



Developing EJBs

An introduction to the development
cycle of Enterprise Java Beans

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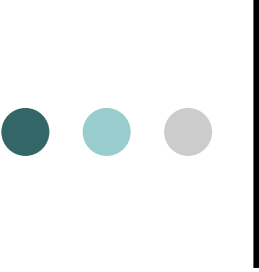
Agenda

- Choosing a J2EE-Server
- IDEs for the development of EJBs
- Deployment & Packaging
- Useful tools
- Sample application



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Choosing a J2EE-Server

○ Commercial Products

- BEA Weblogic
- IBM Websphere Application Server
- Oracle Application Server
- Borland Enterprise Server
- SAP Web Application Server ...

○ Free / Open Source Software

- JBoss
- JOnAS
- Sun Java System Application Server...



<http://www.theserverside.com/reviews/matrix.tss>



JBoss



- Available at <http://www.jboss.org>
- Microkernel architecture (only needed modules may be used)
- Administration via web interface
- Hot deployment even of server services
- „No compilation“ support
- ⊖ Very few documentation freely available and not for most recent release
- ⊕ Most popular open source J2EE server and 3rd position in application server market in general (in 2003)
- ⊕ Good support available
- ⊕ Sun certified J2EE Server



JOnAS



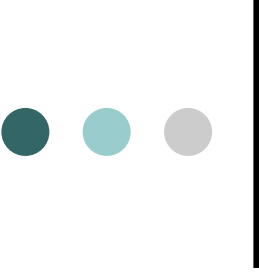
- Available at <http://jonas.objectweb.org>
- Uses Tomcat or Jetty as servlet container and web server
- Can also be administrated via web interface
- Clustering, load-balancing, failover
- Webservices support based on AXIS
- ⊖ Less intensive development than on JBoss
- ⊕ Very good documentation, tutorials, FAQs available



Sun Java System Application Server



- Available at: <http://java.sun.com/j2ee>
- Commercial product, platform edition available freely
- Can be used with Java Application Verification Kit
- ⊖ Really slow and resource-demanding
- ⊕ Reference implementation ⇒ strictly implements J2EE specification
- ⊕ Only server that supports JSF



Choosing a J2EE-Server

- In fact, switching the server of an existing application is not possible without effort:
 - Vendor-dependent deployment descriptors
 - Minor changes to code necessary



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IDEs for the development of EJBs

○ Commercial Products

- IntelliJ IDEA
- Sun Java Studio Enterprise
- IBM Websphere Studio Application Developer
- ...

○ Free / Open Source Software

- Eclipse
- NetBeans (planned for 4.1)
- Oracle JDeveloper



Eclipse



- Eclipse can be used for developing J2EE applications by using plugins
 - Lomboz:
 - XDoclet supported
 - May be used to control J2EE servers
 - Supports deployment
 - JOPE (JOnAS plugin for Eclipse)
 - Beta-stadium
 - JBoss IDE:
 - Code wizards
 - XDoclet very well integrated
 - Packaging support
 - Deployment support
 - Offers control of JBoss AS
 - Debugging of applications



Oracle JDeveloper

ORACLE
JDEVELOPER **10^g**

- Click 'n play development:
 - Includes UML modeling and visual page flow diagrammer for Struts
 - Entity beans can be created by dragging a table from the DB to the UML model
 - Dragging entity beans into JSP creates all relevant fields
- Professional Profiler
- Optimal when using Oracle DB



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Deployment Descriptor

- Deployment Descriptor: /META-INF/ejb-jar.xml
- Used to
 - configure beans (section `<enterprise-beans>`)
 - assemble the whole application (section `<assembly-descriptor>`)
- DTD in EJB 2.0, XML Schema in EJB 2.1
- No longer needed in EJB 3.0



Bean configuration

- Names bean interfaces
- Describes bean attributes:
 - CMP vs. BMP
 - SFEB vs. SLFB
 - Persistence details
 - ...
- Describes cross-references



Example bean configuration

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE ejb-jar PUBLIC "-//Sun Microsystems, Inc.//DTD Enterprise JavaBeans 2.0//EN"
    "http://java.sun.com/dtd/ejb-jar_2_0.dtd">

<ejb-jar >
  <enterprise-beans>

    <session >
      <description><![CDATA[Session bean that implements business processes]]></description>
      <display-name>BookShop Bean</display-name>

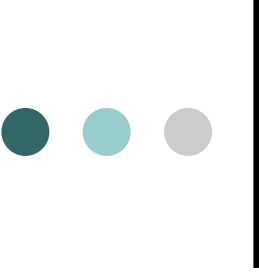
      <ejb-name>BookShop</ejb-name>

      <home>example.interfaces.BookShopHome</home>
      <remote>example.interfaces.BookShop</remote>
      <ejb-class>example.ejb.BookShopBean</ejb-class>
      <session-type>Stateless</session-type>
      <transaction-type>Container</transaction-type>
      <ejb-ref >
        <ejb-ref-name>ejb/Book</ejb-ref-name>
        <ejb-ref-type>Entity</ejb-ref-type>
        <home>example.interfaces.BookHome</home>
        <remote>example.interfaces.Book</remote>
        <ejb-link>Book</ejb-link>
      </ejb-ref>
    </session>
  </enterprise-beans>
```




Assembly configuration

- Configures security service
 - Roles
 - Permissions
- Configures transaction service
- May be used to configure message destinations



Example assembly configuration

```
<assembly-descriptor>
  <security-role>
    <role-name>jaas</role-name>
  </security-role>
  <method-permission>
    <role-name>jaas</role-name>
    <method>
      <ejb-name>JAASOp</ejb-name>
      <method-name>*</method-name>
    </method>
  </method-permission>
  <container-transaction>
    <method>
      <ejb-name>JAASOp</ejb-name>
      <method-name>*</method-name>
    </method>
  </container-transaction>
</assembly-descriptor>
</ejb-jar>
```

Packaging

- JAR (Java-Archive): contains libraries, clients, beans, ...
- WAR (Web-Archive): contains libraries, servlets, JSPs, ...
- EAR (Enterprise-Archive): contains J2EE components (beans + clients)





Packaging

- META-INF/application.xml: describes components in an enterprise archive

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE application PUBLIC "-//Sun Microsystems, Inc.//DTD J2EE Application
1.3//EN" "http://java.sun.com/dtd/application_1_3.dtd">
<application>
  <display-name>Bookshop Application</display-name>
  <module>
    <ejb>BookEJB.jar</ejb>
  </module>
  <module>
    <web>
      <web-uri>BookWeb.war</web-uri>
      <context-root>/book</context-root>
    </web>
  </module>
</application>
```



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XDoclet



- Two main functions:
 - Generates code
 - Generates deployment descriptors and vendor-specific configuration files
- Descriptive: uses JavaDoc-like meta-tag annotations
- Works like Ant



Sun J2EE Application Verification Kit

- Tool that verifies whether an application conforms to the J2EE platform specification
 - Static verification: verifies deployment descriptors
 - Dynamic verification: runtime profiling of J2EE applications
- ⊖ Requires application to run in Sun AS
- ⊖ Does not verify Message-driven beans and Servlet filters



UML2EJB

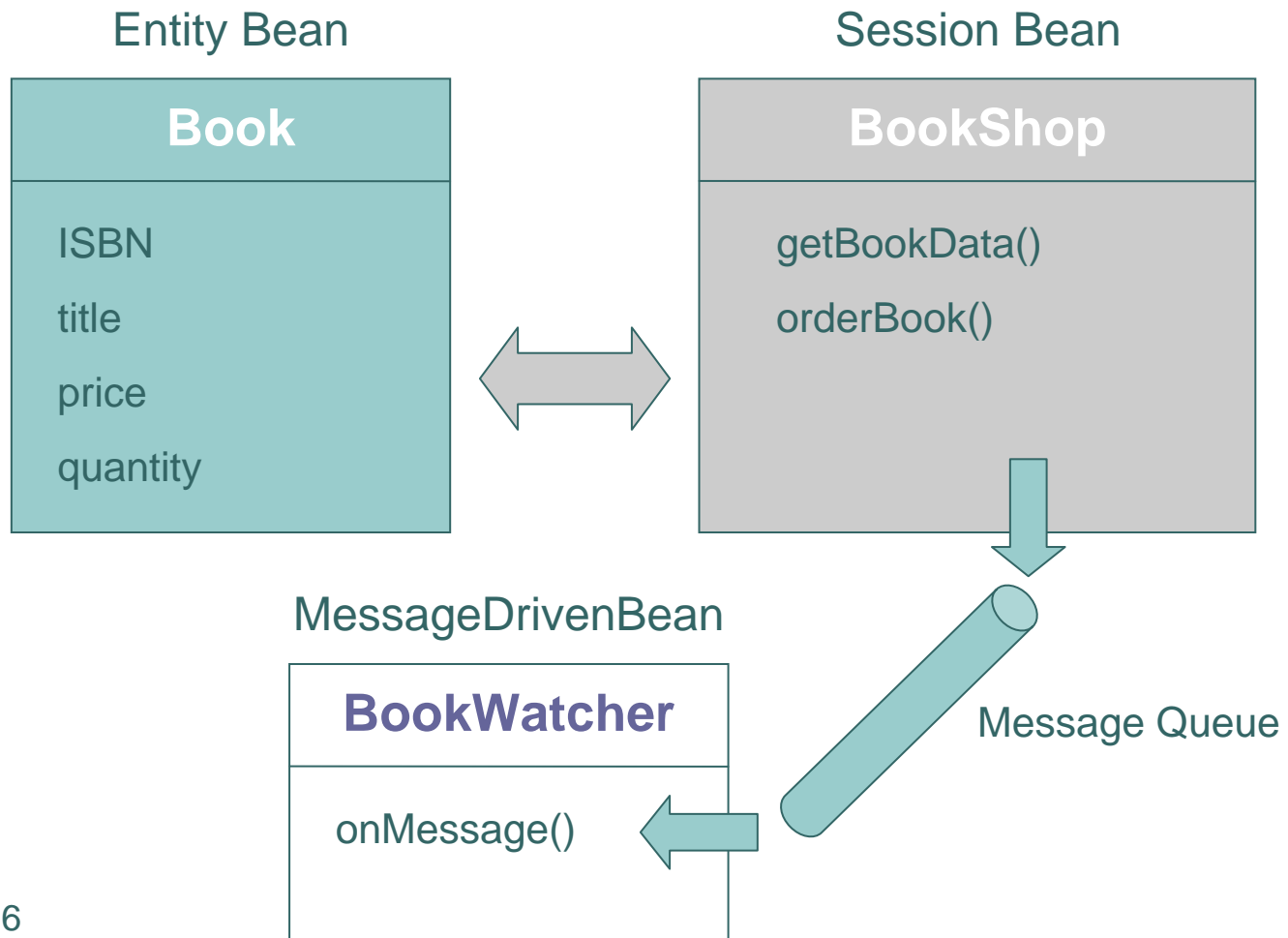
- Code generator
- Creates EJBs with XDoclet tags from UML model from a case tool
- ⊖ JDeveloper can do the same
- ⊖ No longer under development, version 1.3.1 is latest



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Sample Application - Architecture





Sample Application - Environment

- JBoss AS
- Eclipse with JBoss-IDE
- XDoclet via JBoss-IDE
- MySQL as database