Preface xvii
   About the Front Cover xvii

Acknowledgments xix

Chapter 1 Introduction 2
   1.1 What Is the Enterprise JavaBeans Architecture? 3
   1.2 How This Book Is Organized 4
   1.3 Our Vision 6
   1.4 Reader Audience 7
   1.5 About the Examples 7
   1.6 Source Code Online 10
CHAPTER 2 ENTERPRISE JAVA BEANS

OVERVIEW 12

2.1 The J2EE Architecture 14
2.2 The J2EE Components 15
   Enterprise JavaBeans (EJB) 15
   Java Servlets 15
   JavaServer Pages (JSP) 15
   Java Naming Directory Interface (JNDI) 16
   Java Database Connectivity (JDBC) 16
   Java Message Service (JMS) 16
   Java Transaction API (JTA) 16
   Java API for XML (JAXP) 17
   JavaMail 17
   J2EE Connector API 17
   Java Authentication and Authorization Service (JAAS) 17
   J2EE Reference Implementation 17
   Remote Method Invocation (RMI) 18
   Java Interface Definition Language (IDL) 18

2.3 The J2EE Application Server 18
   Containers and Services 18

2.4 Enterprise JavaBeans 20
   Session Beans 20
      Stateless Session Beans 21
      Stateful Session Beans 22
   Entity Beans 23
      Bean-Managed Persistence (BMP) 25
      Container-Managed Persistence (CMP) 26
CHAPTER 3  STATELESS SESSION BEANS  34

3.1 Introducing Stateless Session Beans 35
3.2 The Loan Enterprise Bean 36

Enterprise Session Bean Structure 38
 Home Interface 39
 Remote Interface 41
 LoanObjectException 42
 Value Objects 42
 LoanVO Class 43
 PaymentVO Class 45
 Bean Implementation Class 47

Compiling, Packaging, and Deployment 51
 Compiling 51
 Packaging 52
 Deployment 55

3.3 Stand-alone Java Application Client 55

Compiling and Packaging the Client Application 61
 Compiling 61
 Packaging 61

Running the Stand-alone Java Client Application 62
 Starting the J2EE Application Server 62
Deployment 63
Running the J2EE Application Client 63

3.4 Web Component Client (JSP Client) 63

Introducing Servlets and JSP 64
   HttpServlet Class 64
   JSP Engine 64
   JSP Comments 65
   Declarations 65
   Scriptlets 65
   Expressions 66
   Implicit Objects 66
   JSP Directives 67

The JSP payment Client 67
   paymentGet.jsp 69
   paymentPost.jsp 72
   The Role of a JSP Client 76

Packaging the Web Component 77

Running the Web Client 78

3.5 Design Guidelines and Patterns 79
   Business Object 79
   Controller 79
   Enterprise Bean 79
   Model 80
   Session Bean 80
   Value Object 80
   View 80

3.6 Key Point Summary 81
CHAPTER 4 SESSION BEANS WITH JDBC  84

4.1 Session Beans and JDBC 85
   Database Fundamentals 87
   Music Collection Database 87
   Introducing JDBC 88
      Statement Object 89
      ResultSet Object 90
      PreparedStatement Object 91
      JDBC Code Sample 91

4.2 Music Stateless Session Bean 94
   Home Interface 94
   Remote Interface 94
   NoTrackListException 95
   RecordingVO Class 96
   TrackVO Class 97
   Bean Implementation Class 98
   Deployment Descriptor 105

4.3 A Java Swing Application Client 106

4.4 JSP Web Component Client 110
   musicGet.jsp 111
   musicPost.jsp 115
   error.jsp 118

4.5 Data Access Object Pattern 119
   DAO Pattern Implementation 121
      MusicBean 122
      Naming Environment Entry 124
      MusicDAOFactory 124
Contents

MusicDAO 126
MusicDAOSysException 126
MusicDAOCloudscape 127

4.6 Design Guidelines and Patterns 133
   DAO Pattern 133
   Factory Pattern 133
   Connection Pooling 133
   The Role of finally 133
   Using Exceptions with EJBs 134

4.7 Key Point Summary 134

CHAPTER 5  STATEFUL SESSION BEANS  136

5.1 Introducing Stateful Session Beans 138
   Stateful Session Passivation and Activation 138
5.2 MusicCart Stateful Session Bean 140
   The Big Picture 140
   CustomerVO 142
   Home Interface 143
   Remote Interface 144
   Bean Implementation 145
   Deployment Descriptor 148
5.3 Value List Iterator Pattern 149
   MusicPage Stateless Session Bean 152
   Deployment Descriptor 156
   MusicIterator Stateful Session Bean 157
   Deployment Descriptor 163
   Invocation Patterns 164
5.4 Web Component Client 165

login.jsp 170
loginPost.jsp 172
musicCart.jsp 174
shoppingPost.jsp 180
Deployment Descriptor 185

5.5 Local Interfaces 186

Local Interface Implementation 187
Local Home Interface 189
Local Interface 190
Bean Implementation Class 190
MusicIterator Client 191
Deployment Descriptor 191

5.6 Design Guidelines and Patterns 193

Value List Iterator Pattern 193
Stateful vs. Stateless Session Beans 194
Local Interfaces 195
JSP Web Clients 195

5.7 Key Point Summary 195

CHAPTER 6 ENTITY BEANS WITH BMP 198

6.1 Introducing Entity Beans 200

Properties of Entity Beans 200
Persistent and Shareable 200
Local and Remote Interfaces 201
EJB Methods and Database Access 201
Primary Key and Finder Methods 202
Create Methods 202
6.2 Customer Entity Bean 203

The Big Picture 203
Structure of Entity Beans 205
Home and Local Home Interfaces 207
Remote and Local Interfaces 210
The Role of the EJB Container 212
Optimizing Stores 212
Method Calls 213
DAO Pattern Implementation 215
CustomerModel 215
CustomerDAOSysException 218
CustomerDAO 219
CustomerDAOCloudscape 220
CustomerDAOFactory 231
Bean Implementation 232
Deployment Descriptor 240

6.3 Entity Bean Test Client 242

6.4 Transaction Overview 246
Properties of Transactions 247
Transactions Within the J2EE Platform 248
Transactions Within the Music Collection Application 250

6.5 Session Facade Pattern 250
Home Interface 252
Remote Interface 253
Application Exceptions 254
Bean Implementation 255
Contents xi

Deployment Descriptor 261

6.6 Web Component Client 262
  login.jsp 264
  signUp.jsp 264
  signUpPost.jsp 266
  loginPost.jsp 269

6.7 Design Guidelines and Patterns 272
  Using BMP 272
  DAO Pattern 272
  Local Interfaces 273
  Transactions 273
  Session Facade Pattern 273
  Entity Bean Testing 274

6.8 Key Point Summary 274

CHAPTER 7  ENTITY BEANS WITH CMP  276

7.1 Introducing Container-Managed Persistence 278
  Properties of CMP Entity Beans 278
    Abstract Persistence Schema 279
    Relationship Multiplicity 282
    Relationship Navigability 284
    Life Cycle Relationships 285
    Cascading Deletes 286
    Access Methods for Persistent Fields 287
    Access Methods for Relationship Fields 288

  Custom Finder and Select Methods 290
    Finder Methods 290
    Select Methods 292
Contents

Introducing the EJB Query Language 294
   Select Clause 295
   From Clause 295
   Where Clause 296
   Navigating to Related Beans 296
   Query Language Examples 297

7.2 The Three Entity Beans 299
   The Big Picture 299
   Structure of CMP Entity Beans 299
   Line Item Entity Bean 301
      Local Home Interface 303
      Local Interface 304
      Primary Key Generation 304
      Bean Implementation 305
      Generated SQL for Container Methods 308
      EJB Query for Custom Finders 309
      Container-Managed Persistence 309
      Container-Managed Relationships 311
   Order Entity Bean 312
      Local Home Interface 312
      Local Interface 314
      Bean Implementation 314
      Generated SQL for Container Methods 317
      EJB Query for Custom Finders 318
      Container-Managed Persistence 318
      Container-Managed Relationships 320
   Customer Entity Bean 321
      Local Home Interface 321
      Local Interface 322
      Bean Implementation 323
Generated SQL for Container Methods 326

EJB Query for Finder and Select Methods 327

Container-Managed Persistence 328

Container-Managed Relationships 329

7.3 Session Facade Pattern 329

Value Object Pattern Revisited 331

LinItemVO 331

OrderVO 332

CustomerSession EJB 334

Home Interface 334

Remote Interface 335

Bean Implementation 337

Deployment Descriptor 349

Entity Beans and Session Beans Revisited 351

7.4 Web Component Client 351

processOrder.jsp 353

submitOrder.jsp 356

7.5 Administrator Client 360

AdminClient.java 360

7.6 Design Guidelines and Patterns 363

Using CMP 363

Local Interfaces 363

Transactions 364

Session Facade Pattern 364

Value Object Pattern 364

Administrative Client 364

7.7 Key Point Summary 365
CHAPTER 8  MESSAGE-DRIVEN BEANS 368

8.1 Messaging Architectures 369

8.2 Introducing JMS 372
   Messaging Domains 372
      Publish/Subscribe 372
      Point-to-Point 373
   JMS Building Blocks 374
   Topic Messaging 375
      TopicConnectionFactory and Topic 375
      TopicConnection and TopicSession 376
      TopicPublisher (Producer Side) 377
      Message Types 377
      TopicSubscriber (Consumer Side) 379
      The onMessage() Method 380
   Queue Messaging 381
   JMS Deployment Descriptors 385

8.3 Designing Message-Driven Beans 386
   Message Bean Structure 387
   Message Bean Life Cycle 390
   Exceptions with Message Beans 391

8.4 Student Message-Driven Bean 392
   School Client 393
   Student Message Bean 398
   Deployment Descriptors 401

8.5 ShipOrder Message-Driven Bean 403
   OrderApp Client 405
   ShipOrder Message Bean 407
Deployment Descriptors 409

8.6 Design Guidelines and Patterns 411

Java Message Service (JMS) 411
Publish/Subscribe Pattern 411
Point-to-Point Pattern 411
Publish/Subscribe vs. Point-to-Point 411
Message-Driven Beans 412
When to Use Message-Driven Beans 412
Transactions 413

8.7 Key Point Summary 413

APPENDIX A 415

A.1 MusicApp Swing Application 415

INDEX 423