

FIFTH EDITION

# Enterprise JavaBeans 3.0

*Bill Burke and Richard Monson-Haefel*

**O'REILLY'**

Beijing • Cambridge • Farnham • Kb'ln • Paris • Sebastopol • Taipei • Tokyo

# Table of Contents

**Foreword**..... **xv**

**Preface**..... **xix**

## **Part I. The EJB 3.0 Standard**

**1. Introduction**..... **3**

    Server-Side Components 4  
    Persistence and Entity Beans 6  
    Asynchronous Messaging 6  
    Web Services 8  
    Titan Cruises: An Imaginary Business 10  
    What's Next? 10

**2. Architectural Overview**..... **11**

    The Entity Bean 11  
    The Enterprise Bean Component 14  
    Using Enterprise and Entity Beans 22  
    The Bean-Container Contract 28  
    Summary 29

**3. Resource Management and Primary Services**..... **31**

    Resource Management 31  
    Primary Services 39  
    What's Next? 50

<b>4. Developing Your First Beans</b> .....	<b>51</b>
Developing an Entity Bean	51
Developing a Session Bean	54
<b>5. Persistence: EntityManager</b> .....	<b>63</b>
Entities Are POJOs	64
Managed Versus Unmanaged Entities	65
Packaging a Persistence Unit	67
Obtaining an EntityManager	71
Interacting with an EntityManager	75
Resource Local Transactions	82
<b>6. Mapping Persistent Objects</b> .....	<b>85</b>
The Programming Model	86
Basic Relational Mapping	89
Primary Keys	93
Property Mappings	104
Multitable Mappings with @SecondaryTable	111
@Embedded Objects	114
<b>7. Entity Relationships</b> .....	<b>117</b>
The Seven Relationship Types	117
Mapping Collection-Based Relationships	150
Detached Entities and FetchType	153
Cascading	154
<b>8. Entity Inheritance</b> .....	<b>159</b>
Single Table per Class Hierarchy	160
Table per Concrete Class	163
Table per Subclass	165
Mixing Strategies	168
Nonentity Base Classes	168
<b>9. Queries and EJB QL</b> .....	<b>170</b>
Query API	171
EJB QL	175
Native Queries	201
Named Queries	204

<b>10. Entity Callbacks and Listeners</b> .....	<b>207</b>
Callback Events	207
Callbacks on Entity Classes	208
Entity Listeners	209
<b>11. Session Beans</b> .....	<b>213</b>
The Stateless Session Bean	214
SessionContext	225
The Life Cycle of a Stateless Session Bean	229
The Stateful Session Bean	232
The Life Cycle of a Stateful Session Bean	243
Stateful Session Beans and Extended Persistence Contexts	247
Nested Stateful Session Beans	248
<b>12. Message-Driven Beans</b> .....	<b>250</b>
JMS and Message-Driven Beans	250
JMS-Based Message-Driven Beans	261
The Life Cycle of a Message-Driven Bean	275
Connector-Based Message-Driven Beans	278
Message Linking	281
<b>13. Timer Service</b> .....	<b>285</b>
Titan's Maintenance Timer	286
Timer Service API	287
Transactions	297
Stateless Session Bean Timers	297
Message-Driven Bean Timers	299
Final Words	304
<b>14. TheJNDI ENCand Injection</b> .....	<b>305</b>
TheJNDIENC	305
Reference and Injection Types	313
<b>15. Interceptors</b> .....	<b>339</b>
Intercepting Methods	339
Interceptors and Injection	347
Intercepting Life Cycle Events	349
Exception Handling	352
Interceptor Life Cycle	355

Bean Class @AroundInvoke Methods	355
Future Interceptor Improvements	356
<b>16. Transactions.....</b>	<b>357</b>
ACID Transactions	357
Declarative Transaction Management	362
Isolation and Database Locking	374
Nontransactional EJBs	385
Explicit Transaction Management	386
Exceptions and Transactions	397
Transactional Stateful Session Beans	403
Conversational Persistence Contexts	406
<b>17. Security.....</b>	<b>413</b>
Authentication and Identity	414
Authorization	415
The RunAs Security Identity	421
Programmatic Security	422
<b>18. EJB 3.0: Web Services Standards.....</b>	<b>425</b>
Web Services Overview	425
XML Schema and XML Namespaces	426
SOAP 1.1	438
WSDL1.1	441
UDDI 2.0	449
From Standards to Implementation	450
<b>19. EJB 3.0 and Web Services.....</b>	<b>451</b>
Accessing Web Services with JAX-RPC	452
Defining a Web Service with JAX-RPC	461
Using JAX-WS	466
Other Annotations and APIs	476
<b>20. Java EE.....</b>	<b>477</b>
Servlets	477
JavaServer Pages	479
Web Components and EJB	479
Filling in the Gaps	480
Fitting the Pieces Together	486

<b>21. EJB Design in the Real World. . . . .</b>	<b>488</b>
Predesign: Containers and Databases	488
Design	491
Should You Use EJBs?	517
Wrapping Up	521

## Part II. The JBoss Workbook

<b>Introduction. . . . .</b>	<b>525</b>
<b>1. JBoss Installation and Configuration. . . . .</b>	<b>527</b>
About JBoss	527
Installing the JBoss Application Server	527
A Quick Look at JBoss Internals	531
Exercise Code Setup and Configuration	534
<b>2. Exercises for Chapter 4. . . . .</b>	<b>537</b>
Exercise 4.1: Your First Beans with JBoss	537
Exercise 4.2: JNDI Binding with Annotations	544
Exercise 4.3: JNDI Binding with XML	549
<b>3. Exercises for Chapter 5. . . . .</b>	<b>551</b>
Exercise 5.1: Interacting with EntityManager	551
Exercise 5.2: Standalone Persistence	561
<b>4. Exercises for Chapter 6. . . . .</b>	<b>565</b>
Exercise 6.1: Basic Property Mappings	565
Exercise 6.2: @IdClass	569
Exercise 6.3: @EmbeddedId	571
Exercise 6.4: Multitable Mappings	573
Exercise 6.5: Embeddable Classes	575
<b>5. Exercises for Chapter 7. . . . .</b>	<b>577</b>
Exercise 7.1: Cascading	577
Exercise 7.2: Inverse Relationships	583
Exercise 7.3: Lazy Initialization	587

<b>6. Exercises for Chapter 8</b> . . . . .	<b>593</b>
Exercise 8.1: Single Table per Hierarchy	593
Exercise 8.2: Single Table per Hierarchy	597
Exercise 8.3: JOINED Inheritance Strategy	599
<b>7. Exercises for Chapter 9</b> . . . . .	<b>602</b>
Exercise 9.1: Query and EJB QL Basics	602
Exercise 9.2: Native SQL Queries	621
<b>8. Exercises for Chapter 10</b> . . . . .	<b>626</b>
Exercise 10.1: Entity Callbacks	626
Exercise 10.2: Entity Listeners	631
<b>9. Exercises for Chapter 11</b> . . . . .	<b>639</b>
Exercise 11.1: Stateless Session Bean	639
Exercise 11.2: XML Override	643
Exercise 11.3: Annotationless Stateless Session Bean	646
Exercise 11.4: Stateful Session Bean	647
Exercise 11.5: Annotationless Stateful Session Bean	654
<b>10. Exercises for Chapter 12</b> . . . . .	<b>655</b>
Exercise 12.1: The Message-Driven Bean	655
<b>11. Exercises for Chapter 13</b> . . . . .	<b>663</b>
Exercise 13.1: EJB Timer Service	663
<b>12. Exercises for Chapter 15</b> . . . . .	<b>666</b>
Exercise 15.1: EJB Interceptors	666
Exercise 15.2: Intercepting EJB Callbacks	668
<b>13. Exercises for Chapter 16</b> . . . . .	<b>671</b>
Exercise 16.1: Conversational Persistence Contexts	671
<b>14. Exercises for Chapter 17</b> . . . . .	<b>674</b>
Exercise 17.1: Security	674
Exercise 17.2: Securing Through XML	679

<b>15. Exercises for Chapter 19.....</b>	<b>.681</b>
Exercise 19.1: Exposing a Stateless Bean	681
Exercise 19.2: Using a .NET Client	689

### **Part III. Appendix**

<b>Appendix: JBoss Database Configuration.....</b>	<b>.695</b>
<b>Index.....</b>	<b>.699</b>