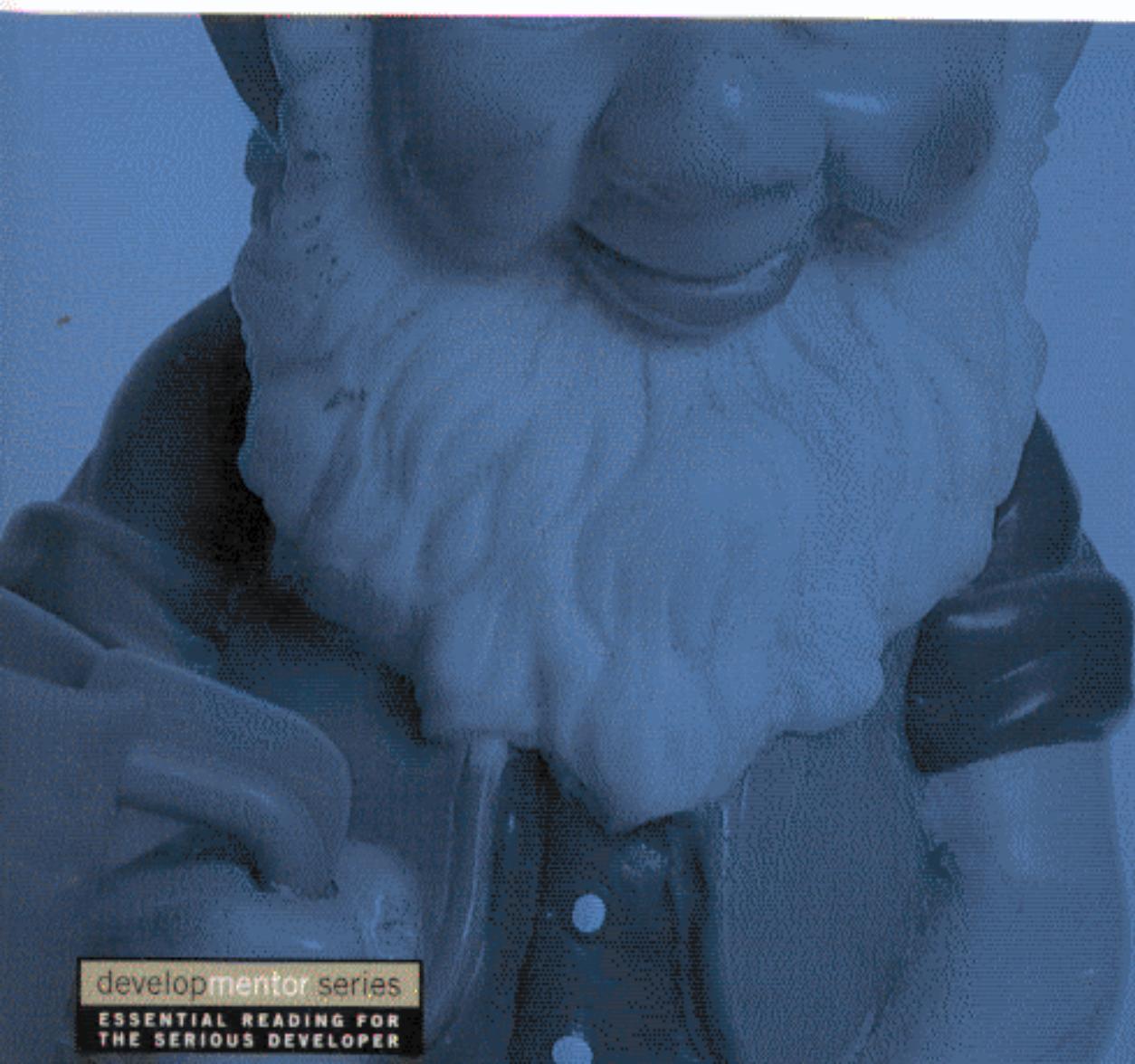




# Servlets and JavaServer Pages<sup>TM</sup>

## The J2EE™ Technology Web Tier

### Jayson Falkner and Kevin Jones



developmentor series

ESSENTIAL READING FOR  
THE SERIOUS DEVELOPER

# Contents

|  |           |
|--|-----------|
| <b>Preface</b>                                       | <b>xv</b> |
| <b>1 Setting Up a Servlet and JSP Environment</b>    | <b>1</b>  |
| A Quick History of Web Development                   | 1         |
| CGI  | 2         |
| Java Servlets  | 4         |
| Containers   | 4         |
| Getting Java Support                                 | 6         |
| <i>Downloading the Java 2 Standard Edition 1.4</i>   | 6         |
| <i>Installing J2SE 1.4 on Microsoft Windows</i>      | 7         |
| <i>Installing J2SE 1.4 on Linux Distributions</i>    | 7         |
| Tomcat   | 9         |
| Configuring Tomcat                                   | 17        |
| Web Applications                                     | 19        |
| <i>/WEB-INF and web.xml</i>                          | 22        |
| Java Classes and Source Files                        | 24        |
| Java Archive (JAR) Files                             | 25        |
| Web Application Resource (WAR) Files                 | 25        |
| Ant  | 26        |
| What Does Ant Do?                                    | 26        |
| Installing Ant                                       | 27        |
| Using Ant  | 27        |
| Summary  | 29        |
| <b>2 Java Servlets</b>                               | <b>31</b> |
| What Servlets Are and Why You Would Want to Use Them | 32        |
| Web Applications                                     | 32        |
| Servlets and HTTP Servlets                           | 32        |
| Filters  | 33        |
| Security   | 33        |
| Internationalization                                 | 33        |
| Servlet Life Cycle                                   | 33        |
| Servlets for the World Wide Web                      | 35        |
| Requests, Responses, and Headers                     | 36        |

|  |            |
|--|------------|
| <i>GET and POST</i>                                    | 39         |
| <i>HTTP Response Codes</i>                             | 40         |
| Coding a HttpServlet                                   | 41         |
| <i>Deploying a Servlet</i>                             | 43         |
| <i>Web Application Deployment Descriptor Structure</i> | 46         |
| Servlet Configuration                                  | 47         |
| <i>Limitations of Configuration: web.xml Additions</i> | 50         |
| <i>Client/Server Servlet Programming</i>               | 51         |
| <i>HttpServletRequest and HttpServletResponse</i>      | 51         |
| <i>HttpServletResponse</i>                             | 52         |
| <i>HttpServletRequest</i>                              | 64         |
| ServletContext   | 92         |
| <i>Initial Web Application Parameters</i>              | 92         |
| Servlet Event Listeners                                | 102        |
| Summary  | 106        |
| <b>3 JavaServer Pages</b>                              | <b>109</b> |
| JSP 2.0 Specification                                  | 110        |
| <i>JSP</i>   | 110        |
| <i>JavaBeans</i>                                       | 110        |
| <i>Custom Tags and JSP Fragments</i>                   | 110        |
| <i>Expression Language</i>                             | 110        |
| JSP Life Cycle   | 111        |
| The Difference Between Servlets and JSP                | 112        |
| JSP Syntax and Semantics                               | 116        |
| <i>Elements and Template Data</i>                      | 116        |
| <i>Two Types of Syntax</i>                             | 116        |
| <i>Scripting Elements</i>                              | 117        |
| <i>Directives</i>                                      | 126        |
| <i>JSP Configuration</i>                               | 133        |
| <i>Standard JSP Actions</i>                            | 136        |
| <i>White Space Preservation</i>                        | 145        |
| <i>Attributes</i>                                      | 147        |
| <i>Comments</i>  | 147        |
| <i>Quoting and Escape Characters</i>                   | 149        |
| Implicit Objects                                       | 150        |
| <i>pageContext</i>                                     | 153        |
| <i>out</i>   | 154        |
| <i>config</i>  | 157        |
| <i>page</i>  | 159        |
| JSP in XML Syntax                                      | 159        |
| <i>XML Rules</i>                                       | 162        |
| <i>JSP Documents</i>                                   | 162        |
| Summary  | 165        |

|  |            |
|--|------------|
| <b>4 Exception Handling</b>                                    | <b>167</b> |
| Errors and Exceptions  | 168        |
| <i>Throwing Exceptions</i>                                     | 169        |
| <i>Try, Catch, Finally</i>                                     | 172        |
| JSP and Servlet Exceptions                                     | 174        |
| Web Application Exception Handling                             | 176        |
| <i>Micro-Managing Exceptions</i>                               | 176        |
| <i>Macro-Managing Exceptions</i>                               | 181        |
| <i>Web Application Error Pages</i>                             | 182        |
| Logging  | 191        |
| <i>The Problem with System.out.println()</i>                   | 192        |
| <i>JDK 1.4 Logging Versus Log4j</i>                            | 193        |
| <i>Using the java.util.logging Package</i>                     | 193        |
| <i>Handlers</i>  | 196        |
| <i>Loggers</i>   | 199        |
| Logging and Performance  | 208        |
| <i>A General Philosophy for Exception Handling and Logging</i> | 208        |
| Summary  | 210        |
| <b>5 JavaBeans and the JSP Expression Language</b>             | <b>213</b> |
| JavaBeans  | 214        |
| Get and Set Methods  | 214        |
| <i>Why Get and Set Methods?</i>                                | 215        |
| Servlets, JSP, and JavaBeans                                   | 217        |
| <i>&lt;jsp:useBean/&gt;</i>                                    | 217        |
| <i>&lt;jsp:getProperty/&gt; and &lt;jsp:setProperty/&gt;</i>   | 221        |
| Good Use of JavaBeans  | 225        |
| <i>Design Patterns and JavaBeans</i>                           | 226        |
| JSP. 2.0 Expression Language                                   | 227        |
| <i>Disabling the EL</i>  | 227        |
| <i>JSP EL Syntax</i>   | 228        |
| <i>Reserved Words</i>  | 230        |
| <i>EL Functions</i>  | 230        |
| <i>Good Uses of the JSP EL</i>                                 | 231        |
| Summary  | 234        |
| <b>6 JavaServer Pages Standard Tag Library</b>                 | <b>235</b> |
| JSTL 1.0 Specification   | 235        |
| Why You Should Use the JSTL                                    | 237        |
| Installing the JSTL  | 237        |
| JSTL Expression Language                                       | 238        |
| <i>Twin Libraries</i>  | 239        |
| Core Tags  | 239        |
| <i>General-Purpose Tags</i>                                    | 239        |

|  |            |
|--|------------|
| <i>Iteration</i>                         | 243        |
| <i>Conditionals</i>                      | 247        |
| <i>URL Manipulation</i>                  | 250        |
| I18N-Capable Text Formatting             | 255        |
| XML Manipulation                         | 255        |
| SQL Tags                                 | 256        |
| Justification for Skipping the SQL Tags  | 256        |
| Summary                                  | 258        |
| <b>7 Custom Tag Libraries</b>            | <b>259</b> |
| Why Custom Tags?                         | 260        |
| Tag Library Basics                       | 261        |
| How Are Tags Being Used?                 | 262        |
| New and Old Custom Tags                  | 265        |
| Tag Library Descriptors (TLDs)           | 265        |
| <i>What Is a Tag Library Descriptor?</i> | 266        |
| <i>Using a Tag Library Descriptor</i>    | 267        |
| Simple, JSP 2.0 Custom Tags              | 271        |
| <i>SimpleTag Interface</i>               | 272        |
| Attributes                               | 275        |
| Body Evaluation and Iteration            | 285        |
| .tag Files                               | 288        |
| Cooperating Tags                         | 299        |
| Classic JSP Tag Handlers                 | 300        |
| Basic Tags                               | 300        |
| Coding a BasicTag                        | 303        |
| Reusing Tags                             | 308        |
| TryCatchFinally Interface                | 310        |
| Cooperating Tags                         | 311        |
| Mixing New Tags with Classic Tags        | 313        |
| Iteration Tags                           | 315        |
| Body Tags                                | 321        |
| Tag Scripting Variables                  | 324        |
| Tag Library Listeners                    | 328        |
| Validation                               | 329        |
| Summary                                  |            |
| <b>8 Filters</b>                         | <b>333</b> |
| Introducing Filters                      | 334        |
| <i>What Is a Filter?</i>                 | 334        |
| The Filter Life Cycle                    | 335        |
| Coding a Simple Filter                   | 336        |
| Wrappers                                 | 352        |
| Request Wrapping                         | 353        |
| Response Wrapping                        | 357        |

|  |            |
|--|------------|
| Filters That Provide JSP-Replacing Functionality | 387        |
| Summary  | 388        |
| <b>9 Managing State in a Web Application</b>     | <b>389</b> |
| HTTP and Session State                           | 390        |
| <i>Using an ID to Identify Clients</i>           | 391        |
| <code>javax.servlet.http.HttpSession</code>      | 392        |
| Cookies  | 395        |
| <i>Initializing Session Resources</i>            | 406        |
| Persistent State                                 | 411        |
| Session Smearing                                 | 412        |
| Sharing State Information via a Database         | 413        |
| State and Thread Safety                          | 414        |
| Synchronizing                                    | 416        |
| Protecting Servlet State                         | 416        |
| <code>javax.servlet.SingleThreadModel</code>     | 420        |
| Protecting Session and Application State         | 421        |
| Summary  | 422        |
| <b>10 Security</b>                               | <b>423</b> |
| What Do We Mean by Security?                     | 424        |
| Declarative Security                             | 425        |
| Role-Based Security                              | 426        |
| Configuring Realms                               | 430        |
| The Big Picture                                  | 432        |
| Configuring Basic or Digest Authentication       | 437        |
| Custom Form-Based Authentication                 | 438        |
| Programmatic Security in a Servlet/JSP           | 440        |
| Secure, Encrypted Communication                  | 443        |
| Specifying HTTPS                                 | 448        |
| How Secure Is Security?                          | 452        |
| Encryption and Compression and Caching           | 453        |
| Summary  | 455        |
| <b>11 Design Patterns</b>                        | <b>457</b> |
| Why Use a Design Pattern?                        | 458        |
| Common Design Patterns                           | 458        |
| Model 1  | 459        |
| Model 2  | 472        |
| <i>Good Model 2 Implementation</i>               | 487        |
| Jakarta Struts                                   | 490        |
| Installing Struts                                | 491        |
| Struts Control Servlet                           | 494        |
| Actions  | 496        |

|  |            |
|--|------------|
| Using Struts                                       | 507        |
| Model 1½   | 507        |
| Abstracting DHTML via Custom Tags                  | 510        |
| Why Abstract DHTML with Custom Tags?               | 510        |
| Coding DHTML Widget Custom Actions                 | 511        |
| Summary  | 512        |
| <b>12 Internationalization</b>                     | <b>513</b> |
| Content Encoding                                   | 514        |
| ISO-8859-1   | 514        |
| Unicode  | 517        |
| Working with Non-ISO-8859-1 Encoding               | 518        |
| i18n Implementation Techniques                     | 523        |
| Language Detection                                 | 524        |
| Multiple Pages                                     | 527        |
| Content Abstraction                                | 531        |
| Number and Date Formatting                         | 539        |
| i18n Numbers and Dates at Runtime                  | 540        |
| Using DateFormat, NumberFormat, and MessageFormat  | 543        |
| JSTL Number and Date Formatting Tags               | 549        |
| Summary  | 550        |
| <b>13 Multi-Client Support</b>                     | <b>553</b> |
| Who Should Read This Chapter                       | 554        |
| Separating Format from Content                     | 555        |
| Implementing Multi-Client Support                  | 557        |
| Templates  | 558        |
| Transformations                                    | 563        |
| Solving Multi-Client Problems                      | 566        |
| Creating a Multi-Client Interface                  | 566        |
| Non-Text Formats                                   | 586        |
| Summary  | 588        |
| <b>14 Database Connectivity</b>                    | <b>591</b> |
| What Is a Database?                                | 592        |
| SQL  | 594        |
| CRUD   | 597        |
| JDBC   | 605        |
| javax.sql.DataSource                               | 606        |
| java.sql.Connection and java.sql.Statement         | 614        |
| java.sql.ResultSet                                 | 617        |
| A Simple JDBC-Based Application                    | 624        |
| Using JDBC Optimally                               | 632        |
| Connection Pooling                                 | 633        |
| Optimized Statements                               | 634        |
| Database Administrators Are Expected to Know a Lot | 638        |

|   |            |
|---|------------|
| JDBC Web Application Design Patterns  | 638        |
| Data Access Object Design Pattern   | 640        |
| Summary   | 649        |
| <b>15 Building a Complete Web Application</b>                                       | <b>651</b> |
| Designing a Web Application   | 652        |
| Physical Implementation   | 654        |
| Distributing the Workload: Dividing Up Who Does What                                | 656        |
| Practical Use of Web Application Labor Division                                     | 657        |
| Implementing Database Support: Creating a Database and Using JDBC                   | 658        |
| Database Physical Design  | 658        |
| Interfacing Without SQL   | 661        |
| Implementing Business Logic: Filters and the Model 2 Design Pattern                 | 662        |
| Coding Model 2 Logic Classes and Populating   |            |
| Request-Scope Variables   | 664        |
| Dealing with Overly Complex Logic Components  | 687        |
| Implementing Presentation Logic: JSP, Multi-Client Design, and Internationalization | 687        |
| Building a Simple Presentation Page   | 688        |
| Creating the Other Presentation Pages   | 696        |
| Localized Content   | 703        |
| 日本語 (in Japanese)   | 709        |
| Finishing the Site  | 711        |
| Site-Wide Error Handling  | 712        |
| Adding Security   | 715        |
| Link Tracking   | 717        |
| Caching and Compression   | 721        |
| Adding the Egg  | 726        |
| Summary   | 733        |
| <b>Index</b>  | <b>735</b> |