



Contents



Preface xxi

Chapter 1

The Java Project Lifecycle 1

Introduction 1

Risk Management 2

Rules for Success 4

Deciding How to Focus Development:

Features vs. Modules 5

Components Contain Components 6

Task Granularity 7

Organizing a Project Team 7

Project Roles 7

*Configuration Management and Change Control
in More Detail* 11

The Phases of Development 14

Requirements Gathering 14

Logical Design, Requirements Development,



Advanced Java 2 Development for Enterprise Applications

- and Prototyping* 14
- Detailed Design* 15
- Walkthroughs* 17
- The Testing Process* 18
- Acceptance Testing* 21
- The Importance of Continuity* 22
- More CM Issues 22
 - Versions, Releases, and Builds* 22
 - Module Evolution and Derived Modules* 24
 - Prototype Branch Threads* 25
 - Reuse of Modules as Custom Builds* 26
 - Putting the CM Process Together* 27
- Documenting a Design 28
 - UML—A Universal Modeling Language* 29
 - What Should a Java Design Spec Contain?* 30
 - The Object (Class) Model* 33
 - Properties and Messages* 43
 - Design Tools* 43
- Coding 44
 - Compiling and Development Environments* 44
 - Optimization* 46
 - Developing Coding Standards* 46
- Platform-Independent Building and Deployment 57
 - The SDK Toolkit* 58
 - The Need for a Platform-Independent Build Process* 62
- Using a Repository 64
 - Only Check In Code that Compiles* 65
 - Synchronize Before You Check In* 66
- Organizing Source and Build Components 67
 - External Teams and Shared Builds* 69
 - Third-Party Products* 69
 - Workstations* 69



Creating a Release 70
Integration Testing and Deployment 70

Chapter 2

Resources, Components, and Packaging 74

Resource Files and Internationalization 75
 Characters 75
 Converting from Other Latin-Character-Mapped Representations 76
 Multinational Font Support 78
 Locales 78
 Formatting and Parsing of Localized Values 79
 Resources 86
 Resource Bundles 88
 Runtime Configurable Resources 91
 Parameterized Resources 91
 Keyboard Entry 92

JavaBeans 95
 What Are JavaBeans? 95
 How JavaBeans Work 96
 What You Should Implement 97
 Bean Design 98
 JavaBeans Metainformation—“BeanInfo” 106
 Packaging 110
 Instantiating a Bean 111
 Bound and Constrained Properties 112
 Property Editors 116
 Customizers 121
 Understanding JavaBeans Event Dispatching 124
 BeanContexts 125

JAR Files 130
 Signed JAR Files 132



Signing with JDK 1.1 133
Signing with Java 2 136
Packages Are Field-Replaceable Units 139
Creating an Executable JAR File 140
Referencing Other Included Items 142
Sealing a JAR File 142

Chapter 3

Threads in Server Applications 144

Java Threads vs. System Threads 146
Creating and Starting a Thread 146
Reentrancy 149
Adding Synchronization 150
Synchronized Code Can Be Preempted 154
Synchronized Methods in Package Java 155
Threads of Execution Are Independent
of Thread Object Instances 156
Thread Groups 156
The wait() and notify() Methods 157
Waiting for Another Thread to Terminate:
The join() Method 159
Thread States 163
Handling External System Interrupts 164
Avoiding Thread Deadlock 165
A Simple Multithreaded Server Application 167
Implementing a Thread Pool 174
A Producer-Consumer Thread Pool Model 174
A Thread Assignment Model 178
Implementing a Thread-Based Service Scheduler 183
Thread-Local Variables 188



Chapter 4

Java Security 190

- Data Encryption, Keys, and Certificates 192
 - Symmetric Key Encryption* 193
 - Public Key Encryption* 194
 - Asymmetric Keys for Authentication* 196
 - Message Digests* 197
 - Asymmetric Key Algorithms* 198
 - Import and Export Laws* 201
 - Java Security Providers* 203
 - Encryption Algorithms Included with the Java APIs* 204
 - Overview of X.509 Certificates* 208
 - Obtaining a Server Certificate* 214
 - Key Management* 215
 - Smartcards and Embedded Keys* 221
 - Obtaining a Certificate* 229
- Secure Communication Protocols 234
 - The Secure Socket Layer (SSL) Protocol* 234
 - Transport Layer Security (TLS)* 237
 - Interpreting Cipher Suite Names* 237
 - Use of HTTPS (HTTP/SSL or HTTP/TLS) URLs* 238
- The Java Security Model: Protecting the Local System 239
 - What Could a Malicious Applet Do Without Security Management in Place?* 239
 - The Sandbox Model* 240
 - Locally Installed Application Code* 247
 - The Extensions Framework* 247
 - Class Loaders* 249
 - The Policy File* 252
 - Policy File Syntax* 253
 - Implementing a Customized Policy* 254
 - Using Thread Groups to Segregate Rights Within a VM* 255



Authorization and Access Control 259
The Java Authentication and Authorization Service (JAAS) 260

Chapter 5

**Java Network Programming
and Internet Server Protocols 262**

Writing Your Own Protocol 264
Understanding Java Networking 265
Sockets and Server Sockets 265
The Socket Class 266
The ServerSocket Class 267
The TCP Reset Problem 268
How TCP Applications Assign Ports 269
Firewall Issues 271
Overview of Software Firewalls 272
SOCKS 273
Application Proxies 274
Proxy Configurations and Where to Put Your Application 275
The Mechanics of Passing Through a Firewall 279
Internet Server Protocols 283
HTTP 283
java.net.Authenticator 286
LDAP 287
FTP 295
SNMP and the Java Management API (JMAPI) 296
SMTP, IMAP, and POP 297

Chapter 6

Java Database Connectivity 310

Using JDBC 312
Two-Tier vs. Three-Tier 313
What Is a “Thin Client”? 314



<i>JDBC Driver Types</i>	314
<i>Driver Comparisons</i>	317
<i>High Performance Driver Features</i>	318
<i>JDBC Compliance</i>	321
<i>Loading a Driver</i>	322
<i>JDBC from an Application</i>	322
<i>JDBC from an Applet</i>	323
<i>Connecting to a Database</i>	324
<i>Displaying Database MetaData</i>	326
<i>Result Sets: Making a Simple Query</i>	326
<i>Cursors</i>	327
<i>Joins and Outer Joins</i>	327
<i>Statements that Don't Return a ResultSet</i>	330
<i>Prepared Statements</i>	330
<i>For Large (BLOB and CLOB) Parameters</i>	331
<i>Dates and Times</i>	331
<i>Data Type Mappings</i>	332
<i>Functions</i>	334
<i>Callable Statements</i>	336
<i>Transactions</i>	337
<i>Isolation Levels Defined by JDBC</i>	338
<i>Deadlock Detection and Response</i>	338
<i>Asynchronous Execution</i>	339
<i>Handling Connection Loss</i>	339
<i>Dealing with the Time Delay of Connecting to a Database</i>	340
<i>The Problems with "Active" Controls</i>	343
<i>Unicode Support</i>	344
<i>Sorting and Comparing Unicode Using the Collator and CollationKey Classes</i>	344
<i>Searching with LIKE</i>	345
<i>Representing Decimal and Monetary Data Types</i>	346
<i>Creating Incremental Queries</i>	348
<i>Is Java Year 2000-Compliant?</i>	349



JDBC 2	351
<i>Result Sets</i>	351
<i>Batch Updates</i>	358
<i>New Types</i>	359
<i>Type Maps</i>	360
<i>Java Objects</i>	361
<i>Use of JNDI</i>	361
<i>Other Additions</i>	362
<i>Connection Pools and Distributed Transactions</i>	362
SQLJ (aka J/SQL)	365
<i>Basic Syntax</i>	366
<i>Creating a Connection</i>	366
<i>Improved Support for Cursors—Iterators</i>	367
<i>Stored Procedures</i>	368
<i>Installing SQLJ Stored Procedures</i>	369
<i>OUT Parameters</i>	370
<i>Deployment</i>	371
Persistent Object Databases	372
<i>Why Use a Persistent Object Database?</i>	372
<i>How ODBMSs Work</i>	374
<i>The ODMG Object Model</i>	375
<i>An Example: Creating a Persistent Database Application</i>	384
<i>Serializing or Externalizing Database References;</i> <i>Interdatabase References</i>	389
<i>Building an Object Database Application Server</i>	390
<i>Evolution and Enterprise Integration</i>	400
<i>Network Implementations</i>	401
<i>Concurrency and Performance</i>	401
<i>Replication and Scalability</i>	402
<i>Multiple Client Connections</i>	402
<i>Finding Objects</i>	402
<i>Storing Persistent Object References Inside of Controls</i>	403
<i>Initial Instantiation of Control Objects</i>	404



*Object/Relational (“Blend”) Persistence Mapping
Products 405*

Logical Object Transaction Models 406

Transaction Boundaries 406

Defining Objects by Composition 407

Saving Change History 413

Views 415

*Garbage Collection of Resources Assigned to Voided
Objects 415*

Database Locking and Isolation 416

Understanding Transaction Isolation 416

The Importance of Locking Data You Have Read 419

Implementing Pessimistic Locking 421

Implementing Optimistic Locking 424

*Checkout-based Locking (Application-based Write
Locking) 433*

Defining the Transaction Layer 437

Multidatabase Transactions 437

*Cleaning Up Partially Completed Logical Transaction
Remnants 438*

Forward Cache Designs 439

Using Events for Database Client Notification 442

Chapter 7

Distributed Computing Protocols and APIs 448

JNDI 450

Retrieving Entries 451

Referrals 453

Delegation 455

Storing Entries 455

Implementing References 457

Storing (Binding) Java Objects in LDAP Using JNDI 457

JNDI over a Secure Connection 461



<i>Achieving Provider Independence</i>	462
<i>Using a Directory for Object Management</i>	463
Remote Method Invocation	465
<i>Object Serialization</i>	466
<i>How RMI Works</i>	469
<i>Passing or Returning Objects by Reference and by Value</i>	470
<i>Basic RMI</i>	471
<i>Implementing the Server Object</i>	472
<i>Making Callbacks and Local Object Resolution</i>	473
<i>Codebase Issues</i>	474
<i>Remote Reflection</i>	475
<i>Automatic Invocation</i>	475
<i>How RMI Assigns Server Ports</i>	479
<i>Object Reference Issues</i>	480
<i>Security Permissions that Need to be Enabled</i>	482
<i>Controlling Port Numbers and Network Adapter Selection</i>	483
<i>Creating Custom RMI Sockets</i>	484
<i>Creating a Registry with Custom Sockets</i>	488
<i>HTTP Tunnelling</i>	489
<i>Servants Behind a Firewall</i>	489
<i>Implementing Secure RMI</i>	497
<i>RMI Java Properties</i>	502
<i>Storing Remote References in LDAP</i>	503
Java and CORBA	503
<i>CORBA Overview</i>	503
<i>ORBs</i>	504
<i>The Object Adapter</i>	505
<i>Stubs and Skeletons</i>	505
<i>Repositories</i>	506
<i>How CORBA Sends Information over the Wire:</i>	
<i>GIOP and IIOP</i>	508
<i>IDL</i>	510
<i>The IDL-to-Java Mapping</i>	512



<i>RMI vs. CORBA</i>	514
<i>How a Program Finds CORBA Objects</i>	515
<i>Using a Naming Service</i>	516
<i>Storing IIOP References in LDAP</i>	517
<i>CORBA Object Activation</i>	518
<i>Object Cleanup</i>	526
<i>Connection Models</i>	528
<i>Object Management</i>	528
<i>Using CORBA with Castanet</i>	529
<i>Implementing Secure ORB Connections</i>	530
RMI-over-IIOP	533
<i>Passing Objects by Value</i>	534
Messaging	547
<i>End-to-End QOS</i>	547
<i>Java Message Service</i>	549
<i>CORBA Event Service</i>	558
<i>CORBA Messaging Service</i>	562
<i>Mainframe Transaction Gateways</i>	562
XML	562
<i>The XML Syntax</i>	564
<i>Encoding Semantic Rules</i>	564
<i>Message Transport</i>	565
<i>Message Generation</i>	566
<i>Message Processing</i>	567
<i>The Document Object Model</i>	571
<i>XML Standards</i>	572
Distributed Transactions	572
The Java Transaction API (JTA)	573
<i>Overview</i>	573
<i>Two-Phase Commit Protocols</i>	574
<i>Transaction Coupling</i>	576
<i>Thread Association with Transaction Context</i>	578



Mixing of Global and Local Transactions 578
The Platform Layers 578
Normal Usage Scenario 581
How It Works 583
Data Resources 584
OO Transactional Data Resources: OTMs 588
Propagation of Transaction Context to Another Server 589

JTS and OTS 591
The JTS Packages 591
Direct Context Management 594
Indirect Context Management 595
Propagating Transaction Context 598

Chapter 8

Server Frameworks and Architectures 602

Servlets 604
Security 606
Servlets as Gateways to Application Servers 607
Invoking a Servlet 607
The Servlet Programming Interface 608
Example: The Customer Manager Servlet 609
Testing and Deployment 617
Retrieving GET and POST Data 618
Class Loader Issues 620
State Management 620
When Session State Is Large 622
User-Specific Profiles and Authentication 622
Reentrancy 625
Multiple UI Frames and Concurrency 626
Servlet Design 627
Mixing and Matching Servlet Servers and EJB Servers 628
Deploying Servlets 628



<i>Where to Run a Servlet Server</i>	631
<i>JavaServer Pages</i>	631
The Enterprise JavaBeans Framework	635
<i>Client, Server, and Data Resource</i>	636
<i>Transaction Management</i>	636
<i>How It Works</i>	638
<i>Session Bean vs. Entity Bean</i>	640
<i>Beans Are Components</i>	640
<i>Runtime Synchronization</i>	641
<i>Deployment</i>	641
<i>Passivation</i>	651
<i>Context</i>	651
<i>Authentication and Security</i>	654
<i>Integration with CORBA Security</i>	655
<i>Adding Application-Specific Authorization</i>	656
<i>What You Write, and What the Tools Generate</i>	658
<i>Comparing EJB References</i>	663
<i>What to Deploy with Client Applications</i>	664
<i>Persistence Mechanism</i>	664
<i>Persistified References</i>	667
<i>Embedded References to Other Enterprise JavaBeans</i>	667
<i>Runtime Concurrency Issues</i>	669
<i>Transaction Association</i>	671
<i>Bean Demarcated Transactions</i>	673
<i>Client Demarcated Transactions (Transactional Clients)</i>	673
<i>Exceptions</i>	679
<i>Some Exception Scenarios for EJB Clients</i>	681
<i>Different Patterns of Enterprise JavaBean Use</i>	683
<i>Tradeoffs Between Heavy EJB Clients and Thin EJB Clients</i>	716
<i>EJB (User) Session and Persistent Database Session Association</i>	717



<i>The Double Interface Pattern to Provide Strong Typing of Your Implementation and Entity Interface</i>	718
<i>Writing a Utility Layer to Handle Complex Data Relationships</i>	718
<i>Session Beans for Encapsulating Application Processes</i>	721
<i>Session Beans as Entity Factories</i>	722
<i>Don't Invoke Methods on "This"</i>	723
<i>Passing Entities by Value</i>	724
<i>A More Comprehensive Example</i>	724
<i>Running CORBA from Inside an EJB;</i>	
<i>Accessing Beans from CORBA Servants</i>	737
<i>Storing EJB References in an LDAP Server</i>	737
<i>Multiple EJB Server Tiers</i>	739
<i>Initiating Calls from the Inside</i>	740
Java 2 Enterprise Edition	741
Electronic Commerce Server Applications	744
<i>The Electronic Commerce Process</i>	745
<i>Handling Payment</i>	746
Scaling Multitier Java Applications	749
<i>Understanding the Overhead of Each Tier</i>	749
<i>Scalability of Servlet Sessions vs. EJB Sessions</i>	751
<i>Lookups and Reconnects</i>	752
<i>Some Session Profile Scenarios</i>	754
<i>Configuration and Server Resources</i>	755
<i>Running Web and Application Servers</i>	
<i>(and Other Servers Too) on the Same Machine</i>	756
<i>Running Multiple Application Server Instances on a Server</i>	757
<i>Bean Lookup and Identification; Load Balancing and Clustering</i>	758
<i>DNS-Based Load Balancing vs. Network-Based Load Balancing</i>	758



Contents



Clustering 759
Load-Balancing Algorithms 761
Visibility of Failures to Clients 762
Accessing Non-Clustered Resources; Pinning an Object to a Server 762
Benchmarking a Configuration 762
Building a Scalable Architecture 764

Index 767



