRemote and LibrarySessionBean implements LibrarySessionBeanRemote interface.

LibrarySessionBeanRemote

```
package com.tutorialspoint.stateless;

import java.util.List;
import javax.ejb.Remote;

@Remote
```

```
public interface LibrarySessionBeanRemote {  
  
    void addBook(String bookName);  
  
    List getBooks();  
  
}
```

LibrarySessionBean

```
package com.tutorialspoint.stateless;  
  
import java.util.ArrayList;  
import java.util.List;  
import javax.ejb.Stateless;  
  
@Stateless  
public class LibrarySessionBean implements LibrarySessionBeanRemote {  
  
    List<String> bookShelf;  
  
    public LibrarySessionBean(){  
        bookShelf = new ArrayList<String>();  
    }  
  
    public void addBook(String bookName) {  
        bookShelf.add(bookName);  
    }  
  
    public List<String> getBooks() {  
        return bookShelf;  
    }  
  
}
```

Build the Project

- Select EjbComponent project in Project Explorer window
- Right click on it to open context menu.
- Select clean and build.

You will see the following output in NetBeans console output.

```
ant -f C:\\EJB\\EjbComponent clean dist
init:
undeploy-clean:
deps-clean:
Deleting directory C:\\EJB\\EjbComponent\\build
Deleting directory C:\\EJB\\EjbComponent\\dist
clean:
init:
deps-jar:
Created dir: C:\\EJB\\EjbComponent\\build\\classes
Copying 3 files to C:\\EJB\\EjbComponent\\build\\classes\\META-INF
Created dir: C:\\EJB\\EjbComponent\\build\\empty
Created dir: C:\\EJB\\EjbComponent\\build\\generated-sources\\ap-source-output
Compiling 2 source files to C:\\EJB\\EjbComponent\\build\\classes
warning: [options] bootstrap class path not set in conjunction with -source 1.6
Note: C:\\EJB\\EjbComponent\\src\\java\\com\\tutorialspoint\\stateless
\\LibraryPersistentBean.java uses unchecked or unsafe operations.
Note: Recompile with -Xlint:unchecked for details.
1 warning
compile:
library-inclusion-in-archive:
Created dir: C:\\EJB\\EjbComponent\\dist
Building jar: C:\\EJB\\EjbComponent\\dist\\EjbComponent.jar
dist:
BUILD SUCCESSFUL (total time: 3 seconds)
```

Start the Application Server

- Select JBoss application server under Servers in Services window.
- Right click on it to open context menu.
- Select start.

You will see the following output in NetBeans, output under JBoss Application Server.

```
Calling C:\jboss-5.1.0.GA\bin\run.conf.bat
=====

JBoss Bootstrap Environment

JBOSS_HOME: C:\jboss-5.1.0.GA

JAVA: C:\Program Files (x86)\Java\jdk1.6.0_21\bin\java

JAVA_OPTS: -Dprogram.name=run.bat -Xms128m -Xmx512m -server

CLASSPATH: C:\jboss-5.1.0.GA\bin\run.jar

=====

16:25:50,062 INFO  [ServerImpl] Starting JBoss (Microcontainer)...
16:25:50,062 INFO  [ServerImpl] Release ID: JBoss [The Oracle] 5.1.0.GA (build:
SVNTag=JBoss_5_1_0_GA date=200905221634)
...

16:26:40,420 INFO  [TomcatDeployment] deploy, ctxPath=/admin-console
16:26:40,485 INFO  [config] Initializing Mojarra (1.2_12-b01-FCS) for context
'/admin-console'
16:26:42,362 INFO  [TomcatDeployment] deploy, ctxPath=/
16:26:42,406 INFO  [TomcatDeployment] deploy, ctxPath=/jmx-console
16:26:42,471 INFO  [Http11Protocol] Starting Coyote HTTP/1.1 on http-127.0.0.1-
8080
16:26:42,487 INFO  [AjpProtocol] Starting Coyote AJP/1.3 on ajp-127.0.0.1-8009
```

```
16:26:42,493 INFO [ServerImpl] JBoss (Microcontainer) [5.1.0.GA (build:
SVNTag=JBoss_5_1_0_GA date=200905221634)] Started in 52s:427ms
```

Deploy the Project

- Select EjbComponent project in Project Explorer window.
- Right click on it to open context menu.
- Select Deploy.

You will see the following output in NetBeans console output.

```
ant -f C:\\EJB\\EjbComponent -DforceRedeploy=true -
Ddirectory.deployment.supported=false -Dnb.wait.for.caches=true run
init:
deps-jar:
compile:
library-inclusion-in-archive:
Building jar: C:\\EJB\\EjbComponent\\dist\\EjbComponent.jar
dist-directory-deploy:
pre-run-deploy:
Checking data source definitions for missing JDBC drivers...
Distributing C:\\EJB\\EjbComponent\\dist\\EjbComponent.jar to
[org.jboss.deployment.spi.LocalhostTarget@1e4f84ee]
Deploying C:\\EJB\\EjbComponent\\dist\\EjbComponent.jar
Application Deployed
Operation start started
Operation start completed
post-run-deploy:
run-deploy:
run:
BUILD SUCCESSFUL (total time: 2 seconds)
```

JBoss Application Server Log Output

```
16:30:00,963 INFO [DeployHandler] Begin start, [EjbComponent.jar]
...
```

```

16:30:01,233 INFO  [Ejb3DependenciesDeployer] Encountered deployment
AbstractVFSDeploymentContext@12038795{vfszip:/C:/jboss-
5.1.0.GA/server/default/deploy/EjbComponent.jar/}

...

16:30:01,281 INFO  [JBossASKernel]      jndi:LibrarySessionBean/remote-
com.tutorialspoint.stateless.LibrarySessionBeanRemote

16:30:01,281 INFO  [JBossASKernel]
Class:com.tutorialspoint.stateless.LibrarySessionBeanRemote

16:30:01,281 INFO  [JBossASKernel]      jndi:LibrarySessionBean/remote

16:30:01,281 INFO  [JBossASKernel] Added
bean(jboss.j2ee:jar=EjbComponent.jar,name=
LibrarySessionBean,service=EJB3) to KernelDeployment of: EjbComponent.jar

16:30:01,282 INFO  [JBossASKernel] installing bean:
jboss.j2ee:jar=EjbComponent.jar,name=BookMessageHandler,service=EJB3

16:30:01,282 INFO  [JBossASKernel] with dependencies:

16:30:01,282 INFO  [JBossASKernel] and demands:

16:30:01,282 INFO  [JBossASKernel]      jboss.ejb:service=EJBTimerService

...

16:30:01,283 INFO  [EJB3EndpointDeployer] Deploy
AbstractBeanMetaData@5497cb{name=jboss.j2ee:jar=EjbComponent.jar,
name=LibrarySessionBean, service=EJB3_endpoint
bean=org.jboss.ejb3.endpoint.deployers.impl.EndpointImpl properties=[container]
constructor=null autowireCandidate=true}

...

16:30:01,394 INFO  [SessionSpecContainer] Starting
jboss.j2ee:jar=EjbComponent.jar,name=LibrarySessionBean,service=EJB3

16:30:01,395 INFO  [EJBContainer] STARTED EJB:
com.tutorialspoint.stateless.LibrarySessionBean ejbName: LibrarySessionBean

16:30:01,401 INFO  [JndiSessionRegistrarBase] Binding the following Entries in
Global JNDI:

    LibrarySessionBean/remote - EJB3.x Default Remote Business Interface
    LibrarySessionBean/remote-com.tutorialspoint.stateless.LibrarySessionBeanRemote
- EJB3.x Remote Business Interface

16:30:02,723 INFO  [SessionSpecContainer] Starting
jboss.j2ee:jar=EjbComponent.jar,name=LibrarySessionBean,service=EJB3

16:30:02,723 INFO  [EJBContainer] STARTED EJB:
com.tutorialspoint.stateless.LibrarySessionBean ejbName: LibrarySessionBean

16:30:02,731 INFO  [JndiSessionRegistrarBase] Binding the following Entries in
Global JNDI:

```

LibrarySessionBean/remote - EJB3.x Default Remote Business Interface

LibrarySessionBean/remote-com.tutorialspoint.stateless.LibrarySessionBeanRemote
- EJB3.x Remote Business Interface

Create Client to Access EJB

- In NetBeans IDE, select **File > New Project >**.
- Select project type under category **Java**, Project type as **Java Application**. Click **Next >** button.
- Enter project name and location. Click **Finish >** button. We have chosen name as EjbTester.
- Right click on project name in Project explorer window. Select **properties**.
- Add EJB component project created earlier under libraries using **Add Project** button in **compile** tab.
- Add jboss libraries using **Add jar/folder** button in **compile** tab. Jboss libraries can be located at <jboss installation folder>> client folder.

End of ebook preview
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